भारतीयमानकब्यूरो
BUREAU OF INDIAN STANDARDS

Global e-tender Document for Supply, Installation and Commissioning ofTest Equipments for BIS Laboratories
(Tender Reference No. LPPD/28/2020/CME

INVITED BY

BUREAU OF INDIAN STANDARDS (BIS)

Scientist F &Head,Laboratory Policy and Planning Department (LPPD)
9, BSZ Marg, New Delhi-110002
Email: clpolicycell@bis.gov.in
Phone: **011-23230860**

INDEX

Bid opens on08-04-2020 at 1100h

Bid closes on 18-05-2020 at 1530h

GLOBAL E-TENDER NOTICE

Bureau of Indian Standards (Laboratory Policy and Planning Department) invites bids, under **two bid system (Technical bid and Financial bid)**from bonafide experienced Manufacturers/Suppliers/ Dealers / Agencies/ Direct Importers for the job defined in this tender, as per details given below:

DESCRIPTION	SUPPLY, INSTALLATION AND COMMISSIONING OF …… test Equipment for……. **(Please refer Annex-3 for Technical Specifications of the equipment)**
Type of Tender	OPEN
EMD Amount (in INR)	Please see point No 1 Below

i. The bidder can bid for one or more than one equipment. The EMD amount for each equipment is, as detailed in Annex 3. The bidder has to bid for each equipment separately and provide EMD amount mentioned for each equipment separately for which he is submitting his bid.The EMD is to be submitted through payment online in an acceptable form (the bidder shall have to upload scanned copy of the transaction document showing transaction code/RTGS No. etc.) in favour of Bureau of Indian Standards, New Delhi, payable at New Delhi. A scanned copy of EMD submitted also needs to be uploaded along with the bid at the Central Public Procurement Portal.For the purpose of online payment of EMD, the bank details of the BIS are as follows:

- Syndicate Bank, Bureau of Indian Standards, 9 Bahadur Shah Zafar Marg, New Delhi.
- IFSC/NEFT Code: SYNB0009084, Account No.: 90841010000018, Email id: dac@bis.gov.in, PAN No. AAATB0431G, GSTIN : 07AAATB0431G1ZD

ii. Proof of payment of EMD should be submitted along with Technical Bid.

iii. No interest shall be payable for the sum deposited as Earnest Money Deposit.

iv. EMD of the unsuccessful bidders would be returned to them after expiry of the final bid validity and latest on or before the 30 days after the award of the contract.

v. The EMD shall remain valid for a period of forty-five days beyond the final bid validity period.

vi. If EMD is forfeited for any reason, the concerned bidder may be debarred from participation in the RFPs/tenders floated by BIS in future as per its sole discretion.

vii. Registered MSEs & Start-ups (Micro and Small enterprises (MSEs) as defined in MSE procurement policy issued by Department of MSME or are registered with the Central Purchase organisation or the concerned ministry or department or start-ups as recognised by the Government) are exempted from payment of EMD provided proof of registration is submitted.

PERFORMANCE SECURITY DEPOSIT

viii. The successful bidder will have to submit a Performance Security equivalent to 10% of the total order in the form of online payment in an acceptable form; in favour of BIS, New Delhi. Performance Security should remain valid for a period of 60 days beyond the date of completion of all contractual obligations of the supplier including warranty obligations. For the purpose of online payment of Performance Security, the bank details of the BIS are as follows:

- Syndicate Bank, Bureau of Indian Standards, 9 Bahadur Shah Zafar Marg, New Delhi.
- IFSC/NEFT Code: SYNB0009084, Account No.: 90841010000018, Email id:

dac@bis.gov.in, PAN No. AAATB0431G, GSTIN : 07AAATB0431G1ZD

ix. The successful bidder has to renew the performance security on the same terms and conditions for the period up to the contract including extension period, if any.

x. Performance Guarantee would be returned only after successful completion of job assigned to them after adjusting/recovering any dues recoverable/payable from/by the Supplier on any account under the contract.

Address of the issuing Authority	**Sc F &Head,Laboratory Policy and Planning Department** (LPPD) 9, BSZ Marg, New Delhi-110002 Email: clpolicycell@bis.gov.in Phone: **011-23230860**
Download Start & Bid Submission Start Date & Time	08-04-2020 at 11:00 h
Download End & Bid Submission End Date & Time	18-05-2020 at 15:00 h
Pre Bid Meeting	04-05-2020 for Electrical equipment at 11:00 a.m in BIS HQ 05-05-2020 for Chemical Equipment in BIS HQ 06-05-2020 for Mechanical Equipment in BIS HQ
Technical Bid opening date & Time	19-05-2020 at 15:30 h

1. Bureau of Indian Standards reserves the right to amend or with draw any terms and conditions contained in the tender document or to reject any or all bids without giving any notice or assigning any reason. The decision of issuing authority in this regard shall be final.
2. The bidder can submit his technical and financial bid along with applicable EMD for one or more number of equipments separately.The evaluation of technical and financial bid for each equipment will be carried out separately and L1 bidder will be determined for each equipment separately.The selection process for one equipment will not have any effect on other equipments.BIS reserves the right to proceed with one or more equipments as mentioned in the tender document while cancelling the purchase of one or more number of eauipments.
3. Performance security deposit for each equipment will have to be submitted separately by the selected bidder in the manner as detailed above.

-Sd-

Sc F &Head (LPPD)

TENDER DOCUMENT

PART-I: TECHNICAL BID

A: PRE-QUALIFICATION CRITERIA (PQC)

1. The bidder shall be PSU/ autonomous / public /private limited / Partnership/ Proprietorship / any other firm having been in business in India for the last three calender years for supply of the same/similar equipment. The documents authenticating the establishment of the firm shall be submitted.
2. The bidder shall have supplied, installed and commissioned at least three such same/ similar equipment in India and one of them should be in the last three years. Additionally, the list of customers shall also be enclosed.
3. The bidder shall enclose copies of purchase orders/letters of satisfaction from buyers or any other document as a proof of supply of same / similar equipment to Govt. or private customerswith the minimum value of order.
4. The bidder shall submit copies of audited balance sheets of last three years.
5. The bidder shall enclose valid proof of tax registrations as applicable to them such as GST/ PANor any other registration for taxation purpose (for Indian Bidders). In case of foreign companies, bidders shall enclose valid proof of tax registrations from their own country.
6. The bidder should not have been blacklisted.
7. The bidder shouldnot have earlier withdrawn from any tendering process of BIS.
8. The Bidder shall be willing to provide after sales support through a combination of warranty and comprehensive annual maintenance contract for a period of 6 years as per mutually worked out terms and conditions

Note: The bidder shall enclose all requisite documents self attested as specified in the **checklist**.**The bidder must fill the checklist enclosed with relevant details.**

Checklist for Pre-Qualification Criteria (PQC)

Bidders must fill this check list with a **tick (√)** in the boxes in the right hand column. Relevant document, as per the checklist, shall also be enclosed with the technical bid.

S No.	Requirement	Document submitted	Check box
1.	Bidder is	1. Original Equipment Manufacturer 2. Dealer/ agency/ supplier/ Direct Importer	1. ☐ 2. ☐
2.	Bidder is based in	1. India 2. Abroad	1. ☐ 2. ☐
3.	The bidder is a public undertaking/ autonomous body/ public limited / private limited / Proprietorship Company / firm	1. PSU/Autonomous 2.Limited/ Private Limited 3. Prioprietory / Partnership firm/LLP 4. Others (specify ……..)	1. ☐ 2. ☐ 3. ☐ 4. ☐
4.	Enclose applicable documents of establishment of firm - Certificate of Incorportation - Authorization letter from Principals - Partnership Deed/LLP - Proprietory Details - Others (specify ……..)	1. Yes, details enclosed 2. No, details not enclosed	1. ☐ 2. ☐
5.#	Enclose applicable documents of Tax Registration: - GST - PAN - Others (specify ……..)	1. Yes, details enclosed 2. No, details not enclosed	1. ☐ 2. ☐
6	Enclosed statements of turnover per year for last three successive years.	1. Yes, details enclosed 2. No, details not enclosed	1. ☐ 2. ☐
7.	Enclose copies of audited Balance Sheet for last three years	1. Yes, details enclosed 2. No, details not enclosed	1. ☐ 2. ☐
8.	List of customers attached	1. Yes, details enclosed 2. No, details not enclosed	1. ☐ 2. ☐
9.	Enclosed letter of satisfaction from buyers or purchase orders or any other document from customers whom same / similar equipment was supplied.	1. Yes, details enclosed 2. No, details not enclosed	1. ☐ 2. ☐
10	Whether Bidder is willing to provide after sales support through a combination of warranty and comprehensive annual maintenance contract for a period of 6 years as per mutually worked out terms and conditions	1. Yes, willing to provide 2. No, not willing to provide	1. ☐ 2. ☐
11	Whether withdrawn from tendering process of BIS on an earlier occasion	1. Yes 2. No	1. ☐ 2. ☐
12	Whether blacklisted	1. Yes 2. No	1. ☐ 2. ☐
13.##	Had earlier supplied equipment/ service to BIS	1. Yes 2. No	1. ☐ 2. ☐

 # - This is for Indian bidders.In case of foreign companies, bidders shall enclose valid proof of tax registrations from their own country.

##- This is an additional information.

I Pre-bid Meeting

A Pre-bid meeting for interested Bidders will be held at the scheduled date and time indicated in the tender document.Any change in venue or timing of pre-bid meeting will be hosted on BIS website **(**www.bis.gov.in**) and the** Central Public Procurement (CPP) Portal of Government of India **(https://eprocure.gov.in/cppp)**.

Interested Bidders will be allowed to seek clarification and get their doubts cleared during pre-bid meeting.

Any change that would be made in the Tender Document by the Competent Authority after issue of the Tender /Pre bid meeting will be hosted on BIS website **(**www.bis.gov.in**)** and on CPP Portal of Government of India in the form of Corrigendum/Addendum for incorporating the same in the Bid before submission

The minutes of pre-bid meeting shall be intimated to all bidders present in the pre-bid meeting and shall also be exhibited on BIS website and on the CPP portal.

II Availability of Tender Document:

The Tender document may also be downloaded from the website of the Bureau (www.bis.gov.inand the CPP Portal.

The bidder shall bear all costs associated with the preparation and submission of its tender. The Bureau shall, in no case, be responsible or liable for these costs, regardless of the conduct or the outcome of the Bidding process.

III Language of Bid/Contract:

The language of the Bid shall be in English/Hindi and all correspondences etc. shall conform to English/Hindi language.

IV Last Date for Submission

Tenders have to be submitted online on CPP Portal(**https://eprocure.gov.in/eprocure/app)**. It shall be the responsibility of the bidder / tenderer to ensure that tender is submitted on before the deadline of submission prescribed.

Submission of Tenders shall be closed on CPP Portalmentioned earlier at the date & time of submission prescribed after which no bidder shall be able to submit the Tender.

It shall be the responsibility of the bidder / tenderer to ensure that his tender is submitted online on the CPPPortal(https**://eprocure.gov.in/eprocure/app)** before the deadline of submission. BIS will not be responsible for non-receipt of tender documents due to any delay or loss etc.

V Manner of Submission of Bid

Bids shall be submitted online only at CPP Portal.

Bidders are advised to follow the instructions provided in the 'Instructions to theContractors/Bidder for the e-submission of the bids online through the Central Public Procurement Portal. A set of instructions for online bid submission are enclosed.

Bid documents may be scanned with minimum 100 dpi with black and white option which helps in reducing size of the scanned document.

Bidder who has downloaded the tender from the BIS website and the Central Public Procurement Portal shall not tamper/modify the tender form including downloaded price bid template in any manner. In case if the same is found to be tempered/modified in any manner, bid will be completely rejected and EMD would be forfeited and Bidder may be banned from doing business with BIS.

E-mailor fax submission shall not beconsidered.

VI Contents of the bid document

The bidders shall submit their bids in two parts,onepartof thebidshall be **Technical Bid**andsecond part**FinancialBid**.

VII BID Format

a) Price Schedule(s) as per the BoQ format filled up with all the relevant information to be uploaded in the form of BOQ_PriceBid.xls.

The price bid format is provided as BoQ_PriceBid.xls along with this Tender Enquiry Document at https://eprocure.gov.in/eprocure/app**.** Bidders are advised to download this BoQ_XXXX.xls as it is and quote their offer/rates in the permitted column and upload the same in the commercial bid. The wages quoted shall be inclusive of the bonus payable by the contractor to the technical persons and the administrative charges (if any) deployed in the Bureau. **Bidder shall not tamper/modify downloaded price bid template in any manner**. In case if the same is found to be tempered/modified in any manner, tender will be completely rejected and tenderer is liable to be banned from doing business with the Bureau.

b) The authorized signatory of the bidder must digitally sign the bid. Bid sent by fax/email shall not be considered.

B: INSTRUCTIONS TO BIDDERS (FOR STRICT COMPLIANCE)

I DISCLAIMER

The information contained in the Tender Document, provided by the Bureau, is for information of the Bidders to assist them in formulation of their bids. Each Bidder can conduct their own investigation and analysis before submission of the bid. The Bureau shall not incur any liability, whatsoever, with regard to the completeness of the information contained in the Tender Document that the Bidder may require for submission of the bid. The Bureau reserves the right to amend any condition of the Tender Document through publication of a Corrigendum, besides rejection of any or all the bids received, if the Competent Authority of the Bureau decides so.

II ONLINE BID SUBMISSION

The bidder can bid for one or more than one equipment. The bidder has to bid for each equipment separately and provide EMD amount mentioned for each equipment separately for which he is submitting his bid.

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal. More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app.

Bidder should be responsible for registering his company at Central Public Procurement Portal and seeking all necessary approvals required to upload the bid.

The THE BUREAUreserves the right to amend the document, tentative schedule and critical dates. It is the sole responsibility of prospective bidders to go through Central Public Procurement Portal / THE BUREAUWebsite from time to time for any updated information.

III REGISTRATION ON CPP PORTAL

i. Bidders are required to enrol on the e-Procurement module of the Central Public Procurement Portal (URL: https://eprocure.gov.in/eprocure/app) by clicking on the link “Online bidder Enrolment” on the CPP Portal which is free of charge.
ii. As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
iii. Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
iv. Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.
v. Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC’s to others which may lead to misuse.
vi. Bidder then logs in to the site through the secured log-in by entering their user ID /password and the password of the DSC / e-Token.

IV SEARCHING THE TENDER DOCUMENT

i. There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

ii. Once the bidders have selected the tenders they are interested in, they may download the required documents / tender Annexes. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.

iii. The bidder should make a note of the unique Tender ID assigned to each tender; in case they want to obtain any clarification / help from the Helpdesk.

V PREPARATION OF BIDS

i. Bidder should consider any corrigendum published on the tender document before submitting their bids.

ii. Bidder should go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

iii. Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / Annex and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

iv. To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. GST/PAN, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or ''Other Important Documents'' area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

VI SUBMISSION OF BIDS

i. Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

ii. The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

iii. Bidder has to select the payment option as "offline" to pay the EMD as applicable and enter details of the instrument.Bidder should pay the EMD as per the instructions specified in the tender document. The details of the NEFT/onlineinstrument, should tally with the data entered during bid submission time. Otherwise the uploaded bid will be rejected. The EMD amount will be returned to the unsuccessful Bidders as per the provisions of GFR. It will be returned to the successful Bidder after receipt of the Performance Security.

Forfeiture of EMD: The Bid Security / Earnest Money deposited is liable to be forfeited if the tenderer withdraws or amends or impairs or derogates the offer in any respect within the period of

validity of the tender or if the successful Bidder does not pay the Performance Security in the prescribed time limit or fails to sign the Agreement after the award of Contract.

iv. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it, enable Macro in the excel sheet and complete the coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

v. The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.

vi. All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128-bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid openers public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.

vii. The uploaded tender documents become readable only after the tender opening by the authorized bid openers.

viii. Upon the successful and timely submission of bids (i.e. after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.

ix. The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.

VII ASSISTANCE TO BIDDERS

i. Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

ii. Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk Nos. 0120-4200462, 0120-4001002

VIII TERMS & CONDITION

i. The Invitation for Bids is to be uploaded on two bids basis i.e. Technical Bid and Financial Bid. The bidder can bid for one or more than one equipment. The EMD amount for each equipment is, as detailed in Annex 3. The bidder has to bid for each equipment separately and provide EMD amount mentioned for each equipment separately for which he is submitting his bid.

ii. It is the responsibility of the Bidder to ensure that the bids are up loaded on time within the deadline through www.eprocure.gov.in A scanned copy of the EMD sunmitted needs to be uploaded at the Central Public Procurement Portal and the original instrument of EMD shall be submitted before the closing date and time 18-05-2020, till 13:00 h. to Sc F &Head (LPPD), 9, Bahadur Shah Zafar Marg, New Delhi-110002. Registered Micro & Small Enterprises (MSEs) as defined in MSEs Procurement Policy, 2012 issued by Department of Micro, Small & Medium Enterprises (MSME) or as registered with the Central Purchase Organisation or the concerned Ministry or Department or

Start-ups recognized by Department of Industrial Policy and Promotion (DIPP) are exempted from payment of EMD on production of valid certificate of registration with the authority/agency as indicated in the policy.

iii. All bids shall remain valid for 180 days from the last date of submission of bids.

iv. The BIS reserves the right to solicit additional information from Bidders.

v. The THE BUREAU reserves the right to accept the whole, or part of or reject any or all bids without assigning any reasons and to select the Bidder(s) who, in the sole opinion, best meet the interest of the THE BUREAU.

vi. Although negotiations are severely discouraged, the THE BUREAU also reserves the right to negotiate with the bidders placed as L1 bidder in the interest of the THE BUREAU.

vii. The THE BUREAU reserves the right not to accept bid(s) from agencies resorting to unethical practices or on whom investigation/enquiry proceedings have been initiated by Government investigating Agencies/Vigilance Cell.

viii. All information contained in this tender/bid, or provided in subsequent discussions or disclosures, is proprietary and confidential. No information shall be shared by the bidder with any other organizations/agencies.

ix. The successful bidder will submit the supply plan to THE BUREAU.

x. The **Financial bid will be opened** on a date, to be fixed later,for the successful bidders in the technical bid. Authorized representative of the bidder with an authority letter may remain present on the scheduled date and time.

xi. The bid along-with all requisite documents must **be signed and stamped by the authorized person,** failing which the bid shall be liable for rejection.

xii. The Head (LPPD/ Laboratory), THE BUREAUreserves the right to accept or reject any bid or all the bids without assigning any reason thereof.

xiii. **Process to be confidential:**
Information relating to the examination, evaluation and comparison of Bids and the award of a Contract shall not be disclosed to Bidders or any other person not officially concerned with such process until the award to the successful Bidder has been announced.

xiv. Any kind of canvassing in regard to the offered equipment after submitting bid shall be treated as disqualification.

xv. **Special Conditions:** The Indian Agent, if submitting the quotation on behalf of their Principal (i.e. Foreign Supplier), shall ensure and submit the following:
i) Copy of the Agency Agreement with the foreign Principal.
ii) The firm shalltake care of after sales service and requisite spares made available during the lifetime of the equipment, after expiry of the Guarantee / Warranty period, also.
iii) The bank charges for opening of the Letter of Credit out side India are to be borne by the supplier.

xvi. Rates how to be quoted:
Cost of the items should be mentioned clearly in the **Part-II: Financial Bid** only. The following details need to be included:
a. Price break-up of main equipment, accessories.Consumables, spares, fixtures (whichever is applicable) to be supplied by the bidder. Please quote unit rate for each item in Indian Rupees/ USD/ EURO (whichever is applicable). The rates quoted shall be on CIF basis (cost insurance and freight) on door delivery basis.
b. Rates quoted should specifically mention GST/other taxes-duties, as applicable. In absence of any such stipulation, it will be presumed that the prices include all Taxes/charges and no claim for the same shall be entertained.
c. Please quote your rates, othercharges, applicable taxes and duties in the format prescribed in **Part-II: Financial Bid** (Please refer page 18).
d.The equipment is required to be supported for performance for six years, i.e., three years of warranty plus three years of **CAMC** (Comprehensive Annual Maintenance Contract). If the warranty offered by the bidder is less than three years, then the bidder shall quote the CAMC charges,year wise, for

the remaining period of warranty, plus for fourth, fifth and sixth years. Please refer (B) of**Part-II: Financial Bid**

Financial bid shall be evaluated on the total price quoted, which is a combination of unit price of the equipment and CAMC charges upto six years of operation of equipment. The payment will be made for unit price of the equipment which will cover the warranty period also. The CAMC charges as quoted in the financial bid at (B)of Part -II shall be payableon yearly basisafter CAMC starts.

e.Prices shall be quoted in Indian Rupees (INR)/ USD/ EURO (whichever is applicable). In case the rates are quoted in the foreign currency, **the conversion rate to INR (Reserve Bank of India rate) shall be applicable as on the last date of submission of tender.** Evaluation of the financial bid shall be done on the basis of price in INR on the bid closing date.
fThe rates quoted shall be **valid for a period ofone year**from the date of opening of the financial bid of the tender.
g. The successful bidder is responsible for Packing, Forwarding, Freight & Insurance, Customs Clearance, Delivery at site and Installation, Commissioning and Training of THE BUREAU personnel(at least 2 personnel per instrument) in a satisfactory manner.

h.The Agency Commission to the Indian Clearing Agent will not be paid by the THE BUREAU and the same would be borne by the supplier. THE BUREAUshall not provide Custom Duty Exemption Certificate at the time of Custom Clearanceand the supplier has to obtain customs clearance and deliver the goods at specified location (s).

i. The bidder is expected to work out his rates keeping in view the technical specifications as per Annexure-3 of Technical bid& conditions mentioned clearly and arrive at the amount to be quoted. The bidder shall be deemed to have satisfied itself before bidding as to the correctness and sufficiency of its bid and of the rates and prices quoted in the attached form for financial bid (Part-II), which rates and prices shall, except as otherwise provided, cover all its obligations under the Tender and all matters and things necessary for proper fulfilling his obligations under the Tender.The financial bid shall clearly indicate all taxes including local taxes, etc. to be paid by the bidder for the goods to be supplied at specified places and any claim for extra payment on any such account shall not be entertained.
j. The price quoted by the biddershall be applicable for the repeat order(s), if repeat orders are placed with the supplier. However, THE BUREAU reserves the right, not to place the repeat order.

xvii. **Execution of Agreement:** It shall be incumbent on the successful bidder to execute the Agreement, as per Annexure 6, on a non-judicial stamp paper of appropriate value to be purchased in New Delhi before commencement of the supply of the laboratory equipment andpay stamp duty, legal and statutory charges for the Agreement, if any, as applicable on the date of the execution. Please read carefully, the conditions of contract as given **in Part-III: Conditions of contract.**

xviii. The bidder can submit his technical and financial bid along with applicable EMD for one or more number of equipments separately.The evaluation of technical and financial bid for each equipment will be carried out separately and L1 bidder will be determined for each equipment separately.The selection process for one equipment will not have any effect on other equipments.THE BUREAU reserves the right to proceed with one or more equipments as mentioned in the tender document while cancelling the purchase of one or more number of eauipments.

xix. In case, more than one bidder becomes L1 jointly and there are more than one equipment of that kind to be supplied, the purchase order will be split in the successful bidders.

xx. Customs Duty Drawback-If any of the contracted stores are, on exportation, entitled to a drawback of customs duty in respect of themselves or the raw materials involved in their manufacture, the

price to be charged by the Seller should be the net price after the deduction of all the entitled custom duty drawbacks.

xxi. Country of Origin: All goods and services to be supplied and provided under the contract shall have the origin in India or in the countries with which the Government of India has trade relations. The word "origin" incorporated in this clause means the place from where the goods are mined, cultivated, grown, manufactured, produced or processed or from where the services are arranged.

xxii. The insurance cover shall be obtained by the Supplier in its own name and not in the name of the Purchaser or its Consignee.

xxiii. Software and Software Upgrades :

The Supplier shall agree to provide copies of as-built software in executable code that are installed in the system at all levels. It shall also state the Hardware that needs to be in place for implementation ensuring that the Equipment/ Instrument un-availability is minimal. The Supplier shall also comply and guarantee software upgrades for the service life of the Equipment/ Instrument. Taking into account the operational requirements of the Purchaser, there may be a need to customize some portion of the software. Supplier should agree for such customization, which is expected to be limited, at no extra cost. Any software upgrades developed by the Supplier during the warranty and the post warranty period should be made available to the Purchaser at no extra cost and should be delivered and installed in a prompt and efficient manner. The Supplier should install and train the operator with software upgrades.The software provided should be able.

xxiv. **Force Majeure**: Force Majeure (FM) means extraordinary events or circumstance beyond human control such as an event described as an act of God (like a natural calamity) or events such as a war, Strike, riots, crimes (but not including negligence or wrong-doing, predictable/ Seasonal rain and any other events specifically excluded in the clause). An FM clause in the contract frees both parties from contractual liability or obligation when prevented by such events from fulfilling their obligations under the contract. An FM clause does not excuse a party's non-performance entirely, but only suspends it for the duration of the FM. The supplier has to give notice of FM as soon as it occurs and it cannot be claimed ex-post facto. There may be a FM situation affecting Bureau of Indian Standards only. In such a situation, the Bureau of Indian Standardsis to communicate with the supplier along similar lines as above for further necessary action. If the performance in whole or in part or any obligation under this contract is prevented or delayed by any reason of FM for a period exceeding 90 (Ninety) days, either party may at its option terminate the contract without any financial repercussion on either side.

xxv. **Preference to 'Make in India'**: The process will also be subjected to the provisions of 'Public Procurement (Prefrerence to Make in India) Order 2017 and the same will be followed. The bidder, however, shall meet the requirements of technical bid for availing preference under the make in India order.

xxvi. Integrity Pact: For successful supplier, it is essential to sign the integrity pact with the THE BUREAU, given at annexure-7. The pact essentially envisages an agreement between the prospective suppliers/ bidders and the buyer, committing persons/ officials on both sides, not to resort to any corrupt practices in any aspect/ stage of the contract. Only those suppliers/ bidder, who commit themselves to such a pact with the buyer, would be considered competent to participate in the bidding process. In other words, entering into this pact is a preliminary qualification.

C: <u>STANDARD FORMS TO BE UTILIZED BY THE BUREAUANDTHE BIDDERS</u>.

a. **Annexure-1** **Details to be furnished by Bidders**

b. **Annexure-2** **Statement regarding the deviations from the clausesof the tender document**

c. **Annexure-3** **Technical Specification**

d. **Annexure-4** **Technical compliance statement by the bidder**

Annexure-1

Details to be furnished by the bidders

i. Name of the bidder:

2 Details Registration/Import licence if any with validity date:

i. Address for Communication:

i. Telephone No.:
Landline:……. Mobile:……

i. E-mail:

i. Manufacturers Name and Address (if different);

7. Bank Account Details:
Name of the bank:……. A/c no. ……
IFSC code …….. Type of A/c…….

i. Name and designation of the person authorized to sign the documents:

7. PAN, TIN Number of the bidder:

8 Service Tax Registration No.:

i. Details of EMD
Draft Number :…….. Date:……
Name of the Bank: …… Payable at: …….

This is to certify that the above facts are true to the best of my/our knowledge and belief. I/We have read and understood the terms and conditions of the Tender document.
I/We give an undertaking to abide by these terms and conditions of the tender document.
Name and Signature of the bidder
Seal of the Bidder

Date

Annexure-2

Statement regarding the deviations from the clauses of the tender document:

S No.	Tender clause no.	Details of deviation	Justification, if any

Annexure-3

List of equipment

A. List of Test Equipment -Analytical

Sl. No	Equipment	EMD Amount (Lakhs)	No. of Equipment Required	BIS Lab where supply is to be made(*)	Technical Specifications
1.	GC MSMS	Rs. 14.00 Lakhs	7	BNBOL, EROL, WROL, SROL, CL, NROL, PBOL	Annexure- A1
2.	LC MSMS	Rs. 21.00 lakhs	7	BNBOL, EROL, NROL, WROL, SROL, CL, PBOL	Annexure- A2
3.	Spark OES and sample preparation Machines	Rs. 10.00 Lakhs	5	EROL, NROL, PBOL, BNBOL,	Annexure- A3

				SROL	
4.	AAS with autosampler	Rs. 1.40 Lakhs	2	EROL, BNBOL	Annexure- A4
5.	ICP MS	Rs. 12.00 Lakhs	6	WROL, SROL, EROL, BNBOL, NROL, PBOL	Annexure- A5
6.	O, H, N analyzer	Rs. 2.10 Lakhs	3	WROL, EROL, SROL	Annexure- A6
7.	XRF for cement with UPS and computer	Rs. 1.40 Lakhs	2	NROL, WROL	Annexure- A7
8.	DSC Analyzer	Rs. 3.60 Lakhs	3	WROL, CL, SROL	Annexure- A8
9.	CS Analyzer	Rs. 1.20 Lakhs	2	EROL, SROL	Annexure- A9
10.	Epiflourescence/differe ntial interface contrast(DIC) microscope	Rs. 1 Lakh	2	CL, SROL	Annexure- A10
11.	Ion chromatograph	Rs. 0.5 Lakhs	1	PBOL	Annexure- A11
12.	Ultra pure water System	Rs. 1.20 Lakhs	6	CL, BNBOL, WROL, EROL, NROL , PBOL	Annexure- A12
13.	Auto titrator	Rs. 1.20 Lakhs	6	WROL, BNBOL, SROL, PBOL, NROL, CL	Annexure- A13
14.	XRF for referral assay	Rs. 2.00 Lakhs	4	BNBOL, NROL, WROL, PBOL	Annexure- A14
15.	Microbalance	Rs. 2.40 Lakhs	6	BNBOL, NROL, WROL, PBOL, 2 no. at SROL	Annexure- A15

(*)- detailed address given at the end this document

B. List of Equipment- Mechanical

Sl. No	Equipment	EMD Amount (Lakhs)	No. of Equipment Required	BIS Lab where supply is to be made(*)	Technical Specifications
1.	All cut Machine	Rs. 2.80 Lakhs	7	EROL, WROL, SROL, NROL, CL, PBOL, BNBOL	Annexure B1

2.	Computerized digital Impact Tester (Izod charpy)	Rs. 7.20 Lakhs	4	NROL, CL, EROL, PBOL	Annexure B2
3.	Computerized cupping machine	Rs. 1.20 Lakhs	6	NROL, WROL, SROL, CL, EROL, PBOL	Annexure B3
4.	Computerized digital profile projector, 3D	Rs. 4.00 lakhs	2	CL, EROL	Annexure B4
5.	Fully automatic digital micro Vickers hardness tester	Rs. 3.20 Lakhs	2	CL, EROL	Annexure B5
6.	Fully automatic digital Vickers hardness machine	Rs. 3.20 Lakhs	2	CL, EROL	Annexure B6
7.	Automatic load cell based rockwell cum superficial rockwell hardness tester	Rs. 3.60 Lakhs	6	CL, NROL, PBOL, SROL, EROL, WROL	Annexure B7
8.	Metallurgical Microscope	Rs. 4.20 Lakhs	3	EROL, NROL, CL	Annexure B8
9.	Thickening time tester unit	Rs. 1.00 Lakhs	1	EROL	Annexure B9
10.	Computerized UTM 100 KN with provision for digital extensometer	Rs. 1.00 Lakhs	1	EROL	Annexure B10
11.	Computerized UTM 500 KN with provision for digital extensometer with hydraulic grip	Rs. 11.20 Lakhs	7	EROL, PBOL, WROL, BNBOL, CL, NROL and SROL	Annexure B11

12.	Computerized UTM 1000 KN with provision for digital extensometer with hydraulic grip	Rs. 14.40 Lakhs	6	EROL, NROL, PBOL, WROL, BNBOL, SROL	Annexure B12
13.	Computerized UTM 2000 KN	Rs. 2.00 Lakhs	1	CL	Annexure B13
14.	HST Machine with PID Controller	Rs. 2.10 Lakhs	3	SROL, WROL, CL	Annexure B14
15.	Power Press machine	Rs. 1.50 Lakhs	3	SROL, WROL, CL	Annexure B15
16.	Automatic Digital Brinell Hardness testing machine	Rs. 9.60 Lakhs	6	CL, NROL, WROL, PBOL, SROL, EROL	Annexure B16
17.	CNC Milling Machine	Rs. 1.80 Lakhs	6	CL, WROL, SROL, BNBOL, PBOL, EROL	Annexure B17
18.	Computerized Compressive testing Machine (3000 KN) with separate attachment for 500 KN	Rs. 1.80 Lakhs	6	SROL, PBOL, EROL, CL, WROL, BNBOL	Annexure B18
19.	Shaper machine	Rs. 0.96 lakhs	6	EROL, NROL, SROL, WROL, BNBOL, PBOL	Annexure B19
20.	Bend Test machine	Rs. 0.90 Lakhs	3	SROL, WROL, PBOL	Annexure B20

(*)- detailed address given at the end this document

C. List of Equipment-Electrical

Sl. No	Equipment	EMD Amount (Lakhs)	No. of Equipment Required	BIS Lab where supply is to be made (*)	Technical Specifications
1.	Dynamometer and vibration test equipment with computer controlled test bench-FHP motors	Rs. 2.00 Lakhs	1	CL	Annexure C1
2.	Dynamometer and vibration test equipment with computer controlled test bench(5 KW) as per IS 12615	Rs. 2.00 lakhs	1	NROL	Annexure C2
3.	-Fast Transient /Bust Generator -Conducted Susceptibility -Electrostatic Discharge -Damp Oscillatory Wave generator -CE /RE /Radiated Immunity/ Disturbance Power measurement Surge/Impulse Tester	Rs. 12.54 lakhs	1	CL	Annexure C3
4.	Programmable Vibration Test Apparatus. Programmable shock Test Sep Up	Rs. 0.9 lakhs	1	CL	Annexure C4
5.	Meter test system bench 10 position	Rs. 2.4 lakhs	1	CL	Annexure C5

	with at least 10 ICT				
6.	Environmental chamber for dry test, cold test and damp heat test	Rs. 0.7 Lakhs	1	CL	Annexure C6
7.	Making and breaking capacity & Normal Operation test setup up as per IS 1293	Rs. 2 Lakhs	2	CL, WROL	Annexure C7
8.	Making and breaking capacity and normal operation test set up as per IS 3854	Rs. 1.6 Lakhs	2	CL, WROL,	Annexure C8
9.	Tensile testing machine(horizontal) for ultimate breaking	Rs. 0.8 Lakhs	1	NROL	Annexure C9
10.	Humidity Chamber	Rs. 3 lakhs	6	4 no. at CL, 2 no. at WROL	Annexure C10
11.	Data logger for electric immersion water heaters	Rs. 1.2 Lakhs	2	CL, NROL	Annexure C11
12.	Data acquisition system for storage water heaters	Rs. 1.6 Lakhs	2	CL, NROL	Annexure C12
13.	Computerized TTM	Rs. 1 Lakh	1	NROL	Annexure C13
14.	Profile projector with data acquisition system	Rs. 3 lakhs	3	NROL, CL, SROL	Annexure C14
15.	HV tester (up to 700 KV and RIV tester)	Rs. 1.2 Lakhs	1	NROL	Annexure C15
16.	Data logger with microprocessor control for electric iron	Rs. 1.2 lakhs	2	CL, NROL	Annexure C16
17.	Ageing oven	Rs. 0.96 Lakhs	4	1 no. at CL, 1 no. at WROL, 2 no. at NROL	Annexure C17

18.	Skewing machines	Rs. 0.8 Lakhs	2	CL, NROL	Annexure C18
19.	Power analyser single phase	Rs. 0.84 Lakhs	14	9 no. at CL, 5 no. at NROL	Annexure C19
20.	Impulse test (0 to 5KV, 0-15 KV)	Rs. 0.8 Lakhs	2	2 no. at CL	Annexure C20

(*)- detailed address given at the end this document

(*)- detailed address of BIS Labs

BIS Lab	Address of BIS Laboratory
Bangalore Laboratory (BNBOL)	Bangalore Laboratory Bureau of Indian Standards Peenya Industrial Area, 1st Stage, Bangalore -Tumkur Road, Bangalore-560 058, Karnataka
Central Laboratory (CL)	Central Laboratory Bureau of Indian Standards Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad - 201 010, Uttar Pradesh
Eastern Regional Laboratory(EROL)	Eastern Regional Laboratory Bureau of Indian Standards P-230, C.I.T. Scheme VII M, Block-W, Kankurgachi, Kolkata – 700054, West Bengal
Northern RegionalLaboratory(NROL)	Northern Regional Laboratory Bureau of Indian Standards B-69, Phase VII, Industrial Focal Point, SAS Nagar,Mohali – 160051, Punjab
Southern Regional Laboratory(SROL)	Southern Regional Laboratory Bureau of Indian Standards C.I.T Campus, IV Cross Road, Chennai - 600 113, Tamil Nadu
Western Regional Laboratory (WROL)	Western Regional Laboratory Bureau of Indian Standards Manakalaya, E-9, M.I.D.C., Behind Marol Telephone Exchange, Andheri (East), Mumbai - 400 093, Maharashtra
Patna Branch Laboratory (PBOL)	Patna Branch Laboratory Pataliputra Industrial Estate, Patna-800 013

Annexure 3

A. List of Test Equipment -Analytical

Sl. No	Equipment	Item No.	EMD Amount (Lakhs)	No. of Equipment Required	BIS Lab where supply is to be made(*)	Technical Specifications
1.	GC MSMS	C/A1	Rs. 14.00 Lakhs	7	BNBOL, EROL, WROL,SROL, CL, NROL, PBOL	Annexure- A1
2.	LC MSMS	C/A2	Rs. 21.00 lakhs	7	BNBOL, EROL, NROL, WROL, SROL,CL, PBOL	Annexure- A2
3.	Spark OES and sample preparation Machines	C/A3	Rs. 10.00 Lakhs	5	EROL, NROL, PBOL, BNBOL, SROL	Annexure- A3
4.	AAS with autosampler	C/A4	Rs. 1.40 Lakhs	2	EROL, BNBOL	Annexure- A4
5.	ICP MS	C/A5	Rs. 12.00 Lakhs	6	WROL, SROL, EROL,BNBOL, NROL, PBOL	Annexure- A5
6.	O, H, N analyzer	C/A6	Rs. 2.10 Lakhs	3	WROL, EROL, SROL	Annexure- A6
7.	XRF for cement with UPS and computer	C/A7	Rs. 1.40 Lakhs	2	NROL, WROL	Annexure- A7
8.	DSC Analyzer	C/A8	Rs. 3.60 Lakhs	3	WROL, CL, SROL	Annexure- A8
9.	CS Analyzer	C/A9	Rs. 1.20 Lakhs	2	EROL, SROL	Annexure- A9
10.	Epiflourescence/differential interface contrast(DIC) microscope	C/A10	Rs. 1 Lakh	2	CL, SROL	Annexure- A10
11.	Ion chromatograph	C/A11	Rs. 0.5 Lakhs	1	PBOL	Annexure- A11
12.	Ultra pure water System	C/A12	Rs. 1.20 Lakhs	6	CL, BNBOL, WROL, EROL, NROL , PBOL	Annexure- A12
13.	Auto titrator	C/A13	Rs. 1.20 Lakhs	6	WROL, BNBOL, SROL, PBOL, NROL, CL	Annexure- A13
14.	XRF for referral assay	C/A14	Rs. 2.00 Lakhs	4	BNBOL, NROL, WROL, PBOL	Annexure- A14
15.	Microbalance	C/A15	Rs. 2.40 Lakhs	6	BNBOL, NROL, WROL, PBOL, 2 no. at SROL	Annexure- A15

(*)- detailed address given at the end this document

B. List of Equipment- Mechanical

Sl. No	Equipment	Item No	EMD Amount (Lakhs)	No. of Equipment Required	BIS Lab where supply is to be made(*)	Technical Specifications
21.	All cut Machine	M/B1	Rs. 2.80 Lakhs	7	EROL, WROL, SROL, NROL, CL, PBOL, BNBOL	Annexure B1
22.	Computerized digital Impact Tester (Izodcharpy)	M/B2	Rs. 7.20 Lakhs	4	NROL, CL, EROL, PBOL	Annexure B2
23.	Computerized cupping machine	M/B3	Rs. 1.20 Lakhs	6	NROL, WROL, SROL, CL, EROL, PBOL	Annexure B3
24.	Computerized digital profile projector, 3D	M/B4	Rs. 4.00 lakhs	2	CL, EROL	Annexure B4
25.	Fully automatic digital micro Vickers hardness tester	M/B5	Rs. 3.20 Lakhs	2	CL, EROL	Annexure B5
26.	Fully automatic digital Vickers hardness machine	M/B6	Rs. 3.20 Lakhs	2	CL, EROL	Annexure B6
27.	Automatic load cell based rockwell cum superficial rockwell hardness tester	M/B7	Rs. 3.60 Lakhs	6	CL, NROL, PBOL, SROL, EROL, WROL	Annexure B7
28.	Metallurgical Microscope	M/B8	Rs. 4.20 Lakhs	3	EROL, NROL, CL	Annexure B8
29.	Thickening time tester unit	M/B9	Rs. 1.00 Lakhs	1	EROL	Annexure B9
30.	Computerized UTM 100 KN with provision for digital extensometer	M/B10	Rs. 1.00 Lakhs	1	EROL	Annexure B10
31.	Computerized UTM 500 KN with provision for digital extensometer with hydraulic grip	M/B11	Rs. 11.20 Lakhs	7	EROL, PBOL, WROL, BNBOL, CL, NROL and SROL	Annexure B11
32.	Computerized UTM 1000 KN with provision for digital extensometer with hydraulic grip	M/B12	Rs. 14.40 Lakhs	6	EROL, NROL, PBOL, WROL, BNBOL, SROL	Annexure B12
33.	Computerized UTM 2000 KN	M/B13	Rs. 2.00 Lakhs	1	CL	Annexure B13
34.	HST Machine with PID Controller	M/B14	Rs. 2.10 Lakhs	3	SROL, WROL, CL	Annexure B14

35.	Power Press machine	M/B15	Rs. 1.50 Lakhs	3	SROL, WROL, CL	Annexure B15
36.	Automatic Digital Brinell Hardness testing machine	M/B16	Rs. 9.60 Lakhs	6	CL, NROL, WROL, PBOL, SROL, EROL	Annexure B16
37.	CNC Milling Machine	M/B17	Rs. 1.80 Lakhs	6	CL, WROL, SROL, BNBOL, PBOL, EROL	Annexure B17
38.	Computerized Compressive testing Machine (3000 KN) with separate attachment for 500 KN	M/B18	Rs. 1.80 Lakhs	6	SROL, PBOL, EROL, CL, WROL, BNBOL	Annexure B18
39.	Shaper machine	M/B19	Rs. 0.96 lakhs	6	EROL, NROL, SROL, WROL, BNBOL, PBOL	Annexure B19
40.	Bend Test machine	M/B20	Rs. 0.90 Lakhs	3	SROL, WROL, PBOL	Annexure B20

(*)- detailed address given at the end this document

C. List of Equipment-Electrical

Sl. No	Equipment	Item No	EMD Amount (Lakhs)	No. of Equipment Required	BIS Lab where supply is to be made (*)	Technical Specifications
21.	Dynamometer and vibration test equipment with computer controlled test bench-FHP motors	E/C1	Rs. 2.00 Lakhs	1	CL	Annexure C1
22.	Dynamometer and vibration test equipment with computer controlled test bench(5 KW) as per IS 12615	E/C2	Rs. 2.00 lakhs	1	NROL	Annexure C2
23.	-Fast Transient /Bust Generator -Conducted Susceptibility -Electrostatic Discharge -Damp Oscillatory Wave generator	E/C3	Rs. 12.54 lakhs	1	CL	Annexure C3

	-CE /RE /Radiated Immunity/ Disturbance Power measurement Surge/Impulse Tester					
24.	Programmable Vibration Test Apparatus. Programmable shock Test Sep Up	E/C4	Rs. 0.9 lakhs	1	CL	Annexure C4
25.	Meter test system bench 10 position with at least 10 ICT	E/C5	Rs. 2.4 lakhs	1	CL	Annexure C5
26.	Environmental chamber for dry test, cold test and damp heat test	E/C6	Rs. 0.7 Lakhs	1	CL	Annexure C6
27.	Making and breaking capacity & Normal Operation test setup up as per IS 1293	E/C7	Rs. 2 Lakhs	2	CL, WROL	Annexure C7
28.	Making and breaking capacity and normal operation test set up as per IS 3854	E/C8	Rs. 1.6 Lakhs	2	CL, WROL,	Annexure C8
29.	Tensile testing machine(horizontal) for ultimate breaking	E/C9	Rs. 0.8 Lakhs	1	NROL	Annexure C9
30.	Humidity Chamber	E/C10	Rs. 3 lakhs	6	4 no. at CL, 2 no. at WROL	Annexure C10
31.	Data logger for electric immersion water heaters	E/C11	Rs. 1.2 Lakhs	2	CL, NROL	Annexure C11
32.	Data acquisition system for storage water heaters	E/C12	Rs. 1.6 Lakhs	2	CL, NROL	Annexure C12
33.	Computerized TTM	E/C13	Rs. 1 Lakh	1	NROL	Annexure C13
34.	Profile projector with data acquisition system	E/C14	Rs. 3 lakhs	3	NROL, CL, SROL	Annexure C14
35.	HV tester (up to 700 KV and RIV tester)	E/C15	Rs. 1.2 Lakhs	1	NROL	Annexure C15
36.	Data logger with microprocessor control for electric iron	E/C16	Rs. 1.2 lakhs	2	CL, NROL	Annexure C16
37.	Ageing oven	E/C17	Rs. 0.96 Lakhs	4	1 no. at CL, 1 no. at WROL, 2 no. at NROL	Annexure C17
38.	Skewing machines	E/C18	Rs. 0.8 Lakhs	2	CL, NROL	Annexure C18
39.	Power analyser single phase	E/C19	Rs. 0.84 Lakhs	14	9 no. at CL, 5 no. at NROL	Annexure C19
40.	Impulse test	E/C20	Rs. 0.8 Lakhs	2	2 no. at CL	Annexure C20

	(0 to 5KV, 0-15 KV)					

(*)- detailed address of BIS Labs

BIS Lab	Address of BIS Laboratory
Bangalore Laboratory (BNBOL)	Bangalore Laboratory Bureau of Indian Standards Peenya Industrial Area, 1st Stage, Bangalore -Tumkur Road, Bangalore-560 058, Karnataka
Central Laboratory (CL)	Central Laboratory Bureau of Indian Standards Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad - 201 010, Uttar Pradesh
Eastern Regional Laboratory(EROL)	Eastern Regional Laboratory Bureau of Indian Standards P-230, C.I.T. Scheme VII M, Block-W, Kankurgachi, Kolkata – 700054, West Bengal
Northern RegionalLaboratory(NROL)	Northern Regional Laboratory Bureau of Indian Standards B-69, Phase VII, Industrial Focal Point, SAS Nagar,Mohali – 160051, Punjab
Southern Regional Laboratory(SROL)	Southern Regional Laboratory Bureau of Indian Standards C.I.T Campus, IV Cross Road, Chennai - 600 113, Tamil Nadu
Western Regional Laboratory (WROL)	Western Regional Laboratory Bureau of Indian Standards Manakalaya, E-9, M.I.D.C., Behind Marol Telephone Exchange, Andheri (East), Mumbai - 400 093, Maharashtra
Patna Branch Laboratory (PBOL)	Patna Branch Laboratory Pataliputra Industrial Estate, Patna-800 013

Annexure-4

Technical compliance statement by the bidder for …….Test equipment for ……

Sl.No.	Technical Specification (Annexure 3)	Quoted details by the bidder	Deviation from col (2), if any	Remarks
(1)	(2)	(3)	(4)	(5)

Note:
Do not mention "We Comply or Complied with or yes" in your response at col (3),
Quote the actual specifications of equipment to be supplied in col (3).
Deviations, if any, from col (2) be quoted in col (4).

PART-II: FINANCIAL BID

i) The financial bid will be submitted in the following form which can be downloaded from CPPP website. Bidders are advised to quote their offer/ rates in therelevant column and and upload the same in the financial/ commercial bid.

ii) Financial bid shall be evaluated on the unit price quoted + custome duty + surcharge/ cess on custom duty+ CAMC charges upto six years of operation of equipment+ other taxes including IGST (for foreign suppliers) and unit price quoted + CAMC charges upto six years of operation of equipment + other taxes including GST (for 30unctionin suppliers). The payment will be made for unit price of the equipment (which will cover the warranty period also), custome duty with surcharge/ cess on custom duty (if applicable) and IGST / GST. The CAMC charges as quoted in the financial bid at (B) of Part -II shall be payable on yearly basis after CAMC starts.

iii) The format for submitting **Financial Bid** is given below:

(A) UNIT PRICE

S No. **(i)**	**Item description and item code** **(ii)**	**Component As per Technical Specification (Annexure –3)** **(iii)**	**Unit Price (in INR/ USD/EURO) Exclusive of all Taxes at designated Delivery Point** **(iv)**	**Price in words** **(v)**	**Custom Duty, in % of unit price to be entered by bidder** **(vi)**	**Surcharge on Custom Duty, to be entered by the bidder** **(vii)**	**IGST (for imported item) in % of unit price+ Custom duty+ Surcharge or GST (for indegenous item) in % of unit price to be entered by the bidder** **(viii)**	**Total Unit Price 30unctioni of taxes (in INR/ USD/ EURO) [=(iv)+(v)+(vi)+(vii)+(viii)]** **(ix)**	**Period of Warranty (1/2/3 years)** **(x)**
1.									
2									
3									

(i) **Comprehensive Annual Maintenance Contract (CAMC) Charges (in INR):**

S No.	**Component**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
1	*CAMC* *					
2.	Applicable Taxes					
3.	Total					

Total Price of Bid (A+B) (Inclusive of taxes) (In Words)

……

…....…….

Signature of bidder
Name & Address
Date

Note:

i) Discount or any other offers affecting the package price must be mentioned here only. Discount or any other offers affecting the package price mentioned at any other place of the bid will not be considered.

ii) Bids shall be evaluated based on total price (in INR) withtaxes as applicable on the date of closing of Bid in case financial bid is filled in USD/Euro.

iii) * CAMC for 2nd and 3rd year to be quoted if the warranty period is for one year

PART-III: CONDITIONS OF CONTRACT

a) CONTRACTOR:

'Contractor' shall mean the individual or firm or company whether incorporated or not, has qualified in bidding process and undertaking the Contract and shall include legal representatives of such individual or persons composing such firm or unincorporated company or successors of such firm or company as the case may be and permitted assigns of such individual or firm or company.

b) PARTIES TO THE CONTRACT:

The parties to the contract shall be the Supplier/ Contractor (whose offer is accepted by THE BUREAU) and THE BUREAU.

The person signing the offer or any other document forming the part of Contract on behalf of other persons of a firm shall be deemed to have due authority to bind such (person/s) or the firm as the case may be, in all matters pertaining to the Contract. If it is found that the person concerned has no such authority, THE BUREAUmay, without prejudice to any other Civil/Criminal remedies, terminate the Contract and hold the signatory and / or the firm liable for all costs and damages for such termination.

c) PERFORMANCE SECURITY

i) For Foreign Supplier: The successful bidder shall furnish within 15 days of placement of the order an **unconditional Performance Bank Guarantee from a Nationalized/ scheduled Bank for 10% of the order value. Performance Security should remain valid for a period of 60 days beyond the date of completion of all contractual obligations of the supplier including warranty obligations.**On acceptance of this condition and submission of Bank Guarantee, the Letter of Credit will be opened for 100% order value at THE BUREAU HQ/ by concerned lab. If the firm fails to submit the same, the Contract shall be deemed as terminated and the firm's EMD will be forfeited. Performance Security will be furnished in the form of DD/PO favouring BUREAU of INDIAN STANDARDS (payable at .....)/Performance Bank Guarantee as per format indicated in Annexure-5.

ii) For Indian Supplier: The successful bidder shall submit, within 15 days of the placement of the order, an unconditional Performance Bank Guarantee from a Nationalized/ scheduled Bank for 10% of the order value, as per format indicated in Annexure-5. Performance Security will remain **valid for a period of sixty days beyond** the date of completion of all contractual obligations of the supplier including warranty obligations.

Any amount due/recoverable from the Supplier/ Contractor under the terms of this Contract or any other account, may be deducted from the amount of Performance Security In case, the amount of Performance Security is reduced by reason of any such deduction, the Supplier/ Contractor shall, within fifteen (15) days of receipt of notice of demand from THE BUREAU, make good the deficit. In case, security is deposited by way of bank guarantee by the Supplier/ Contractor, then any penalty for damages liquidated or un-liquidated or for any breach or failure or determination of Contract, not previously paid to THE BUREAU, shall immediately on demand be paid by the said bankers to THE BUREAU under and in terms of the said guarantee.

If during the term of this Contract, the Contractor is in default of the due and faithful performance of its obligations under this Contract, or any other outstanding dues by the way of fines, penalties and recovery of any other amounts due from the Contractor, THE BUREAU shall, without prejudice to its other rights and remedies hereunder or at the Applicable Law, be entitled to call in, retain and appropriate the Performance Security.

Nothing herein mentioned shall debar THE BUREAU from recovering from Contractor by a suit or any other means any such losses, damages, costs, charges and expenses as aforesaid, in case the same shall exceed the amount of the Performance Security.

The Performance Security shall be retained until all disputes, if any, between both the parties have been settled to the entire satisfaction of THE BUREAU. The Performance Security shall be returned to the Contractor by THE BUREAU within sixty days following the Completion Date or Termination Date of this Contract provided that there are no outstanding claims of THE BUREAU on the Contractor.

d) CONTRACT DOCUMENTS:

The several Contract documents forming the Contract shall be taken as mutually explained to one party by the other, but in case of ambiguities or discrepancies the same shall be explained and harmonized by the Authorized Officer of THE BUREAU who shall issue to the Contractor necessary instruction thereon and in such event unless otherwise provided in the Contract the priority of the documents forming the contract shall be as follows:

i) The Agreement
ii) The terms and conditions of the Contract
iii) Tender Notice and Tender Document
iv) Purchase orderor Letter of Acceptance
v) Any other correspondence exchanged between the parties in connection with the contract.
vi) The Contractor's Offer

5. QUANTITY OF GOODS or PLACE OF SUPPLY or PERSONS WHO CAN PLACE ORDERS

The **Testing Equipments** shall be supplied at various THE BUREAU labs, as detailed in Annexure 3, at the address(s) given below:

a) Head, ---------- Laboratory
Bureau of Indian Standards

----------, PIN ----------

b) Head, ---------- Laboratory
Bureau of Indian Standards

----------, PIN ----------

c) Head, ---------- Laboratory
Bureau of Indian Standards

----------, PIN ----------

Goods for each THE BUREAULaboratory can be ordered by Head of that THE BUREAULaboratory only, who is authorized by THE BUREAU to place orders against this Contract. Goods can be repeat-ordered by Head of otherTHE BUREAU Laboratories, who are authorized by THE BUREAU to place repeat orders against this Contract. However, the Authorized Officer reserves right not to place repeat orders.

Immediately on receipt of the purchase order (leats within one week of receipt of the purchase order), the contractoror supplier shall intimate the concerned laboratory about the consumables or other additional

articles required for correct 34unctioning of the instrumentor equipment, so that timely installation and commissioning can be done, and no time is lost in completion of such formalities after receipt of the instrumentor equipment.

6 TRANSPORTATION:

The supplier is required to ensure having an import license for the equipment quoted where applicable as per GOI guidelines. The Goods shall be delivered at the destinations specified in Clause 8 below and shall include loading, unloading and transportation. **The Goods damaged during transportation shall have to be replaced at Contractor's cost.**THE BUREAU will provide Customs Duty Exemption Certificate for imported items as applicableand the successful bidder shall be responsible for necessary customs clearance.

7. QUALITY OF GOODS:

All Goods to be supplied by the Contractor shall be in conformity with the Technical specifications as laid down in Annexure-3 of this bid.

8 CONSIGNMENT DESTINATION:
For the destination mentioned in the purchase order:

a) Head (---------- Laboratory),
Bureau of Indian Standards,

----------, PIN ----------

b) Head, ---------- Laboratory
Bureau of Indian Standards

----------, PIN ----------

c) Head, ---------- Laboratory
Bureau of Indian Standards

----------, PIN ----------

d) Head, ---------- Laboratory
Bureau of Indian Standards

----------, PIN ----------

9 INSTALLATION AND COMMISSIONING: Installation and commissioning of the equipment will be done by the supplier **FREE OF CHARGE** at the consignee's premises. The supplier has to arrange for labour and others.

10 WARRANTY

10.1 The equipment along with all critical componentsoraccessories is to be guaranteed for trouble free performance for a **minimum period of three years after installation.**If the warranty period is less than three years, the Comprehensive Annual Maintenance Contract Charges for the remaining period (three years – the actual warranty period quoted) shall be added to the cost of equipment for the purpose of evaluation of the financial bid.

10.2 The defects, if any, during the warranty periodshall be rectified free of charge by arranging free

replacement at site, wherever necessary. **The last six months of the warranty period shall be free of complaints, failing which the warranty period will get extended by another six months.**

11. FREE TRAINING

Training, free of cost will be provided by the supplier to **at least twoTHE BUREAUofficials**for testing, routine maintenance and smooth running of the equipment, after installation and commissioning at the location.

12. INSPECTIONor PRE-DELIVERY INSPECTION

THE BUREAU reserves the right to carry out predelivery inspectionorinspection at the time of delivery. The obligation to supply goods conforming to specification and its successful installation and commissioning shall be on the supplier.

The Authorized Officer shall be entitled to inspect and examine goods intended to be supplied to THE BUREAU either at the factory, godown or at any place(s) where these are lying or from which these are being obtained and the supplier shall provide such facilities as may be required for such inspection and examination. If goods are not found as per specified requirements, purchase order will be revoked and thereafterTHE BUREAU shall be free to purchase the goods from the open market.THE BUREAU will not make any payment for any such non-conforming goods.

All goods shall be inspected by THE BUREAUpreferably in the presence of supplier or his authorized representative, when the packages are opened in THE BUREAULabs on delivery and prior to installation. The decision of THE BUREAUshall be binding. Rejected itemsorgoodsorstores shall be removed by the supplier at his own cost and risk, within 30 days of receipt of notice for the removal of such goods, and no liability, whatsoever, on THE BUREAUshall be attached for the rejectedordisapproved goodsoritemsorstores.In case of default on the part of the supplier in removing the rejected goods, the Authorized Officerof THE BUREAU shall be at liberty to have them removed by other means. The Authorized Officer shall have full powers to procure other goods through other means for substitutingthe rejected goods. All costs, which may be incurred upon such removal andoror substitution, shall be borne by the supplier.

The Authorized Officer shall have full powers to decide about removal of any or all of the goods supplied which are not in accordance with the contract specifications or which do not conform to the samples, if any, approved by THE BUREAU.

13. TIME FORSUPPLY, INSTALLATION AND COMMISSIONING.

13.1 The time allowed for delivery, successful installation and commissioning shall be 8 weeksfrom the date of purchase order (PO). In case of foreign suppliers, the date of delivery, successful installation and commissioning shall be within 8 weeks of opening of Letter of Credit (LOC).

13.2 **Liquidated Damages For Delayed Supply Installation and Commissioning:** Time and date of **Supply Installation and Commissioning of equipments**as stipulated in the order shall be deemed to be the essence of the contract. In case of delay in execution of the order beyond the date of delivery as stipulated in the order or any extensions sanctioned by the Authorized Officer, THE BUREAU may at its option either:-

13.3.1 Accept delayed delivery at prices reduced by a sum equivalent to one percent (1%) of the value of any goods not delivered for every week of delay or part thereof limited to a maximum of 10% of the total order value.

13.3.2 Cancel the order in part or full and purchase such cancelled quantities from elsewhere on account and at the risk of the bidder, without prejudice to its rights in respect of goods delivered.

14. RISK PURCHASE

In case the Contractor fails to deliver the quantity as stipulated in the delivery schedule, THE BUREAU reserves the right to procure the same or similar Goods from alternate sources at the risk, cost and responsibility of the Contractor.

15. IMPOSITION OF FINES or PENALTY

Subsequent to an order being placed against the quotation received in response to this enquiry if it is found that the goods supplied are not of the right quality or not according to specifications required by THE BUREAU or received in damaged or broken condition or otherwise not satisfactory owing to any reason of which THE BUREAUshall be the sole judge, THE BUREAUshall be entitled to reject the goods, cancel the contract and buy its requirements in the open market and recover the loss, if any, from supplier reserving to itself the right to forfeit the security deposit, if any, furnished by the supplier against the contract. The supplier will make his own arrangements to remove the rejected goods within 30 days of instruction to do so. Thereafter, they will lie entirely at the suppliers risk and responsibilities and storage charges along with any other charges applicable will be recoverable from the supplier.

16. TERMS OF PAYMENT:

A)The Terms of Payment are: The successful bidder shall furnish with in 15 days of placement of the order a Performance Security, from a Nationalizedor Scheduled Bank for 10% of the order value. **Performance Security should remain valid for a period of 60 days beyond the date of completion of all contractual obligations of the supplier including warranty obligations.** On acceptance of this condition and submission of Performance Security, as given in 3 of Part-III, the Letter of Credit will be opened for 100% order value. If the firm fails to submit the same, the Contract shall be deemed as terminated and the firm's EMD will be forfeited. The Performance Security shall be furnished in the bank account of BUREAU of INDIAN STANDARDS (payable at……..)orPerformance Bank Guarantee as per format indicated in Annexure-5.

B) Payment to foreign suppliers:

i) **Payment for imported items**: 80% payment shall be made by an Irrevocable Letter of Credit established in favour of the supplier at THE BUREAU HQor by concerned THE BUREAU laboratory, for the order value against the presentation of original shipping documents provided that the Performance Security for 10% of the order value within 15 days of placement of the order is given to THE BUREAU.20% of the order value of goods received shall be paid within 30 days of receipt of the goods and successful installation, **commissioning& training** upon submission of claim supported by the acceptance certificate issued by the Purchaser along with the Performance Security.

ii) **Payment for indigenous items:**100% payment shall be made against delivery, installation, commissioning, training at site and on acceptance as per Purchase Order provided, that the Performance Security for 10% of the order value, within 15 days of placement of the order is given to THE BUREAU.

C) **Payment for Indian Suppliers:**100% payment shall be made against delivery, installation, commissioning, training at site and on acceptance as per Purchase Order provided, that the Performance Security for 10% of the order value, within 15 days of placement of the order is given to THE BUREAU.

17. TAXES

Taxes will be deducted by THE BUREAU wherever applicable.

18. INDEMNITY:

The Contractor shall indemnify and keep indemnifiedTHE BUREAUagainst all losses and claims for injuries or damage to any person or any property whatsoever which may arise out of or in consequence of the Contract and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto under the provisions of various labour laws as amended from time to time.

The Contractor shall indemnify, protect and save THE BUREAU against all claims, losses, costs damages, expenses, action suits and other proceeding, resulting from infringement of any patent, trademarks, copyrights etc. or such other statutory infringements.

19. CORRUPT OR FRAUDULENT PRACTICES

THE BUREAU requires that the Bidders under this Bid observe the highest standards of ethics during the procurement and execution of such Contracts.

THE BUREAU will reject a proposal for award if it determines that the Contractor has engaged in corrupt or fraudulent practices before, during or after the period of contract; THE BUREAUwill hold the Contractor ineligible to be awarded a contract, either indefinitely or for a period of 24 months from the date of declaring the contractor ineligible if it at any time determines that the Contractor has engaged in corrupt and fraudulent practices in competing for, or in executing the Contract.

20. THE BUREAUMAY TERMINATE THE ORDER, IF

(a) The Contractor becomes insolvent;
(b) A receiver, administrator, trustee or liquidator is appointed over a substantial part of its assets;
IAny act is done or event occurs with respect to the Contractor or its assets, which, under any applicable law has substantially similar effect to any of the foregoing acts or events;
(c) Serious discrepancy in the quality of the Goods is noticed during the inspection.
IDelays in delivery beyond the scheduled date of delivery as stipulated in the order or any extensions sanctioned.
(d) Delays in installation and commissioning beyond the period stipulated or any extensions sanctioned.
(e)If the Contractor is in breach of any law or statute governing the supply of Goodsor Services;
(f) The Contractor, in the judgement of the THE BUREAU, has engaged in corruptor fraudulent practices in competing for or in carrying out the Services under the Contract.
(g)The Contractor enters into voluntary or involuntary bankruptcy or liquidation.
It shall also be lawful for THE BUREAU to terminate the Agreement at any time without assigning any reason and without being liable for loss or damage which the Contractor may suffer by reason of such termination, by giving the Contractor 15 days notice in writing by THE BUREAU for such termination. Any such termination shall be without prejudice to any other right of theTHE BUREAUunder the Contract.

If the Contractor decides to terminate the Contract before the end of contractperiod, the Contractor has to give an advance intimation of at least 60 days.If the Contractor terminates the agreement without prior notice of 60

days, then the entire security deposit will be forfeited.

21. PUBLICITY

Any publicity by the Contractor in which the name of THE BUREAU is to be used, should be done only with the explicit written permission of THE BUREAU.

22. JURISDICTION

No suit or other proceedings relating to performance or breach of Contract shall be filed or taken by the Contractor in any Court of law except the competent Courts having jurisdiction in New Delhi, where headquarter of THE BUREAU is located.

23. DISPUTE RESOLUTION - In case of any dispute that cannot be resolved amicably, the same shall be referred to the sole Arbitrator appointed by Director General, Bureau of Indian Standards, whose decision shall be final and binding upon both the Bureau as well as the Applicant. The provisions of the Arbitration and Conciliation Act, 1996, as amended from time to time, shall be applicable

24. MODE OF SERVING NOTICE

Communications between Parties which are referred to in the Contract are effective only when in writing. A notice shall be effective only when it is delivered. All notices shall be issued by the authorized officer of THE BUREAU unless otherwise provided in the Contract. In case, the notice is sent by registered post or speed post to the last known place or abode or business of the Contractor, it shall be deemed to have been served on the date when in the ordinary course of post these would have been served on or delivered to it.

25.GOVERNING LANGUAGE

Governing language for the entire contract and communication thereof shall be English and or or Hindi only. In case of any dispute, the English version shall prevail.

26. LAW:

The contract shall be governed and interpreted under Indian Laws.

27. STAMP DUTY

The Contractor shall bear and pay any stamp duty and registration charges if any, in respect of the agreement to be signed.

28. AUTHORIZED OFFICER:

The Authorized Officer on behalf of THE BUREAU shall be the Head(s), of the THE BUREAU Laboratory giving the purchase order. In case of repeat orders by any other THE BUREAU Laboratory, the Head of concerned THE BUREAU Laboratory placing the repeat order shall be deemed to be the Authorized Officer in respect of the said order.

29. **STANDARD FORMS TO BE UTILIZED BY THE THE BUREAU AND THE CONTRACTOR:**

Annexure-5 BANK GUARANTEE BOND
Annexure-6 CONTRACT AGREEMENT FORM

30. CONFIDENTIALITY

The bidder shall not divulge or disclose proprietary knowledge obtainedwhile delivering Goods and services under this Contract to any person,without the prior written consent of the Bureau.

ANNEXURE-5
FORM OF BANK GUARANTEE BOND

1. In consideration of Bureau of Indian Standards (hereinafter called 'The THE BUREAU') having agreed to exempt _____

   (hereinafter called "the said Contractor(s)') from the demand under the terms and conditions of an Agreement dated _____ made between _____ and _____ for

   _____ (hereinafter called "the said Agreement of **Performance Security** for the due fulfillment by the said Contractor (s) of the terms and conditions contained in the said Agreement, on production of a Bank Guarantee for Rs._____(Rupees_____-_____ Only) we,_____ {hereinafter referred to as (indicate the name of the bank)'the bank'} at the request of _____

   [(Contractor (s)] do hereby undertake to pay THE BUREAU an amount not exceeding Rs. _____ against any loss or demand caused to or suffered or would be caused to or suffered by the THE BUREAU by reason of any breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement.

2. We _____ do hereby indicate the name of the bank)undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the THE BUREAU of Indian Standards stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by THE BUREAU by reason of breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement or by reasons of the Contractor (s) failure to perform the said Agreement. Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. .....

3. We, undertake to pay to THE BUREAU any money so demanded notwithstanding any dispute or disputes raised by the Contractor (s) or Supplier (s) in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

   The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor (s) or Supplier (s) shall have no claim against us for making such payment.

4. We, _____ further agree that the Guarantee

   (indicate the name of Bank)

   herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of THE BUREAU under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till the authorized officer of the THE BUREAU (…….Laboratory) certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said

Contractor (s) and accordingly of the said Agreement have been fully and properly carried out by the said Contractor (s) and accordingly discharges this guarantee. Unless a demand or claim under this guarantee ismade on us in writing on or before the .....we shall be discharged from allliability under this guarantee thereafter.

5. We .....further agree with the THE BUREAU that

(indicate the name of Bank)

THE BUREAU shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time to performance by the said Contractor (s) from time to time or to postpone for any time or from time to time any of the powers exercisable by THE BUREAU against the said Contractor (s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor (s) or for any forbearance, act or commission on the part of THE BUREAU or any indulgence by THE BUREAU to the said Contractor (s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor (s) or Supplier (s).

7. We, ... lastly undertake not to revoke this

(Indicate the name of bank)

guarantee during its currency except with the previous consent of THE BUREAU in writing.

Dated the..... day of..... 20

For .....

(indicate the name of bank)

Annexure-6

CONTRACT FORMorAGREEMENT

THIS AGREEMENT made on this day of between Mors_____ (Name and Address of the Contractor) (hereinafter referred to as the CONTRACTOR, which expression shall, unless it be repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns) of the ONE PART and the THE BUREAU of Indian Standards, 9-Bhadurshah Zafar Marg, New Delhi-110002 (hereinafter referred to as the THE BUREAU, which expression shall, unless it be repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns) of the OTHER PART.

WHEREAS the Contractor is a manufacturersor millsor authorized distributorsor dealers (Details of business)

AND WHEREAS THE BUREAU is a body corporate, enacted by Parliament . THE BUREAU intends to purchase _____ , therefore, invited bids through Open Tender enquiry dated _____

WHEREAS the Contractor (successful bidder) submitted his bid vide _____ in accordance with the bid document and was selected as 'successful bidder' pursuant to the bidding process and negotiation on contract prices, awarded the 'Letter of Acceptance' (LoA) No._____ to the Contractor on _____.

BOTH THE PARTIES HERETO agree to abide the terms and conditions as mentioned in:

"Part-III (Conditions of Contract) of Tender Document".

_____	_____
(Signature of Contractoror Authorized Representative)	(Signature of Authorized Officer of THE BUREAU)
Name _____	Name _____
Designation_____	Designation_____
Address_____	Address_____
_____	_____
Seal of the FirmorCompany	**Seal of THE BUREAU**
Witness:	**Witness:**
_____	_____
(Signature)	(Signature)
Name of Witness_____	Name of Witness_____
Address_____	Address_____

Annexure -7

INTEGRITY PACT GUIDELINES

"The Bureau" and "The supplier" hereby agree not to indulge in any corrupt practices including without limitation any activity or action to influence the transaction on any aspect of contract and commit to take all measures necessary to prevent corruption maintaining complete transparency and fairness in all activities related to the Bureau. Users agree to follow and adhere with the Integrity Pact guidelines as under:

Preamble

The Bureau values full compliance with all relevant laws of the land, regulations, economic use of resources and of fairness or transparency in its relations with its Contractor (s).

Section 1 Commitments of the Bureau.

1. The Bureau commits itself to take all measures necessary to prevent corruption and to observe the following principles:

(a) No employee of the Bureau, personally or through family members, will in connection with the bid for, or the execution of a person, any material or immaterial benefit which the person is not legally entitled to.

(b) The Bureau will during the bid process treat all bidders with equity and reason. The Bureau will in particular, before and during the bid process, provide to all Contractor(s) the same information and will not provide to any supplier(s) confidential or additional information through which the supplier(s) could obtain an advantage in relation to the process or the contract execution.

(c) The Bureau will exclude from the process all known prejudiced persons.

2. If the Bureau obtains information on the conduct of any of its employees which is a criminal offence under the IPC or PC Act, or it there be a substantive suspicion in this regard, the Bureau will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 Commitments of the supplier(s)

1. The supplier(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the bid process and during the contract execution.

(a) The supplier(s) will not, directly or through any other persons or firm, offer promise or give to any of the Bureau's employees involved in the bid process or the execution of the contract or to any third person any material or other benefit which he or she is not legally entitled to, in order to obtain in exchange any advantage before or during the execution of the contract.

(b) The supplier(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

(c) The supplier(s) will not commit any offence under the relevant IPC or PC Act; further the supplier(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any

information or document provided by the the Bureau as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

(d) The supplier(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2. The supplier(s) (s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 Disqualification from bid process and exclusion from future contracts

1. If the supplier(s), before award or during execution has committed a transgression through a violation of Section 2, above or in any other form such as to put his reliability or credibility in question, the Bureau is entitled to disqualify the supplier(s) from the bid process or take action as per the related provisions of the RFP document.

.

Section 4 Compensation for Damages

1. If the Bureau has disqualified the supplier(s) from the bid process prior to the award according to Section 3, the Bureau is entitled to demand and recover the damages equivalent to Earnest Money Deposit.

2. If the Bureau has terminated the contract according to Section 3, or if the Bureau is entitled to terminate the contract according to Section 3, the Bureau shall be entitled to demand and recover from the supplier damages of the amount equivalent to Performance Bank Guarantee.

Section 5 Previous Transgression

1.The supplier declares that no previous transgressions occurred in the last three years with any Government Organization that could justify his exclusion from the bid process.

2. If the supplier makes incorrect statement on this subject, he can be disqualified from the bid process and action can be taken as per the related provisions of the RFP document.

BUYER BUREAU OF INDIAN STANDARDS, NEW DELHI	BIDDERor SUPPLIER SIGNATURE & SEAL

Annexure 8

TENDER ACCEPTANCE LETTER
(To be given on Company Letter Head)

Date:

To,
_____
_____
_____
_____
_____

Sub: Acceptance of Terms & Conditions of Tender.

Tender Reference No: _____

Name of Tender or Work: -
_____
_____
_____
_____
_____

Dear Sir,

1. Ior We have downloaded or obtained the tender document(s) for the above mentioned 'TenderorWork' from the web site(s) namely:
_____
_____

As per your advertisement, given in the above mentioned website(s).

2. I or We hereby certify that I or we have read the entire terms and conditions of the tender documents from Page No. _____ to _____ (including all documents like annexure(s), schedule(s), etc.,), which form part of the contract agreement and I or we shall abide hereby by the terms or conditions or clauses contained therein.

3. The corrigendum(s) issued from time to time by your departmentor organization too have also been taken into consideration, while submitting this acceptance letter.

4. I or We hereby unconditionally accept the tender conditions of above mentioned tender document(s) or corrigendum(s) in its totality or entirety.

5. I or We do hereby declare that our Firm has not been blacklistedor debarred by any Govt. DepartmentorPublic sector undertaking.

6. I or We certify that all information furnished by the our Firm is true & correct and in the event that the information is found to be incorrectoruntrue or found violated, then your departmentor organization shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE – A1

492

Technical Specification of Triple Quadrupole GC MS/MS System with FID

Sl. No	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	**SYSTEM:**	Gas chromatograph with digital display panel & with two injectors and two detectors(MS/MS and FID). The system should be quoted with all accessories required to make it fully operational.
2.	**OVEN:**	i) Up to 450°C, Fast Oven with 120 °C/min ramp, ≥7ramps ii) Cool-down time from 450 °C to 50 °C within 5 minutes iii) Should be able to accommodate two injectors & two columns. iv) Automatic leak test of system through single key
3.	**PNEUMATIC CONTROLS:**	0-100 psi or better, all Electronic Pneumatic Controls/AFC with 0.1 psi precision.
4.	**INJECTOR (Two Nos):**	i) One Injector should be Splitless/Split ii) Second Injector should be Multimode/PTV with 200µL or better Injection Volume capability with complete solvent vaporizer system or Equivalent & should have Backflush system, 400°C max. and ≥ 3 ramps.
5.	**AUTOSAMPLER (LIQUID & HEADSPACE):**	Robust Liquid autosampler capable of injecting 100 samples or higher with injecting volume capacity of 0.5 µl to 200 µL. Head Space Autosampler: Capable of injecting upto 1 ml, with the capacity of minimum 10 vials or better that support 10 & 20 ml vial capacity with pneumatic control with shaking Incubation oven temperature ranges 50-200°C in 1°C steps. Capacity for Incubation oven should be minimum 6 vials Autosampler (Liquid & Headspace) should be completely programmable from software
6.	**Purge and Trap System**	Suitable purge and trap system to install on GC MSMS to analyze Pesticide residue as per USEPA methods
7.	**DETECTORS:**	The GC must be supplied with FID and MS/MS detector
		A) FLAME IONIZATION DETECTOR: i) Linear range : 10^6or better ii) Minimum detectable amount with makeup gases : 1.5 pgC/sec iii) Operating temperature limits: 450°C or better. iv) Auto flame out detection. v) Acquisition rate : 300 HZ or better **B) MS/MS DETECTOR** **Triple Quadrupole Mass Spectrometer (GCMS/MS)** **The Triple Quadrupole GC MS/MS system must offer superior sensitivity and robustness, fast & easy method development for multi-component quantification and should have the following specifications** **(i) Modes (MS/MS)** a) It should have Multiple/Selected Reaction Monitoring (MRM/SRM), combined SRM/full scan, product ion scan. **(ii) Ion Source** a. It should have EI source. Programmable upto 350 °C or better. b. It should have dual filament for EI.

		(iii)Transfer Line Temperature a. The temperature should be up to 350 °C or more **(iv) Quadrupole Mass Analyzer** a. Mass Range : 10 –1000 amu or better b. Resolution : 0.7 amu or better c. Mass Stability: ± 0.1 amu for minimum 24 hours at constant temperature or better. **(v) Detection System** a. The detection system should be with Electron multiplier detector, linear range of 10^6 or better. **(vi) Collision Energy Range** a) 0–60 eV or more **(vii) Scan Speed** a) The MS should have scan speed up to 20000 u/sec or better b) 800 MRM/SRM transitions/sec or better c) 0.5ms dwell time for MRM/SRM transition or better **(viii) Vacuum System** a) Dual-stage turbo molecular pump of capacity 250 l/sec or better. b) It should have Standard rotary-vane pump **(ix) Sensitivity(Reference/Demonstration) Specifications** **a. Electron Ionization SRM/MRM** Ionization 1 µL of 100 fg/µL OFN will produce the following minimum signal-to-noise for the transition from m/z 272 to m/z *222: 30000:1 or better* **b. Instrument Detection Limit** Detection Limit 0.5fg or less OFN, derived at the 99% confidence level from area precision of eight sequential injections of 1 µL, 2fg/µL OFN or less, acquired in EI SRM/MRM. The same to be demonstrated during installation at site. **c. Library and database:** The following libraries/ database should be provided. • Latest (as available at the time of supply) and licensed version of NIST library, Wiley Library and Pesticide Library along with free updation of the library till the CAMC period. • The system should be supplied MRM/*SRM* data base with more than 1,000+ compounds (includingphthalate content) and **minimum 6 transitions** for each compound.
8.	**Sample Preparation Accessory/Kit:**	Solid Phase Extraction for Water sample analysis along with consumable for 2000 samples to be supplied. Quechers kit for PDW /milk products/infant food to be provided-1000 Nos. each per matrix Two nos. Microprocessor based Nitrogen evaporation system with 15 ml capacity and 200 ml capacity from ambient temperature to 70 degree C water bath.
9.	**GAS SUPPLIES:**	High purity Gases like Helium, Hydrogen, Zero Air, Argon etc as applicable to the system in gas cylinders as per GCMS/MS system requirement (3 No. Each). Nitrogen generator of capacity (200 ml/min or better) with required accessories (separate scroll type Air compressor, Connecting lines upto the system, traps/purifiers, regulators etc) to be supplied only in case the system requires

		Nitrogen gas for its operation, the Nitrogen generator should be capable of generating gas having minimum purity of 99.9995% with certificate. Requisite regulatory certificates for the cylinders to be provided. Commissioning and installation of all the required gases including tubing, manifold and purification panel to be done as per the site requirements. i) Automatic Change Over Manifold for each gas line/GCMSMS ii) Two stage SS (316) Gas regulator with Teflon Diaphragm for each gas (01 No each) iii) Complete Gas Purification Panel with fittings, Tubing with Colour coding sleeves (approx. 150 m) & installation of all gases iv) Renewable In Line Gas Purification System v) Renewable gas purifier cartridge, Spare Set vi) Gas clean filters/Traps (6 No.)
10.	**SOFTWARE AND HARDWARE (Single point control of Software & Hardware)**	**A) SOFTWARE**: Windows Based software with multitasking and capable of performing the following functions: It must be able to control all the devices from same software. Quantification software for batch process must confirm the analytes as per regulatory requirements in food and environmental sample analysis as per the applications specified. Data acquisition, integration, calibration, quantification and QC calculations must be automated. Automatic MRM/SRM method Development must be feasible. All Flow Controller i.e. Carrier flow, Make-up flow, Hydrogen flow, Air flow etc. with digital calibrated Flow Meter (for Gas as well as Liquid from 0.1 ml to 400 ml). Value should set through Software by PC. Manual and Auto tune options should be provided. Library searching facility with Licensed NIST, Wiley and Pesticide Library (in CD/ROM Format with Online updation). Fatty Acid Methyl Esters, and artificial flavors. **Licensed software should be provided & it should be 21 CFR part 11 compliant.** **B) HARDWARE:** , Intel core i7 (6th generation or better) processor, 16 GB RAM or more, 1 TB HDD or more, LED Flat-Color size-27" or bigger, DVD Multidrive, USB Port minimum 06 Nos, Optical mouse with pad, Keyboard, laser Jet Printer Color or higher configuration for use with the above system to be provided. Computer should have **licensed version of Windows 10** and other supporting softwares installed.
11.	**IQ,OQ, PQ :**	**On site IQ, OQ of instrument along with document to be provided & supplier to assist till satisfactory PQ of instrument.**
12.	**APPLICATION SUPPORT:**	The Application support for stated applications required during method development and validations (Packaged drinking water/Packaged natural mineral water and milk powders/infant foods – any two to be decided by user lab) must be provided.
13.	**Additional Consumables as**	a. EI filament : 06 Nos

	per stated application:	b. SEPTA for injectors:Non stick, Low bleed, high puncture tolerance and Max. Temp 400 °C (for each injector). (200 No.) c. Liners : i) Suitable Inert Injector Liner for SS & SSL (20 No.) ii) Suitable Injector Liner upto 10 µL (6 No.) iii) Suitable Injector Liner upto 250 µL (6 No.) iv) Liner O-Rings Max Temp 375°C (100 No.) d. Graphite Ferrules and Nuts for injector end and detector end: 50 No. each for GCMS/MS and FID e. VIALS, CAPS AND TOOL FOR AUTOSAMPLER (Only Compatible sizes should be supplied) : i) Vial sets 1-2ml, screw/crimp type Amber glass - 2000No. ii) Vial sets 1-2ml, screw/crimp type Clear glass - 2000No. iii) Recovery vials clear glass– 1000 Nos iv) Head Space Vials 10ml & 20 ml– 1000 Nos each v) 300/500 µL vials inserts – 250 Nos vi) Septa PTFE/Silicone (for 1-2 mL Vials) - 2500 Nos vii) Injector Septa – 500 Nos viii) Storage Racks for (for 1-2 mL Vials) - 5 Nos. ix) Storage Racks for (for 10 mL, 20 ml Vials) - 5 Nos. x) Ergonomic crimping tools for different vial types xi) Ergonomic decrimping/decapping tools for different vial types f. Autosampler Syringe i) 10 µL (06 Nos.) ii) 50 µL (02 Nos.) iii) 100 µL (02 Nos.) iv) 250 µL (02 Nos.) g. HS syringe (5 no. each) or suitable applicator of equivalent numbers h. Autopipettes i) Eppendorf Pipette 10 – 100 µl – 2 Nos ii) Eppendorf Pipette 100 – 1000 µl – 2 Nos iii) Eppendorf Pipette tip for 10 - 100µl & 100 - 1000µl (1000 Nos each) iv) Storage rack for tips (10 - 100µl & 100 - 1000µl) – 02 box each Calibration certificates with proper traceability to be provided for all pipettes i. Pesticide grade glass wool: 01 Packet
14.	**COLUMNS FOR GC APPLICATIONS** :	Pesticide column (30m x 0.250mm x 0.25µm (DB-5MS 04 no., DB-608 01 no.) SP-2560 for fatty acids (100m X 0.25 mm X 0.25 µm) or equivalent – 02 Nos.) for all specified matrices should be provided
15.	**Certified Reference Material**	All pesticides and their analogues & their isomers as mentioned in annex D to IS 14543, annex N to IS 13428, PCBs & PAHs (details at Annexure A) except 2,4-D & Isoproturon. All CRMs should be as per ISO 17034 and shall be supplied with at least 1 year shelf life/validity at the time of supply (the supply should be adequate enough to meet the requirements for analysing approx. 50 BIS samples per month for 3 years. Based on the instrument requirement quoted, the supplier to specify the quantity to be supplied and how they have arrived at the quantity. CRMs for individual pesticides required except for PCBs and PAHs where mixtures to be provided)

16.	**TOOLS AND KITS:**	Septa Removing Tool, Tubing Cutter with rotating blade for column, Tubing Cutter with rotating blade for column for stainless steel tubing (1/16 & 1/8 inch tubing), Tubing Cutter for plastic tubing with separate blade set.
17.	**APPLICATION, OPERATION AND MAINTENANCE TRAINING COMPONENT:**	On site comprehensive application training for scientific/technical personnel operating the system and support services till customer satisfaction with the system followed by two weeks comprehensive training to two personnel on operation and maintenance and application aspect of the instrument at supplier's laboratory. On-site training should be provided on Half yearly basis for two years.
18.	**VALIDATION:**	The supplier shall have to carry out on-site validation of method for analysis of pesticide residues PAHs & PCBs in Packaged drinking water (IS 14543)/Packaged natural mineral water (IS 13428:) and pesticide residues in milk and milk products/Infant food (Annexure A). Method validation shall be part of successful installation and commissioning. The validation has to be completed in maximum of three months.
19.	**Warranty period:**	i) As per tender document ii) During CAMC period, two Preventive maintenance visits /year with PM kit and unlimited breakdown visits to be included. iii) Warranty & CAMC to include third-party supplied items also.
20.	**Satisfactory installation & performance reports**	As per tender document
21.	**Other terms and conditions**	1. UPS: Online UPS with isolation transformer of 15 KVA capacity with at least 120 min back up. UPS should be under warranty for 3 years. 2. Instrument/Column should be suitable for testing of pesticide residues in Packaged Drinking Water/Food. 3. The system must be factory tested and a certificate should be provided. 4. Supplier to specify pre-installation requisites and any other attachment/accessory necessary for operation of the equipment as per the requirement specified by BIS
22.	**Additional Features**	1. Suppliers need to provide the details of pre-installation requisites and all required accessories 2. Equipment shall be 21 CFR Part-11 compliant 3. Training: As per tender document 4. Warranty and Maintenance: As per tender document 5. PC (Desktop) as per latest specs of operating system, processors, 8 GB or more RAM, 1 TB of more storage, with necessary peripherals (Wireless keyboard, Wireless Mouse, Printer and UPS). 6. System software shall be compatible with LIMS for remote observation of data with temper-proof backup facility of data along with Connectivity with Ethernet/LAN.

A. List of Pesticide Residues (except 2,4D and Isoproturon) in Packaged Drinking Water as per Annex D of IS 14543 : 2016 and Packaged Natural Mineral Water as per Annex N of IS 13428 : 2005, PCBs and PAHs(as per table 3 of IS 14543 : 2016 & IS 13428 : 2005)

S.No	Name of Contaminant	Limits as specified in ISs
1.	p,p-DDD	Less than 0.0001 mg/l
2.	p,p-DDE	Less than 0.0001 mg/l
3.	o,p-DDT	Less than 0.0001 mg/l
4.	o,p-DDD	Less than 0.0001 mg/l
5.	p,p-DDT	Less than 0.0001 mg/l
6.	o,p-DDE	Less than 0.0001 mg/l
7.	Alpha- HCH	Less than 0.0001 mg/l
8.	Beta-HCH	Less than 0.0001 mg/l
9.	Gamma HCH (Lindane)	Less than 0.0001 mg/l
10.	Delta HCH	Less than 0.0001 mg/l
11.	Alpha-Endosulphan	Less than 0.0001 mg/l
12.	Beta-Endosulphan	Less than 0.0001 mg/l
13.	Endosulphan Sulphate	Less than 0.0001 mg/l
14.	Chlorpyrifos	Less than 0.0001 mg/l
15.	Alachlor	Less than 0.0001 mg/l
16.	Butachlor	Less than 0.0001 mg/l
17.	Aldrin	Less than 0.0001 mg/l
18.	Dieldrin	Less than 0.0001 mg/l
19.	Phorate Sulphone	Less than 0.0001 mg/l
20.	Phorate	Less than 0.0001 mg/l
21.	Methyl Parathion	Less than 0.0001 mg/l
22.	Ethion	Less than 0.0001 mg/l
23.	Malaoxon	Less than 0.0001 mg/l
24.	Malathion	Less than 0.0001 mg/l
25.	Monocrotophos	Less than 0.0001 mg/l
26.	Methyl Paraoxon	Less than 0.0001 mg/l
27.	Atrazine	Less than 0.0001 mg/l
28.	Phorate Sulphoxide	Less than 0.0001 mg/l
29.	Polychlorinated biphenyle (PCB)	Not Detectable
30.	Polynuclear aromatic hydrocarbons	Not Detectable

B. The list of FSSAI requirements on Pesticide residues for milk and milk products provided by FAD

Sl No.	Name of the Contaminants	Tolerance limit mg/kg (ppm)
1.	Aldrin, dieldrin (the limits apply to aldrin and dieldrin singly or in any combination and are expressed as dieldrin)	0.15 (on a fat basis)
2.	Chlordane (residue to be measured as cis plus trans chlordane)	0.05 (on a fat basis)
3.	D.D.T. (The limits apply to D.D.T., D.D.D. and D.D.E. singly or in any combination)	1.25 (on a fat basis)
4.	Fenitrothion	0.05 (on a fat basis)
5.	Heptachlor (combined residues of heptachlor and its epoxide to be determined and expressed as Heptachlor)	0.15(on a Fat basis)
6.	Hexachlorocycle hexane and its Isomers Alfa (α) Isomer: Beta (β) Isomer : Gamma (γ) Isomer (Known as Lindane) Delta (δ) Isomer :	 Milk (whole) 0.02 Milk (whole) 0.02 Milk 0.01 (on whole basis) Milk products 0.20 Milk products (having less than 0.20 (on whole 2 per cent fat) basis) Milk (whole) 0.02
7.	Chlorienvinphos	0. 2 (fat basis)
8.	Chlorpyrifos	0.01(fat basis)
9.	2,4D	0.05
10.	Ethion (Residues to bedetermined as ethion and its oxygen analogue and expressed as ethion)	0.5 (fat basis)
11.	Monocrotophos	0.02
12.	Paraquat Dichloride (Determined as Paraquat cations)	Milk (whole) 0.01
13.	Trichlorfon	Milk (whole) 0.05
14.	Carbendazim	0.10 (fat basis)
15.	Benomyl	0.10 (fat basis)
16.	Carbofuran (sum of carbofuran and 3-hydroxy carbofuran expressed as carbofuran)	0.05 (fat basis)
17.	Cypermethrin (sum of isomers) (fat soluble residue)	0.01 (fat basis)
18.	Edifenphos	0.01 (fat basis)
19.	Fenthion (sum of fenthion, its oxygen analogue and their sulphoxides and sulphones expressed as fenthion)	0.05 (fat basis)
20.	Fenvalerate (fat soluble residue)	0.01 (fat basis)
21.	Phenthoate	0.01 (fat basis)
22.	Phorate (sum of Phorate, its oxygen analogue and their sulphoxides and sulphones, expressed as phorate)	0.05 (fat basis)
23.	Pirimiphos-methyl	0.05 (fat basis)

ANNEXURE - A2

485

TECHNICAL SPECIFICATIONS FOR Liquid Chromatography Mass Spectrometry (LC-MSMS) (TRIPLE QUADRUPOLE) required to carry out the analysis of food commodities for contaminants like pesticide residues, aflatoxins, dyes, antibiotic residues, drug residues, and other micro nutrient analysis. The supplied equipment should meet all the IQ/OQ/PQ criteria required for IS/ISO/IEC 17025 accreditation.

HPLC: High Pressure Liquid chromatograph with Autosampler, with splitter to analyze injected sample both by PDA and MSMS		
Model:		
S. No.	**Parameter**	**Description**
HPLC:		High pressure Quaternary gradient operations and capable of switching between four solvents
1.	**Flow range**	0.1 to 2.0ml or better
2.	**Flow rate accuracy**	should be +/- 1.0%
3.	**Flow rate precision**	should be 0.075% RSD or better
4.	**Compositional accuracy**	± 0.5%
5.	**Maximum Pressure tolerance**	should be 15,000psi or more.
6.	Split or divert facility after column. This should be programmable to divert flow to waste and reverse during the LC run/program.	
7.	Reservoir tray & automatic rinsing kit must be supplied.	
8.	**Degassing Unit:**	Online membrane degassing unit
9.	**Auto-Sampler/ Injector**	
	•	The auto sampler design should have variable injection volume between. Temperature setting range should be from ambient to +4 to 35°C Suitable racks capable of holding minimum 100 vials at a time for handling 1ml and 1.5ml Vials should be offered.
	Carry Over	The Carry over must be less than 0.005% or better
10.	**Photodiode Array Detector (PDA)**	
	The wavelength range	• should be 190 nm – 700 nm or more with D2 and W Lamp as light source. • Wavelength accuracy should be ±1 nm. • The Noise Level must be less than 0.8×10^{-5} AU. • The photo-diode array detector should have 512 or more elements with resolution of 1.2nm/element or better. • It should have automatic wavelength accuracy check.
11.	**Column Oven:**	
The temperature range should be ambient to 80 deg C.		
The oven should have temperature limit device and temperature fuse.		
It should be able to handle at least 2 Nos of 25 cm columns within the oven.		

12.	**Workstation Software:**	
Latest licensed software to control all the modules of LC and MS.		
Application software should have the database of contaminants (Pesticides, veterinary drug residues, mycotoxins, dyes, antibiotic residues, etc. pertaining to Molecular formula, Mono isotopic mass, Parent ion, Collision energy, etc.		
System suitability, System security as well as System check functions must be provided which comply with Good Laboratory Practice (GLP) and Regulatory Conformity		
It should take care of instrument control, qualitative and quantitative processing, report generation, self-diagnosis and auto-tuning.		
Auto Start-up and shutdown of the MS should be possible using a single key operation.		
Technology for system optimization and status monitoring with automated sample tuning and method development for SIM and MRM scans.		
MSMS Acquisition mode must have various modes apart from MRM eg. Product ion scan, Precursor ion scan and Neutral ion scan.		
MSMS Detector		
13.	Auto-tuning	Auto-tuning with sensitivity and resolution optimization for both positive ion and negative ion modes.
14.	**Mass Range**	15-1500 amu or better
15.	**Scan Speed**	Should have the scan speed of 15,000 amu /sec or better
16.	**Resolution**	1 amu or better at unit mass resolution
17.	**Mass Accuracy**	0.15 Dalton or better
18.	**Mass Stability**	0.1 Dalton over 24 hours or better
19.	**Sensitivity**	ESI Positive: 1 pg Reserpine (on column), specify the following with documentary evidence: (a) Chromatographic signal to noise (S/N – minimum 2,00,000:1) (b) CV with number of repetitive injections (minimum three injections, CV< 0.5 % or better). (c) Injection volume (µl) ESI negative: 1 pg Chloramphenicol (on column), specify the following with documentary evidence: (a) Chromatographic signal to noise (S/N – minimum 2,00,000:1) (b) CV with number of repetitive injections (minimum three injections, CV< 0.5 % or better). (c) Injection volume should be 1.0 µl with 1pg/µl concentration.
20.	**Polarity Switching**	+ve / -ve polarity switching time between alternate MRM scans: 25ms or better (specify switch over time and stabilization time) without disturbing analysis
21.	**Source cleaning**	The cleaning of source should be possible without venting the vacuum of the system.
22.	**Ionization source**	Should include both ESI source and APCI source, with easy interchangeable provision at the customer end.
23.	**Operating modes**	Full scan, SIM, Product ion scan, Precursor ion scan, Neutral loss/gain scan, Multiple Reaction Monitoring, Information dependent acquisition system or equivalent scan mode of MRM to high sensitivity product ion scan for library conformation, Automated tuning

24.	**Columns (suitable for analytes given above):**	C18 2.1 X 50mm 2.5 um – 2 nos C18 2.1 X 100mm 2.5 um – 2 nos Suitable guard columns with connecting union – 4 nos each
25.	**Spares:**	LC-MSMS startup kit All required traceable standards for Mass calibration and tuning and HPLC calibration should be provided Additional vacuum pump oil to be provided 5ul, 10ul, 20ul, 50ul and 100ul loops to be provided
26.	**Nitrogen Gas Generator:**	Nitrogen Gas generator with external compressor having 30L/min generation capacity. Along with shade for external compressor and necessary tubings and electric wiring.
		suitable of providing gas with purity > 99.999% should be supplied. Other Required Gas cylinders with necessary regulators fittings if required should be provided (2 nos. each).
27.	**Warranty:**	i) As per tender ii) During CAMC period, two Preventive maintenance visits /year with PM kit and unlimited breakdown visits to be included. iii) Warranty & CAMC to include third-party supplied items also. **Maximum breakdown period should not exceed 72hrs.** **For any breakdown exceeding this duration warranty period will be proportionally extended.**
	Consumables/ Spares	All consumables/spares like syringes (2 nos), peak tubings/ cutters, etc which needs frequent replacement should be provided in sufficient numbers to operate the instrument for next five years. At least 5000 nos. of vials with caps (plus additional 5000 caps) of 1ml and 1.5 ml each or suitable shall be supplied Reserpine standard 1ml x 6 with certificate shall be provided over a period of 6 years.
28.	**Additional features**	Additional Manual Syringe for manual tuning
29.	**Instrument performance verification (IQ,OQ, PQ)**	To be done with traceable standards for the first 2 years (at the time of installation and on each maintenance visit) Required documents, kits and required standards as required
30.	**Desolvation/Block Heater Temperature**	Should be 500°C or more
31.	**System Software**	Software (Licensed) must be Multitasking type. It must acquire and process the data simultaneously • Application manager must be compatible with data of full scan, SIM/SIR or MRM for Pesticides,

		Mycotoxins, Antibiotics, Dyes, Vitamins and Ayurvedic Plant Extracts • Data Acquisition, Peak Integration, Calibration, Quantification and QC calculations must be fully automated. 12 • The Quantification method editor must be viewable in page view or spreadsheet. • Application manager must allow to monitor the molecular ion and up to 04 (four) • Confirmatory ions or better. • Must be capable of performing the following functions and should be upgradable: • Workstation must be able to control the MS, acquire, store, process and reproduce the data by the same computer. • Workstation must be able to control LC, Detector and auto sampler. • It must be able to regulate the gas pressure and flow during the data acquisition and append to the relevant data file. • Software must have automated calibration and Quantitative optimization. • Automated MS to MS/MS switching during a single run with user selectable criteria • Perform alternating positive/negative scans in one run • Automated Quantitation and reporting of acquired samples. • Data may be processed as it is being acquired
32.	**Validation**	The supplier shall have to carry out validation of method for analysis of pesticide residues in Packaged Drinking Water (IS 14543)/Packaged Natural Mineral Water (IS 13428) and Pesticide Residues & Aflatoxins in milk and milk products, Antibiotic residues in Milk and Milk products. Method validation shall be a part of successful installation and commissioning. The validation has to be completed in maximum three months.
33.	**Application, Operation And Maintenance Training Component:**	On site comprehensive application training for scientific/technical personnel operating the system and support services till customer satisfaction with the system followed by two weeks comprehensive training to two personnel on operation and maintenance and application aspect of the instrument at supplier's laboratory. Training should be provided on Half yearly basis for two years at BIS Lab.
34.	**Other conditions:**	The system must be factory tested and a certificate should be provided. Supplier to specify pre installation requisites.

10KVA UPS with isolation transformer with minimum of 120 minute backup time for supporting the instrument. The same should be under warranty for atleast 3 years.

- All the required necessary Gas generators, Gas cylinders with appropriate purity and dual stagesteel regulators (two for each type of gas) should be provided:
- Must include installation and maintenance of LC-MS/MS kit.
- Offer must include declaration of ten years use guarantee with full support including spares, consumables, accessories and upgradation of instrument and softwares.
- Installation and demonstrating the performance as claimed in the offer at the installation site.
- Onsite training must be provided at the installation site by application engineers after installation and performance demonstration (at least two visits).

ANNEXURE - A3

48)

Technical Specification

Specifications for Spark-OES	
Parameters Description	Spark type optical emission spectrometer Floor mounted minimum foot print meant for chemical analysis of ferrous, and non-ferrous metals and alloys. The system should have latest software for analysis and calibration for the defined multi-base alloys in Solid form.
Metal/alloy bases/ standards:	Annexure A mentions the compositions and dimensions of the Certified Reference Material (CRMs) for Ferrous, Copper, Aluminium, Tin, Zinc, Nickel bases required along with SUS standards.. Annexure A gives the list of ranges of maximum and minimum % of an element detectable in each alloy type. The min% represents the minimum detectable wt% of the element in that alloy type. The minimum detectable limit of the equipment should fall in the range given in the min% column for each alloy type in each base. The bidders' equipment will be ranked according to the lowest minimum detectable limit for each alloy type. We may ask the bidders to verify trial samples or ask them to demonstrate the capabilities of their equipment as required. Vendors have to provide 2 CRMs each covering the minimum and maximum points in certified range/value for the alloys mentioned in Annexure A.
Detector System:	Fully PMT based detectors only. Multiple detectors to cover the range as per specified metal alloy bases with superior resolution and signal to noise ratio.
Optic System:	Vacuum based optic system with focal length of 600mm or better. Machine should have facility to add PMT in future if required. The limit on the no of base and PMTs that can be added should be 65 PMT's or better. Instrument shall have high resolution multi detectors. Order of wavelength should be of first order. Minimum effective wavelength range of 130-650 nm or more. High resolution grating of 2200 grooves/mm or better. Accuracy of the equipment should be of third decimal. Optical systems should be stabilized against temperature fluctuations.
Analytical software:	Softwares: a) Equipment control to seamlessly control the equipment and display the results and analysis. b) Software (Integrated or separate) to perform qualitative and quantitative elemental analysis c) software for grade identification. d) Factory set standard Ferrous, Aluminum, Copper, Nickel, Titanium, Zinc, Tin alloy databases and factory settings for quick analysis with minimizing runs on CRM samples. The analysis of the results should be automatically giving us the composition in wt%/ atomic %/ppm with the possible errors for each element. However, provisions should be provided to save the raw data whenever necessary. Latest software for chemical analysis of elements should provide greatest flexibility in terms of, operation, calibration, analysis of the spectra. The software should be built such a way that it can hint interferences between two elements when present together. The software should enable printing out of the result and also to enable saving data before every data processing step. The software should come with robust background identification and peak identification algorithms. Software should be provided in softcopy through removable media devices. Software and database upgrades to be given at

	least up to the warranty period. Software must be Multitasking type. It must acquire and process the data simultaneously. Shall be fully compatible with LIMS available with BIS Labs. • Data may be processed as it is being acquired
Structure:	Argon flushed spark stand with maximum freedom and flexibility to be provided. It should in with for simultaneous measurement of all elements.
PC& Printer:	Personal computer with colour Laser Printer, The PC must have minimum 8 GB RAM, minimum 500 GB HDD with Win 10 OS and Recommended Windows 10 Professional with installed CD/DVD software. Antivirus software shall be preloaded in the system. All the software provided should be original software with License key as applicable.
Aragon Gas Consumption	During analysis not more than 4L and during Sleep not more than 0.1L/min or/else 1000 or more sparks per standard 7 cuM cylinder
Power Supply	200V – 230V Single phase 4kVA
Validation	The supplier shall have to carry out validation of method for analysis of elements in various base alloys given in Annexure A. The validation has to be completed in maximum one month.
Application, Operation and Maintenance Training Component:	On site comprehensive application training for scientific/technical personnel operating the system and support services till customer satisfaction with the system followed by two weeks comprehensive training to two personnel on operation and maintenance and application aspect of the instrument at supplier's laboratory. Training should be provided on Half yearly basis for two years at BIS Lab.
Other conditions:	The system must be factory tested and a certificate should be provided. Supplier to specify pre installation requisites.
Program sheet & calibration ranges	Equipment should be calibrated for the different alloys as per given analytical program sheet for all the above-mentioned bases (Annexure A). Calibration certificates/reports with traceability to be provided
Warranty	i) Comprehensive Warranty on all parts except consumables for at least 6 years from the date of satisfactory installation shall be provided by the manufacturer & two Preventive maintenance visits /year with PM kit to be provided during warranty period. ii) During CAMC period, two Preventive maintenance visits /year with PM kit and unlimited breakdown visits to be included. iii) Warranty & CAMC to include third-party supplied items also. **Maximum breakdown period should not exceed 72hrs.** **For any breakdown exceeding this duration warranty period will be proportionally extended.**
Standard Accessories	Standard accessories are to be supplied with the machine for regular and smooth operation. Different sample holders need to be provided for wire and plate samples If Nitrogen, Argon or any other gas is required one set of cylinders, regulator and cylinder trollies provided. Argon gas purifier shall be provided.
Upgradation for additional matrix	At site
Power supply/stabilizer	220V ±10%, 50 Hz, AC supply.
Additional items	1. Operation and maintenance manual to be provided in hard and soft copy form with the unit. 2. Application notes (CD-ROM) for elemental analysis in ferrous, copper, Aluminium, Tin, Nickel & Zinc alloys or as applicable.

	3. Operation kit comprising all required items like pump, tubing, transfer tubing, work coils etc. for startup/ regular operation of the instrument 4. Consumables including emery paper for ferrous and non-ferrous for three years operation of system for main OES unit are required 5. High speed disc grinder unit (closed type) to polish the samples with 2800 rpm minimum shall be provided
Instrument performance verification (IQ,OQ, PQ)	To be done with traceable standards for the first 2 years (at the time of installation and on each maintenance visit) Required documents, kits and required standards as required
Safety	The design of equipment shall ensure safety of operators and equipment at all times. Exhaust filters system for flushing out of argon gas.
After sales support	

Additional accessories to be supplied along with the main equipment

1) Basic grinding machine/sample preparation tools required for ready functioning
2) Isolation transformer of optimal size to isolate the system from surges in all lines (Neutral, Phase and Earthing)
3) UPS: Minimum 3KVA UPS to give 30 mins or more backup.

Annexure A

Elements and the range of factory calibrations for different Cu bases

Element	Bronze		Brass		Pure Copper	
	min	max	min	max(±10%)	min	max(±10 %)
Sn	0.001-0.5	13.5-16.5	0.001-0.1	2.2	0.0005 - 0.1	0.1
Pb	0.001-0.5	10-12	0.001-0.1	0.8	0.001 - 0.1	0.1
Zn	0.001-0.5	3.5-4.3	9-11	40.0	0.0005 - 0.1	0.1
Fe	0.001-0.5	0.6-0.7	0.001-0.1	3.1	0.002 - 0.1	0.1
Ni	0.001-0.5	4.5-5.5	0.001-0.1	3.2	0.001 - 0.1	0.1
Al	0.001-0.5	0.09 - 0.11	0.001-0.1	8.0	0.001 - 0.05	0.05
Si	0.001-0.5	0.63 - 0.77	0.001-0.1	0.7	0.0005 - 0.05	0.05
As	0.001-0.5	0.18 - 0.22	0.001-0.1	0.2	0.001 - 0.1	0.1
Mn	0.001-0.5	0.27 - 0.33	0.001-0.1	5.2	0.0005 - 0.05	0.05
Bi	0.001-0.5	0.18 - 0.22	0.001-0.1	0.05	0.0005 - 0.02	0.02
Sb	0.001-0.5	0.9-1.1	0.001-0.1	0.45	0.002 - 0.1	0.1
Mg			0.001-0.1	-	0.0005 - 0.03	0.03
P	0.001-0.5	0.72 - 0.88	0.001-0.1	0.16	0.0005 - 0.1	0.1
S	0.001-0.5	0.15 - 0.18	0.001-0.1	0.04	0.0005 - 0.02	0.02

Cr	-			-	0.0002 - 0.04	0.04
Ag	-			-	0.0005 - 0.02	0.02
Cd	-			-	0.0001 - 0.03	0.03
Co	-			-	0.002 - 0.06	0.06

	Pure Ni		Inconel		Ni-Cu-Sn	
element	min	max (±10%)	min %	max (±10%)	min %	max (±10%)
C	0.001-0.1	1.50	0.001-0.1	0.10	0.001-0.1	0.13
Si	0.001-0.1	6.00	0.001-0.1	1.00	0.001-0.1	
Mn	0.001-0.1	3.00	0.001-0.1	1.70	0.001-0.1	2.20
P	0.001-0.1	1.00	0.001-0.1	0.02	0.001-0.1	1.00
S	0.001-0.1	0.20			0.001-0.1	0.22
Cr	0.001-0.1	33.00	11 - 13	28.00	0.001-0.1	
Fe	0.001-0.1	50.20	4 - 5	28.00	0.001-0.1	3.00
Mo	0.001-0.1	37.00	0.001-0.1	10.00		
V	0.001-0.1	1.40	0.001-0.1	0.05		
W	0.001-0.1	4.50	0.001-0.1	3.00		
Ti	0.001-0.1	6.50	0.001-0.1	2.60		
Cu	0.001-0.1	50.00	0.001-0.1	1.90	26-28	47.00
Nb	0.001-0.1	8.00	0.001-0.1	6.00		
Al	0.001-0.1	7.00	0.001-0.1	0.80		
N	0.001-0.1	0.03	0.001-0.1	0.03		
B	0.001-0.1	3.20	0.001-0.1	0.01		
Co	0.001-0.1	23.00	0.001-0.1	3.30		
Ta	0.001-0.1	4.50				
Zr	0.001-0.1	0.70				
Mg	0.001-0.1	0.13			0.001-0.1	0.14
Pb	0.001-0.1	0.07				
Sn	0.001-0.1	12.00			6 - 8	13.00
Zn	0.001-0.1	0.40				
Ni	Reference		Reference		Reference	

Elements and the range of factory calibrations for different Tin bases

	Sn General		Sn-Cu-Sb		Sn-Pb	
	min %	max (±10 %)	min %	max (±10 %)	min %	max (±10 %)
Pb	0.0001-0.1	70.00	0.0001-0.1	3.50	10.00	70.00
Sb	0.0001-0.1	15.00	0.0001-0.1	15.00	0.0001-0.1	0.65
As	0.0001-0.1	0.60	0.0001-0.05	0.60	0.0001-0.001	0.03
Bi	0.0001-0.05	0.70	0.0001-0.05	0.70	0.0001-0.01	0.30
Cd	0.0001-0.1	1.50	0.0001-0.1	1.50	0.0001-0.001	0.01
In	0.0001-0.005	0.07	0.0001-0.005	0.07	0.0001-0.001	0.01
Ag	0.0001-0.1	5.00	0.0001-0.05	0.90	0.0001-0.005	0.07
Cu	0.0001-0.1	9.00	0.0001-0.1	9.00	0.0001-0.01	0.23
Al	0.0001-0.005	0.07	0.0001-0.005	0.07		
Fe	0.0001-0.01	0.10	0.0001-0.01	0.11	0.0001-0.005	0.05
Ni	0.0001-0.1	1.20	0.0001-0.05	0.60	0.0001-0.001	0.02
Zn	0.0001-0.1	2.70	0.0001-0.001	0.02	0.0001-0.001	0.03
Ge	0.0001-0.05	0.55				
Te	0.0001-0.001	0.03			0.0001-0.001	0.01
P	0.0001-0.001	0.01				
Au	0.0001-0.01	0.18			0.0001-0.01	0.18
Hg	0.0001-0.01	0.16				
Co	0.0001-0.001	0.03	0.0001-0.001	0.03		
Ga	0.0001-0.001	0.02				
S	0.0001-0.001	0.01				
Se						
Sn	Reference		Reference		Reference	

Elements and the range of factory calibrations for different Fe bases

Element	Low Alloy Steel		Cr-Ni Steel		Cr Steel	
	min	max (±10 %)	min	max (±10%)	min	max (±10%)
C	0.001-0.1	1.2	0.001-0.1	0.15	0.001-0.1	0.15
Si	0.001-0.1	1.7	0.001-0.1	1.9	0.001-0.1	1.9
S	0.001-0.005	0.07	0.0001-0.005	0.03	0.0001-0.005	0.03
P	0.001-0.01	0.1	0.001-0.003	0.04	0.001-0.005	0.04
Mn	0.001-0.1	2	0.001-0.1	1.5	0.001-0.1	1.5
Ni	0.001-0.1	4.5	3-4	31.0	0.001-0.1	4.0
Cr	0.001-0.1	4	4-5	26.0	8-9	27.0
Mo	0.001-0.1	1.6	0.001-0.1	3.6	0.001-0.1	3.6
Cu	0.001-0.01	0.5	0.001-0.01	0.35	0.001-0.01	0.35
Co	0.001-0.1	0.3	0.001-0.01	0.4	0.001-0.01	0.4
Sn	0.001-0.1	0.1	-		-	
Al	0.001-0.1	1.5	0.001-0.01	0.2	0.001-0.01	0.2
Nb	0.001-0.01	0.15	0.001-0.1	1.6	0.001-0.1	1.6
W	0.001-0.1	3	0.001-0.01	0.25	0.001-0.01	0.25
As	0.001-0.01	0.1	-		-	
Ti	0.001-0.01	0.3	0.001-0.01	0.47	0.001-0.01	0.47
V	0.001-0.05	0.5	0.001-0.01	0.3	0.001-0.01	0.3
Zr	0.001-0.01	0.2	-		-	
B	0.001-0.01	0.01	0.001-0.005	0.01	0.001-0.005	0.01
Pb	0.001-0.005	0.08	0.001-0.01	0.05	0.001-0.01	0.05
Mg	-		-		-	
N	10 ppm onwards		10 ppm onwards		10 ppm onwards	
Zn	-		-			-

Elements and the range of factory calibrations for different Fe bases continued.

Element	Low Alloy Cast Iron		High Alloy Cast Iron	
	min	max (±10%)	min	max (±10%)
C	1.6-1.7	3.8	0.9-1.0	3.7
Si	0.001-0.1	3.2	0.001-0.1	1.6
S	0.001-0.01	0.14	0.001-0.005	0.08
P	0.001-0.1	1.5	0.001-0.01	0.4
Mn	0.001-0.1	1.3	0.001-0.1	2.0
Ni	0.001-0.1	1.8	1.8-2	16.0
Cr	0.001-0.1	1.2	5.4-6	31.0
Mo	0.001-0.1	1.5	0.001-0.1	3.8
Cu	0.001-0.1	1.2	0.001-0.1	2.0
Co		-		
Sn	0.001-0.1	0.4		
Al	0.001-0.01	0.075		

Nb	0.001-0.005	0.06		
W	0.001-0.005	0.15		
As	0.001-0.1	0.1		
Ti	0.001-0.1	0.3		
V	0.001-0.1	0.5		
Zr	0.001-0.1	0.1		
B	0.001-0.01	0.1		
Pb	0.0002-0.01	0.04		
Mg	0.001-0.005	0.095		
N	10 ppm onwards	10 ppm onwards		
Zn	-	0.001 - 0.05		

Elements and the range of factory calibrations for different Al bases

Element	Low Alloy Al		Al-Si		Al-Mg	
	min	max (±10%)	min	max (±10%)	min	max (±10%)
Al	INT.STD.	INT.STD.	INT.STD.	INT.STD.	INT.STD.	INT.STD.
Si	0.001-0.1	1	1 – 1.1	20	0.001-0.05	1
Fe	0.001-0.01	0.8	0.001 – 0.1	1.2	0.001-0.05	1
Cu	0.001-0.01	0.5	0.001 - 0.05	0.5	0.001-0.01	0.2
Mn	0.001-0.1	1.5	0.001 - 0.05	0.6	0.001-0.1	11
Mg	0.001-0.1	1.3	0.001 - 0.05	0.7	1 -1.1	10
Cr	0.001-0.01	0.2	0.001 - 0.01	0.4	0.001-0.01	0.3
Zn	0.001-0.01	0.2	0.001 - 0.01	0.3	0.001 -0.01	0.3
Ti	0.001-0.01	0.1	0.001 - 0.01	0.2	0.001 -0.01	0.2
Ni	0.001-0.01	0.1	0.001 - 0.01	0.3	0.001-0.005	0.05
Zr	0.001-0.01	0.1			0.001-0.005	0.06
Na	0.001-0.01	0.03	0.001 - 0.005	0.03		
Bi	0.001-0.01	0.08			0.001-0.005	0.03
Sn	0.001-0.01	0.08	0.001 - 0.01	0.1	0.001-0.005	0.05
Cd	0.001-0.01	0.05				
Co	0.001-0.005	0.007				
Sb	0.001-0.005	0.05	0.001 - 0.01	0.1		
Ca	0.001-0.005	0.03	0.001 - 0.03			
Pb	0.001-0.005	0.1	0.001 - 0.2		0.001- 0.005	0.05
V	0.001-0.005	0.04	0.001 - 0.01		0.001- 0.005	0.01

Analytical Program Sheet: This table provides the approximate wavelength and typical range in which the PMTs have to be performing. It can be better as well. However, the ultimate criteria would be that the vendors gives the details on the equipment's capability as per above min and max detectable %s for each element as given in tables for each alloy in each base.

Element	Wavelength nm	Analytical Range (%)		
		Fe	Cu	Al

Fe	271.4	INT.STD.	0.5 – 10	0.1 - 10
Fe	259.9		0.001 - 1.0	0.001 - 2.0
C	193.0	0.001 - 4.2*	0.005 - 0.5	
Si	212.4	0.001 - 5.0		
Si	251.6		0.0005 - 5.0	0.001 - 1.0
Si	390.5			1 - 25
Mn	293.3	0.001 - 1.0	0.0005 - 2.0	0.001 - 2.0
Mn	290.0	0.1 - 20	1 – 10	1 - 10
P	178.3X2	0.001 - 1.0	0.001 - 1.0	0.005 - 0.1
S	180.7	0.001 - 0.5	0.0005 - 0.5	
Cu	327.4	0.001 - 0.5		0.001 - 0.5
Cu	224.2	0.01 - 5.0		
Cu	296.1		INT.STD.	0.1 - 15
Ni	231.6	0.001 - 4.0	0.001 - 1.0	0.01 - 10
Ni	227.7	1 - 40.0		
Nb	317.5	0.001 - 2	1 - 35	
Cr	267.7	0.001 - 4.0	0.0001 - 1.0	0.001 - 1.0
Cr	298.9	1 - 40.0		0.1 - 10
Sn	189.9	0.001 - 0.2	0.0005 - 1.0	
Sn	317.5		1 - 20	0.001 - 15
As	197.2	0.002 - 0.2	0.001 - 0.2	
Ti	337.2	0.001 - 1.0	0.001 - 1.0	0.001 - 1.0
V	311.0	0.001 - 1.0		0.001 - 0.5
Mo	202.0	0.001 - 1.0		
Mo	277.5	0.1 - 10		
B	182.6	0.0005 - 0.05		
Al	394.4	0.001 - 1.0	0.001 - 1.0	
Al	237.2		1 - 15	INT.STD.
Ca	396.8	0.0005 - 0.01		0.0005 - 0.1
Zr	339.2	0.001 - 1.0	0.005 - 0.5	0.001 - 1.0
Ag	328.0		0.001 - 0.8	0.001 - 0.8
Pb	405.7	0.001 - 0.1	0.001 - 10	0.001 - 1.0
Bi	306.7	0.001 - 0.1	0.0005 - 1.0	0.001 - 1.0
Sb	187.1x2	0.003 - 0.5	0.005 - 1.0	
W	220.4	0.005 - 20		
Co	258.0	0.001 - 10	0.01 - 2.0	0.01 - 1.0
Zn	206.1	0.001 - 0.01	0.0005 - 0.5	0.001 - 0.1
Zn	481.0		0.01 - 45	0.01 - 15
Mg	280.2	0.001 - 0.1		0.001 - 0.1
Mg	383.8			0.01 - 15
N	170.0/ 129	50 ppm onwards		
Cd	228.8		0.0001 - 0.15	
Na	589.0			0.0001 - 0.01

ANNEXURE- A4

471

Technical Specification of AAS

Sl No	Item	Technical Specification

1.	**ATOMIC ABSORPTION SPECTROPHOTMET ER [GTA /FLAME / VGA]**	• Atomic Absorption Spectrophotometer (GTA/FLAME/VGA), Computer Controlled with built-in flame emission mode, Unit for Flame (Air Acetylene and nitrous oxide- acetylene), Graphite Tube Atomizer (GTA), Chiller / Water circulating unit, programmable Auto samplers for GTA and flame
		• Wave length range 190 – 800 nm wave length
		• Sensitivity at least 0.9 abs for 5µg/ml aqueous copper standard solution with air – acetylene flame
		• Optics: Double Beam with Czerny turner/ Echelle or equivalent Monochromator with automated slit selection
		  • Width Automatic bandwidth of 0.2 to 1.0 nm
		• Flame Atomizer: All titanium or equivalent burner with impact bead/ Flow spoiler
		  • Movement: Automatic movement into the sample compartment
		  • Affect from Acids /Organic solvent: Unaffected from attacks by acid solution or organic solvents
		  • Flame Alignment in liquid beam Fully automatic, optimized with motorized burner mount for vertical and horizontal burner adjustment
		  Suitable and acid resistant all titanium or equivalent Separate burners for Air – Acetylene and nitrous oxide- acetylene flames
		• Nebulizer: High precision able to provide manually adjustable uptake rates material of the nebulizerand related Venturi should be inert to acid solutions and organic solvents
		• Flame Control: Computercontrolled ignition
		• Gas Control: Computer controlled with oxidant and fuel gases monitoring to monitor constant fuel / oxidant ration ignition
		• Safety Function: Interlocking system to prevent ignition
		• Essential Interlock Monitor: Burner type as well as its presence in position, air selector, flame sensor, liquid trap level, gas supply pressure and air supply anywhere in the network of gas tubings in the system
		• Automatic Lamp Selection Function: Computer controlled Hollow Cathode Lamp selection and alignment Lamp Holder At least 6 lamp holder with built in power supplies for hollow cathode lamps and electrode – less discharge lamps or equivalent as applicable. The certificate of the validity of the lamps shall be provided along with one additional set of hollow cathode lamps.
		• Read Out /Display: Display facility for absorbance as well as concentration, Display of errors or error codes, absorbance range at least up to 2.0 Abs.
		  • Scale Expansion Scale expansion at least up to 100x
		  • Integration time Integration time should cover at least 0.2 to 50 seconds range
		  • Measurement Measurements of mean, RSD and CV, Background only mode, Integration of peak height and peak areas.
		• Accessories/Spares with Flame AA System
		  • Vapour Generation Assembly: Should be

continuous flow based hydride / mercury vapour generator with option of using with or without a programmable auto sampler

- Precision Precision of better than or at least 1% at ppb levels of mercury, arsenic etc.
- Absorption Cell The absorption cell's material should have no effect of the high heat of the flame and the cell for the analysis of mercury should be of a closed cell design
- Flame Arrester Flame arrester should be provided in the tube which connects the assembly to the absorption cell
- Cell Design holder. The design of the cell holder should give a firm and easily adjustable (for alignment) mounting on the burner head.
- System accessories Complete with necessary reagent bottles, connectors etc.

Hollow Cathode lamps/ Electrodeless discharge lamps/ or equivalent coded lamps:. One lamp each for the elements: As, Sb, V, Ti, Nb, Ta, Cd, Ca, Mg, Na, K, Pb, Ni, Mn, Cu, Fe, Al, Hg, Se, Ag, Cr, Mo, Ba, Zn, Sn.

AirCompressorwithAirFilter or equivalentAir Service Unit Complete with pressure regulator quite in operation, necessary tubing and connectors and should meet the air supply requirements of AAS operation. Oil Free Pump Oil- free pump and moisture trap Corrosion Resistant to acidic vapour and the drain value (if any) should be made of stainless steel of equivalent corrosion resistantmaterial

All the regulators shall be of SS (316), 2 stage with Teflon Diaphragm.

- Gas Regulators Nitrous – oxide gas regulator Nitrous Oxide Gas regulator (two stage) with heater, with necessary tubings (approx. 150 m) and connectors. Necessary transformer should be provided to transform this supply to the requirements of the heater. The heater should work on 230±10volts 50 Hz AC power supply.
- Acetylene Gas regulator: Acetylene gas regulator (two stage) with necessary tubing (approx. 150 m) and connectors.
- Nitrogen Gas regulator: Nitrogen regulator (two stage) with necessary tubings (approx. 150 m) and connectors.
- All gas cylinders need to be supplied with necessary regulatory certificates.
- Graphite Furnace System:
  - Graphite Tube Atomizer with Zeeman and Deuterium background correction & Furnace vision system accessory to provide high definition images of events inside the graphite furnace cuvette, allowing monitoring of the sample injection and behaviour during the dry and ash phases of the furnace program.
    Should be computer controlled fully enclosed graphite tube system consisting of stabilized temperature / total pyrolytic graphite plate form.
- Gas Supplies: Provision of two gas supplies (programme selectable) with independent control over the gas supply through the furnace.
- Heating Rate: Heating rate of at least 2000°C per second Cooling Time: Cooling time: 20 seconds
- Temperature Range: Temperature range ambient to 3000°C or more in 1°C increments
- Feedback system: Feedback system for furnace temperature control, interlocks for water, gas, temperature, furnace door, graphite tube

damage and mains power.

- Temp. Programming: At least eight steps temperature programming facility with flexibility of programme selection, ramp time, gases, gas flow and read trigger for 20 each temperature step.
- Control: Computer controlled with appropriate provision for print out of the furnace and sample parameters
- Display: Calibration data / graphs, temperature profiles, signal graphics and the instrument status.
- Memory: Memory should be able to store at least ten non volatile programmes
- Chiller / Cooling Water Re- circulation Unit: capable of achieving Water Temperature of -20 degree C. Refrigerating water circulation unit of appropriate capacity. No discharge of water from this water circulation unit.
- DATA WORK STATION
    - Application Software:
        - Programme facility with multitasking software (Licensed with lifetime support including upgradation)
        - Should provide complete control of instrument with instrument status display and its various accessories.
        - Provide accurate and reproducible time averaged, integration, non – averaged integration, multi level calibration.
        - Software should handle instrument linear absorbance reading, concentration, or emission intensity, integration time, built- in statistics, calibration equation control, slope of analytical curve using operator selective calibration standard
        - Built-in interface for computer connection and use of optional accessories.
        - Comprehensive quality control protocols facility including blank, multiple quality control standards, QA/QC audit trail and calibration failure.
        - System should be 21 CFR Part 11 compliant.
- Computer System
- Processor: Intel core i7 or better
- RAM: 8 GB or better
- Storgae Drive: 1 TB or higher
- Monitor: (45 cm) or better
- With Suitable wireless Keyboard and wireless mouse and sufficient numbers of USB ports, VGA port, HDMI Port and Ethernet connection & Laserjet duplex colour Printer
- Operation Software:
- Preloaded Windows 10 and office pack with lisenced CD/DVD
- Preloaded Antivirus with latest version along with Licensed CD
- Shall be fully compatible with LIMS available with BIS Labs.
- ADDITIONAL ITEMS
    - Operation Kit: Manufacturers Standard Operation Kit including all required items, tubings, fittings for start up / regular operation of instrument.
    - Operation / maintenance: Manual Operation / maintenance Manual for each unit Analyticalmanual
    - Analytical manual: including applications for flame, VGA and

		graphite system Service Manual • Service manual: with one set of required tools for each system / unit • Trouble Shooting Charts, Spare parts Catalogue, Application Notes for trace metal analysis in food and water samples • Dust Cover One for each unit • Consumables: 50 Nos of Graphite tube, 1000 nos of Tubes of autosampler, 50 nos peristaltic pump tubings and sufficient numbers of other tubings, Atleast 100 ml of 1000 ppm standard solution traceable as per ISO 17034) with atleast 2 year of shelf life from the date of installation for each of the following elements: As, Sb, V, Ti, Nb, Ta, Cd, Ca, Mg, Na, K, Pb, Ni, Mn, Cu, Fe, Al, Hg, Se, Ag, Cr, Mo, Ba, Zn, Sn. 2 Nos of filled cylinders for each of Acetylene, Nitrous oxide, Nitrogen & Argon with appropriate purity grade. • General Conditions of Supply • The instrument and all its units should operate on 230 ±10 volts 50Hz power supply • All the operation and maintenance manuals, circuit diagrams, application notes and application softwares to be supplied should be in English Language. •
2.	**Warranty:**	As per tender document ii) During CAMC period, two Preventive maintenance visits /year with PM kit and unlimited breakdown visits to be included. iii) Warranty & CAMC to include third-party supplied items also. **Maximum breakdown period should not exceed 72hrs.** **For any breakdown exceeding this duration warranty period will be proportionally extended.**
3	UPS	Branded UPS for providing uninterrupted power supply (with isolation transformer) to the instrument with backup of minimum 30 minutes.
4	Training	On-site demonstration to the users and Operation and Maintenance Training
5	Validation	The supplier shall have to carry out validation of method for analysis of: trace & toxic elements in Packaged Drinking Water (IS 14543) trace & toxic elements in Packaged Natural Mineral Water (IS 13428) trace & toxic elements in Milk products (IS 14433-1, 1656, 11536, etc); Nb, V, Ti, Mn etc in metals and alloys Al, Ca, Mg, Fe, in Cement (IS 12813). Method validation shall be a part of successful installation and commissioning. The validation has to be completed in maximum three months by following standard protocol
6	Other conditions:	The system must be factory tested and a certificate should be provided. Supplier to specify pre installation requisites and all required accessories such as gas line connection with controller, air line connection, fume hood with ducting and any other requirement (eg. Consumables, spares etc. need to be specified) shall be carried out by the supplier.
7	Additional features •	Software must be Multitasking type. It must acquire and process the data simultaneously• Data Acquisition, Peak Integration, Calibration, Quantification and QC calculations must be fully automated. 12 • The Quantification method editor must be viewable in page view or spreadsheet.

		Must be capable of performing the following functions and should be upgradable: • Workstation must be able to control the acquire, store, process and reproduce the data by the same computer. • Workstation must be able to control Equipment, Detector and auto sampler. • It must be able to regulate the gas pressure and flow during the data acquisition and append to the relevant data file. • Software must have automated calibration and Quantitative optimization. • Automated switching between various modes (Flame, VGA, GTA) during a single run with user selectable criteria • Automated Quantitation and reporting of acquired samples. • Data may be processed as it is being acquired
7	Instrument performance verification (IQ,OQ, PQ)	To be done with traceable standards for the first 2 years (at the time of installation and on each maintenance visit) Required documents, kits and required standards as required
8	Document	• Operation manuals • Test/Calibration certificate • Original catalogue and supporting document must be enclosed to support the tender specification

ANNEXURE A5

466

	ICP-MS Technical Specifications
Sl #	**Descriptions**
1	**Inductively Coupled Plasma - Mass Spectrometry**
	The ICPMS system should be capable of doing elemental analysis accurately & precisely for, trace and ultra trace elements in ppm, ppb, & ppt levels and isotope ratios in diverse range of Packaged Drinking Water, Packaged Natural Mineral Water, Ground Water etc. ICP-MS should be fully automated and computer controlled
	Should have ISO or equivalent certification for quality. The instrument should have IEC 61010-1 or equivalent compliance covering safety of the electrical equipment for measurement, control and laboratory use
2	**Sample Introduction**
	Sample introduction kit should be including with a variety of sample types: aqueous, Auto or Argon Dilution facility, relatively high TDS / (3 or more)% level TDS without clogging nebulizer
	Computer controlled with atleast three channel peristaltic pump, preferably Peltier cooled spray chamber with suitable nebulizer and injector
	Auto sampler: High-performance auto sampler to meet the needs of high-throughput requiring a fast, high-capacity (minimum 200 samples), capable of diluting high matrix solution similar to hypersaline water. Should be provided along with suitable top cover.
3	**Plasma**
	Argon ICP source with computer controlled 27/40 MHz RF generator operating from 500 – 1600 W or better.
	Plasma gas flow should be controlled by a active mass flow controller for all gas control of Plasma gas, auxiliary gas and nebulizer gas
4	**RF Generator**
	The instrument must have a frequency matching RF Generator, operating at 27 MHz to 40 MHz, from 500 to 1600 watts or better, should be software controlled. The torch ignition, shut down and system warm up should be auto-controlled.
	Digital solid state RF generator with dynamic impedance matching with nano seconds.
	Adequate water circulating chiller for continuous cooling of RF generator, RF load coil and ICP Interface. Noise suppressor should also be provided for the chiller
5	**Torch Alignment and Plasma control**
	Automatic, programmable computer controlled all mass flow controllers.
	Fully automated and computer controlled XYZ Torch alignment or any better system.
	Demountable Torch with self aligning, acid and HF resistant injected tube
6	**Pneumatics**
	All gas supply lines should be under independent mass flow controllers and should be software regulated and monitored.
7	**Ion Focusing, Cone interface setup**
	Dual or Triple design of cones or any other better system.
	Ni based sample and skimmer cones
	Cone should be suitable for best sensitivity for high matrix as well as low matrix samples without changing any hardware in the interface
	The cones/interface should be easily demountable, easily cleaned and replaced.
8	**Collision / Reaction cell**
	It should incorporate one cell offering three modes of operation namely standard mode collision cell mode with KED and Reaction cell mode to utilize a wide variety of gases including 100% pure reaction gases like He, H2 etc. for removal of polyatomic / spectroscopic interference.
	The switching of reaction and collision gases should be relatively fast and automated through software
	The collision cell must operate effectively in collision mode, using pure Helium Gas to Reach the Detection Limits to PPT. Combination of gases should be avoided due to complexity of reaction or to easily eliminate or optimization of cell parameter for every change of gases and manufacturer original make Cell gas Filter for Collision and reaction(optional) should be included in the offer for better quality
	Instrument should have dedicated and separate gas line for reaction mode (hydrogen, Helium etc.) respectively with separate/isolated mass flow controller
9	**Background noise and signal**
	<1 cps or better.
10	**Interference Removal**
	System equipped with best in line technology, capable of operating in standard, collision/reaction modes
11	**Controls & features**

	Gas controls should be inbuilt and software controlled.
	Gas regulators should also be supplied.
	Spray chamber provided along with the instrument should be of cyclonic or scott double pass and has a capability of Peltier cooling from –5°C to 20 Deg C or better capable of achieving Water Temperature of -20 degree C. Refrigerating water circulation unit of appropriate capacity.
12	**Mass Analyser**
	Hyperbolic or equivalent quad rods to achieve required sensitivity, detection limit etc.
	The analyzer should be a quadrupole, should operate at > 2 to 3 MHZ or more to provide best stability, good resolution, better peak shape and exceptional abundance sensitivity
	The analyzer quadrupole should discretely control the resolution of the selected mass region dynamically without affecting the overall nominal resolution of the system.
	Mass Range. The entire mass range in-between 5 to 260 amu or better
13	**Detector**
	The ion detector should be a discrete Dynode electron multiplier unit or equivalent. Detector should be able to analyze high and low concentration of isotopes simultaneously with about 10 orders or better
	Both the analog and pulse counting modes should be protected against overload. Sufficient safety measures should be incorporated. Minimum dwell time 100µS or better in both pulse count and analog mode
14	**Range**
	5– 260 amu or better
15	Scan Speed
	3000 amu/sec for 35 masses or better
16	**Dynamic Range**
	About 10 orders or more
17	**Mass calibration Stability**
	<0.05 amu over 8 hours of continuous operation
18	**Heat Exchanger**
	Suitable re-circulating Chiller changer for plasma component cooling. Cover for noise reducer should be supplied
19	**Performance of equipment**
	Detection Limit (ppt) : Li or Be (low mass) < 0.5 ppt or better; In or Y (mid mass) < 0.1, U or Bi or Tl (High mass) < 0.1 or better
	Sensitivity: Li or Be (Low mass) : >50 Mcps/ppm or better, Y or other suitable element (mid mass) >160 Mcps/ppm or better & Tl (Hi mass) >80 Mcps/ppm or better Oxide ratio. BaO+/Ba+ or other suitable element ≤2.0 % or better. Doubly-charged ratio (%) Ce2+/Ce or other suitable element ≤3.0 or better
20	**Setup and Detection Solutions**
	All setup and tuning solutions relevant for optimization should be supplied.
21	**Vacuum System**
	Suitable turbo molecular pump, corrosion resistant and protected
	Automatic chamber vacuum isolation when plasma extinguishes and also during system faults
22	**Instrument Control, Data Acquisition and Processing**
	System Controller & Operating System
a	Desktop computer (with the latest processor, 8 GB RAM or better, key board & optical mouse or any better system) with soft copy of latest original Windows Operating System compatible with the ICP-MS software
b	Color Graphics LED Monitor (80 cm or better) preferably Dual monitor
c	All in one Color Laser Printer
	Latest Window OS based Original Soft Copy of ICP-MS software should be provided for

	(a) Method development, Operation and data acquisition (b) Routine maintenance alerts & user defined alerts. (c) Automated quality control. (d) Context Sensitive Help. (e) Qualitative, Semi-quantitative, Quantitative Analysis and for specialized isotope ratio calculation. (f) Generating data table with real time update & calibration curve. (g) Fast simple data layout for automated report generation. (h) Computer Controlled Automated Optimization of cell gas flow. (i) The firm should provide software upgrades from time to time at least for five years after installation and commissioning.
	Soft copy and hard copy of the operation and service manuals and application notes.
23	**Software**
	Orginal Software in Installable CD/Image Disks > Should include all activation licenses/keys > All analysis parameters should be software controlled within a single method > Should control all operating components > Functionality like Internal standard stability, QC checks, error flag > Acquire and process data for quantification in calibration curve fit modes.Software should be LIMS Compatible
24	**Accessories and others**
	Autosampler with 250 vial capacity & 5000 tubes. > Peltier cooled spray chamber for low oxide ratio and polyatomic interference. > Software controlled Aerosol dilution system should be included > Universal cone interface for best sensitivity for high matrix as well as low matrix samples without changing any hardware in the interface > Inert kit for HF digested samples should be provided > checkout solution, tuning solution, internal standard solution. Suitable Microwave digestion system shall be supplied for anlaysis of solid samples like Infant Milk powder, Cereal based complementary foods etc.
25	**Local Items**
	Gas cylinders for ICPMS- Argon (04 No.), He gases cylinder (02 Nos.), Reaction Gas cylinder as per system requirement , Gas purification panels with fittings for supplied gases,02 stage manual manifold for Argon gas, Fume hood/Exhaust, UPS 15KVA/1Hr Back up should be supplied along with the equipment
26	**Consumables for ICPMS**
	Vendor should include routinely used consumable for 03 years.
	Three set of Ni based sample and skimmer cones
27	**Warranty & CAMC :**
	as per tender document
	Stainless steel make Exhaust Hood-cum- laminar flow System, Gas cylinders Argon 6nos, Helium - 2 no. with regulators. Should be Quoted with Branded UPS 20 kVA UPS with at least 120 min back up time to be supplied by the vendor.
28	All cylinders shall be provided with Manifold system.
	Additional Features 1. Suppliers need to provide the details of pre-installation requisites and all required accessories 2. Equipment shall be 21 CFR Part-11 compliant 3. Training: As per tender document 4. Warranty and Maintenance: As per tender document 5. PC (Desktop) as per latest specs of operating system, processors, 8 GB or more RAM, 1 TB of more storage, with necessary peripherals (Wireless keyboard, Wireless Mouse, Printer and UPS). 6. System software shall be compatible with LIMS for remote observation of data with temper-proof backup facility of data along with Connectivity with Ethernet/LAN.

Technical Specification Oxygen, Nitrogen & Hydrogen Analyzer	
The Simultaneous Oxygen, Nitrogen & Hydrogen analysis should be PC controlled which must be operated on Windows based Operating System and should be compatible with external printer for reporting result in hard copy format. The determinator should operate in simultaneous mode for measurement of Nitrogen, Oxygen & Hydrogen in one sample using single carrier gas either Helium or Argon for wide variety of Metals including Iron, Steel, Ferrous & non-Ferrous including Inorganic samples like Refractories and Ferroalloys in the form of Pins, Cubes, Chips and Granular. The determinator must support either Helium or Argon carrier gas with minimum variation in analysis range & precision.The system should employ Inert Gas Fusion (IGF) or Carrier Gas Hot Extraction Method. The instrument must be CE complaint to both Low-voltage and electromagnetic compatibility directives. The determinator must include the following specification:	
Furnace:	Impulse Furnace Type.
Principle of operation	Inert Gas Fusion (IGF) or Carrier Gas Hot Extraction Method (CGE) using IR-detector and/or Thermal Conductivity Detector.
Ramping of Furnace Temperature:	The instrument software must be capable of controlling the furnace output from 0-100% by Power, current and should supports steps, ramps and sustain modes. Control for identifying and quantifying of different Oxides and Nitrides should be available for refractories.
Furnace Power:	7.5 KW or more and should be liquid cooled.
Automatic Cleaning Mechanism:	The determinators must incorporate programmable automatic cleaner for cleaning both the Lower and Upper Electrodes simultaneously after each sample analysis. The Auto cleaner should be equipped with high velocity noiseless integrated Vacuum Cleaner for removing dust maintaining cleaner furnace zone.
Analysis Range:	Based on one gram sample. Oxygen: 0.05 ppm to 5% or better. Nitrogen: 0.05 ppm to 3% or better. Hydrogen: 0.1 ppm to 2500 ppm or better.
Precision:	Oxygen : 0.025 ppm or 0.3% RSD whichever is greater. Nitrogen: 0.025 ppm or 0.3% RSD whichever is greater. Hydrogen: 0.05 ppm or 2% RSD whichever is greater.
Calibration:	Provision for 4 types of calibration should be there, which includes standard calibration, gas dose calibration, and blank calibration and drift calibration. Calibration can be performed automatic or manually. Gas dose calibration should be available for both Oxygen and Nitrogen using CO_2 and N_2 gas to be used when the standard samples for lower range are not available.
Standard Sample	Standard sample with different range of Iron, Steel & Ferroalloys should be quoted & supply with the main machine.
Mass Flow Controller & Dynamic Flow Compensator	The determinators must include heated Mass Flow Controller to maintain stable flow through detectors to improve accuracy for higher level of Oxygen measurement with back pressure control and to improve calibration stability.
Detection Method	The determinators should be equipped with latest generation independent detector for both oxygen & Nitrogen measurement. Oxygen should be measured through series of IR detectors at least two CO_2IR-detectors for measuring High & Low range and at least one CO IR detector. The IR Detector should be independently heated without using any oven to thermally isolate the detectors from environmental

	temperature fluctuations and must save down time & the same IR-detector should not use any moving part like chopper blade etc. Nitrogen should be measured by latest generation independently heated plug-n-play type dual flow controlled Thermal Conductivity Detector (TCD) with auto range change facility.
Sample Introduction System	The sampling mechanism must support direct loading of powder samples without use of any holder or basket. The sample dropping mechanism must incorporate efficient loading of wide range of samples like, Pins, Cubes, Chips, and Granular. Analyzer should have auto sampler with capacity of minimum 60-120 samples. It should have a mass flow controller/electronic flow controller for constant flow of carrier gas & sample introduction by ball valve technique for better accuracy of results to avoid the atmospheric nitrogen contamination. Sample feed : 60 to 120 auto sampler
Application Software:	-The software must contain real time self-diagnostics including ambient chart of instrument temperatures, pressures, and detector signal, manual control of solenoid and switches, automated leak check network and communication diagnostics. The software must also contain an automatic system check that verifies internal network communication, solenoid and switches, system pressure, furnace control and temperature. Shall be fully compatible with LIMS available with BIS Labs. - Calibration sample with extensive graphic displays of peak to understand the combustion cycle and to optimize analytical conditions to ensure optimal performance. - The software program should include Oxides and Nitrides separation with graphically display for both qualitative and quantitative analysis. The software should be capable of being used through android or i-phone also.
Carrier Gas	Helium/Argon should be used for Carrier gas.
Instrument performance verification (IQ,OQ, PQ)	To be done with traceable standards for the first 2 years (at the time of installation and on each maintenance visit) Required documents, kits and required standards as required
Warranty	i) Comprehensive Warranty on all parts except consumables for at least 6 years from the date of satisfactory installation shall be provided by the manufacturer & two Preventive maintenance visits /year with PM kit to be provided during warranty period. ii) During CAMC period, two Preventive maintenance visits /year with PM kit and unlimited breakdown visits to be included. iii) Warranty & CAMC to include third-party supplied items also. **Maximum breakdown period should not exceed 72hrs.** **For any breakdown exceeding this duration warranty period will be proportionally extended.**
UPS	Branded 15 KVA UPS/or suitably for providing uninterrupted power supply to the instrument with backup of minimum 30 minutes
Application, Operation and Maintenance Training Component:	On site comprehensive application training for scientific/technical personnel operating the system and support services till customer satisfaction with the system followed by two weeks comprehensive

	training to two personnel on operation and maintenance and application aspect of the instrument at supplier's laboratory. Training should be provided on Half yearly basis for two years at BIS Lab.
2. Essential units/equipment should be supply/installed with the equipment as follows:-	
a. Compatible water chiller and compatible accessories should be quoted optionally.	
b. Set of high purity (99.999%) Gas cylinders with regulator for carrier gas (2Nos cylinders +1 regulator), combustion gas (2 Nos cylinders +1 regulator) with all connection tubing to the instruments shall be provided.	
c. A pin sample cutter for sample cutting.	
d. Personal computer with minimum 21 inch monitor and colour Laser Printer shall be provided. The PC must have minimum 8 GB RAM , minimum 500 GB HDD with Win 10 OS and Recommended Windows 10 Professional with installed CD/DVD software. Antivirus software shall be preloaded in the system. All the software provided should be original software with License key as applicable.	
e. Required atleast 3 nos of Gas Cylinders (of each type) for both instrument operation and Gas Dose Calibration with respective Two Stage Regulators (or any similar technology) are to be offered.	
d. Consumables for 5000 analysis (except gases) are to be offered.	
e. Necessary Reagents for the main determinator should be offered.	
f. Any other equipment if required should be supplied for smooth functioning of the whole system.	
g. Spare parts so as to ensure that during Warranty/CAMC period the **breakdown period does not exceed 72hrs** should be offered.	
h. BASCRM for Iron & Steel and Ferroalloys with different ranges (refer analysis range given above) at-least three each for each element should be included for Nitrogen, Oxygen and Hydrogen.	
3. All the necessary electrical installation for the equipments will be in the scope of bidder..	
4. One set of consumables to be supplied along with the machine for installation/validation.	
5. Operation & maintenance manuals to be supplied in soft copy & hard copy along with the machine	
6. Demonstration on performance parameters are essential and is to be carried out by the vendors on specification for range, precision & calibration of the offered model during the time of evaluation of the bids.	

ANNEXURE A7

460

X-Rays Fluorescence Spectrometer – Technical Specifications

1. Model : Sequential Wavelength Dispersive X-ray Fluorescence Spectrometer. (fully Computerised)

2. Application : Qualitative and Quantitative Analysis of

   i/ Portland cement, blended cements and raw materials e.g. limestone, clay, bauxite, sandstone, gypsum, kiln feed, iron ore, dolomite etc.

   ii/ Industrial wastes used in cement manufacture like fly ash, slag, sludge, mine's waste etc., aggregates, sand & other minerals etc.

3. Elements to be Analysed : ^{11}Na- ^{92}U; specifically Na, Mg, Al, Si, P, S Cl, K, Ca, Fe in cement and raw materials. Additionally Mn, Ti, Pb, Zn, Ba, Cd, Cr, Hg etc.

4. Accuracy and Precision : To meet the criteria laid down in ASTM-C-114 and ISO 29581-2 or better for cement analysis.

5. Automatic Samples Changer : To hold 60 or more samples in pressed powder pellet and fused glassbead form.

6. Optics : Wavelength dispersive, combination of slits, filters and collimators for achieving high resolution or high sensitivity.

7. H.T. Generator : Power: 50 W or more

8. X-ray Tube : End Window, Rh target, Ceramic Insulation to match the generator

9. Spectrometer : Choice of vacuum and He path

Sample Handling : Solid, pressed powder pellets, beads.

Sample Size : 40 mm (pl. specify)

Sample Inlet : Air lock system

Sample Rotation : ~ 30 rpm (pl. specify)

Goniometer : θ/2θ independent driving mechanism with high angular reproducibility.

Crystal Changer : 8 positions, bidirectional, automatic

Cabinet Temperature : Please mention the temperature & stability, influence of room temperature

Stability

21. Sample Preparation : Pressed Powder. A) Automatic Pressed pelletiser with pressure upto 40 Tons

10. Analysing Crystals : i/ Standard package for ensuring analysis of all elements ^{11}Na- ^{92}U

ii/ Special crystals for efficient analysis of cement and raw materials.

iii/ Minimum 5 Crystals to be quoted to cover above range

11. X-ray Detectors : Flow proportional counter, scintillation counter

12. Safety Standards : X-ray safety – All safety measures to meet latest international standards.

Quoted Model and its power range should be approved by AERB

13. Data Processing System : Computer with latest configuration and operating system, with TFT screen and ready for interfacing with other automation system, Laser printer.

14. Operational, Control and Application Softwares and Databases : High performance software with

- Total control of spectrometer function-Performance check, drift correction and operation.
- Data acquisition and data evaluation system.
- All programmes for qualitative and quantitative analysis of cement and related materials including

B) Vibratory Mill , Heavy Duty floor standing with Tungsten Carbide Bowl

databases required (Please specify and provide details)

- Matrix correction programmes – Linear and Higher order, line overlap correction etc.
- Fundamental parameter method (for standard less quantitative analysis of unknown Materials).
- SPC module for trend analysis.

15. UPS : On line, Generator compatible separate UPS (reputed make) of adequate capacity with ~ 60 min back up to support XRF.

16. Sample Holders 50 Nos

Steel rings for sample preparation 100 Nos.

17. Any other peripheral unit required including UPS etc.

18. Spares and consumables: as per tender document

19. Operator's training : As per tender

i/

20. Warranty / Guaranty ii/ As per tender

22. Suitable Water Chiller – external for cooling of the X-Ray Tube and XRF.

_Set of Standards for elemental analysis in Cement (OPC, PPC, PSC, WPC, SRPC), Fly ash, Limestone, Dolomite, Manganese Ore, Magnesite, Gypsum, Ilmenite, Quartzite, Iron ore and bauxite

Set of CRMs with full traceability as per ISO 17034 of following elements in above mentioned Cements and mineral ores

To meet the XRF laboratory requirements following should be ensured as part of supplies:

(A) Programmable Fusion Parameters: there should be provision to program following parameters to insure stable and reproducible glass disks.
   1. Temperature
   2. Time
   3. Rate of heating
   4. Crucible rocking speed
   5. Cooling air flow

(B) Security features: The offered system must be equipped with following security features:
   1. Integrated safety door
   2. Emergency stop button
   3. Can operate supervision free
   4. Fully automated
   5. The instrument should comply with national safety norms

(C) Software and operation with following features: -
   1. One touch operation
   2. Touch screen
   3. Windows based system
   4. Should contains present programs
   5. Possibility to create new fusion programs and modifies the present programs
   6. Programmable pre-heat mode
   7. Should be possible to connect to external PC

(D) Five sets of Tungsten Carbide Crucible and Casting Mould/Casting Dish should be provided. The Crucible should be capable of holding weight of minimum 30gms of sample

(E) A Platinum-Gold Mould/Casting Dish of 40 mm diameter to match collimator mask of XRF with minimum weight of 35 gm should be offered.

(F) Flux for Fusion Bead Preparation: Following Pre fused anhydrous beads with 99.99% purity, granulometry 100%, <50 micron sized beads, No dust, with water content <0.05% with Certificate of Analysis must be offered. Quantity 1kG with wetting agent. The flux type should be suitable for fusion of Cement and associated materials commonly analysed in Building Industry.

(G) Grinding Mill to grind the sample to powder

ANNEXURE A8

456

Specifications for Standalone Differential Scanning Calorimeter (DSC)

S.No	Feature	Specifications
1.	General Description	Differential Scanning Calorimeter Suitable for OIT analysis as per IS 4984, IS 14885 & IS 16098 (Part-2). (with latest version and amendments)
2.	Sensor type	Suitable with Double Furnace
3.	Temperature range	-100 °C to 700 ° C or better
4.	Temperature accuracy	± 0.1 °C or better
5.	Temperature precision	± 0.05 °C or better
6.	Enthalpy precision	± 0.1% or better
8.	Heating/ Cooling rate	0.01 to 200 °C per min or better
10.	Isothermal stability	±0.1°C
13.	Segment types	Static (Isothermal) and dynamic
14.	Gas atmospheres	Inert & oxidizing (N_2 & O_2)
15.	Calibration Standards	Pure Indium & Pure Tin with purity certificates
16.	Associated accessories	Sealing press /Crimping tool, cleaning brush and tweezers, N_2 & O_2 gas cylinders, flow meters (2 Nos)
17.	Sample pan	Aluminium pans and lids (1000 pcs ; 25µl or better)
18.	Personal computer with color printer	Latest configuration compatible with the instrument
19.	Software	Licensed software for control, data acquisition and processing. Should be multi-tasking and should be able to control multiple thermal modules
20.	Other items	1. 5 KVa UPS with 30 minutes back-up
21.	General terms and conditions	1. Price for each items should be quoted separately 2. Price for optional items should be indicated separately 3. Warranty- as per Model Tender document 4. Indicate the price of AMC after the expiry of the warranty period 5. List of spares needed for each year along with cost and discounted rates should be provided. An undertaking that the vendor will supply all the

		spares for 5 years afier the warranty period to be provided 6. Complete technical details along with hard and soft copies of the manuals should be provided 7. Software upgrade should be incorporated by the vendor as and when the new versions are released at no additional cost 8. Onsite training for at least two persons in the operation and general maintenance should be given 9. List of installations in India for the last two years to be provided 10. Qualification, verification and calibration services must be available.

ANNEXURE A9

45

EQUIPMENT SPECIFICATION

Equipment / Specification Code :

Name of the equipment : Carbon Sulphur Analyser

Microprocessor based PC controlled simultaneous carbon & sulphur analyser for steel (MS, SS and Tool steel)

S. No.	Features	Requirements
1	Design	The instrument should consist of a maximum of two cabin units making a combination of analyser and detector systems
2	Configuration	The instrument should be capable of simultaneous determination of carbon and sulphur in different ranges using a single-point/ multiple point calibration applicable over entire range or 3-4 different ranges calibrated by appropriate IR detection cells (detection channels)
3	Power supply	230±10 V, 50 Hz, single phase
4	Detection range	Carbon : 5 ppm (0.0005 %) - 3.5 % or better Sulphur : 5 ppm (0.0005 %) - 0.35 % or better (Based on 1 g of sample taken for analysis)
5	Accuracy	Carbon : 0.5 % RSD or better Sulphur : 1.5 % RSD or better
6	Operating temperature	10°C – 40°C
7	Determination and detection	High temperature oxidation followed by Non-dispersible / solid state infra-red absorption detection system
8	Furnace for combustion	High frequency induction furnace capable of achieving a temperature of minimum 1500°C and also capable to fuse highly alloyed steels like stainless steel and tool steel etc.
9	Analysis time	Less than 90 seconds
10	Sample size	System should be capable to handle sample weight of up to 2 g
11	Calibration and blank settings	These should be specific to different methods e.g. steels (in different ranges for C & S)
12	Electronic balance	Integrated with the instrument and should have i) Range : Up to 50 g ii) Least Count : 0.1 mg or better iii) Readability : 0.1 mg or better iv) Repeatability : 0.2 mg or better v) Linearity : 0.2 mg
13	Readability	For the results of both C and S , a minimum of six digits after decimal or better
14	PC	Latest branded PC having minimum , i7 processor or better, 8 GB RAM, 1 TB Storage drive or better, installed with original licensed Window 10 operating

		system, provided with compatible cables and ports so as to establish instrument to PC & printer connectivity
15	Monitor	Flat panel LED**minimum** 43 **cm or higher** display screen
16	Printer	Latest branded laser jet. A4 size black & white prints
17	Software to support	i) System control ii) 21 CFR Part 11 compliant software with facility of multi-point calibration iii) Automatic leak check with pressure display on screen iv) Automatic cleaning of the furnace port after a specified number of analysis v) Data storage facility for future reference vi) Graphical display of measurement processes vii) Monitor the system parameters including qualitative analysis; data acquisition, retrieval a and reporting viii) All operation, security, calibration and diagnostic mode ix) Automatic detection of leakage x) Relevant safety alarms xi) Password protected control to limit access to data and methods
18	Consumables	Complete set of consumables (absorbent trap chemicals, accelerator and crucibles etc.) for at least 5000 analysis to be supplied along with the instrument
19	CRMs	Following CRMs**(any declared value of Carbon and Sulpher within the ranges given below)** traceable to international standards with composition certificates to be supplied along with the instrument i) Steel CRM C 0.06-0.12% & S 0.010-0.025 %, 1x100 g ii) Steel CRM C 0.12-0.25% & S 0.030-0.050 %, 5x100 g iii) Steel CRM C 0.35-0.50% & S 0.060-0.090 %, 5x100 g iv) Steel CRM C 0.80-1.20% & S 0.010-0.030 %, 1x100 g
	Connectivity	LAN/Ethernet connectivity with data reporting system to remotely observe the data is required.
	Warranty	As per tender document
	Training	On-site demonstration to the users and Operation and Maintenance Training

ANNEXURE A1b

Scope: The epiflourescence Microscope fitted with DIC shall be capable to test Giardia & Cryptosprorodium as per USEPA 1623/ ISO 15553 with the following specifications :

Fully motorized and computer controlled inverted microscope

- Inverted completely motorized (latest model) microscope with Infinity optical corrected optical system and a vinyl cover to protect from dust.
- Microscope should be dual deck equipped with motorized Z-focus for fast XYZ scanning with minimum step size of 10 nm or better.
- All accessories for high resolution Bright Field (BF), Phase Contrast (PC), Fluorescence (FL) and Differential Interference Contrast (DIC) illumination and imaging should be supplied.
- The microscope should have 1.5X, 2X intermediate magnification changer.
- Nomarski differential interference contrast attachment to be mounted in conjunction with a reflected-light fluorescence attachment to enableone-touch switchover among brightfield, phase contrast, differential interference contrast, fluorescence.
- Motorized fine/coarse focus, focus knob with rotary encoder, escape (for anti-collision) and refocus mechanism, laser safety interlock signal output, light distribution with motorized changer: 100% Eyepiece, 100% Left and 100% Right.
- The microscope should come with a pre-centered 12 Volt 100W Halogen or equivalent illumination for transmitted light and DIC applications.
- The microscope should have hardware and software based automatic focus correction to avoid continuous drift caused by mechanical or thermal changes. Users should have control to keep this option "on" or "off" in both continuous and on-demand experiment needs.
- Microscope should have the facility to project the objective back aperture plane on a monitor with camera
- Microscope should have the automatically engage / disengage all the correct components for their chosen observation method.

Condenser:

Completely motorized universal turret condenser suitable for all microscopy techniques with 6 or more positions.

• Should supply following TWO condensers

1) Air condenser with 0.5 NA or better

2) Oil condenser with 1.40 NA or better

Both Phase contrast condensers are equipped with ring slits for 4X, 10X, 20X and 40X phase contrast objectives.

Nomarski Differential Interference Contrast Attachment:

- It should have Nomarski condenser and NA Nomarski analyzer as accessories.
- In addition to 10X, 20X and 40X Nomarsk i prisms, the multifaceted condenser should contain ring slits for 10X and 40x phase contrast objectives.

Reflected-Light Fluorescence Attachment

- Four types of cubic dichroic mirror units should be available for U, V, Band G excitation, with each unit consisting of an exciter filter, a dichroic mirror and a barrier filter.
- Switchover between the two excitation wavelengths should be achieved by a simple one-touch operation.

Stage:

• Completely motorized, smooth XY encoded stage with Joystick control, as well as total control by the software.

• Universal Holder, well plate holder, slide holder & stage ring holder.

Eyepiece:

- 10x or better

Nosepiece:

• Microscope should have motorized DIC revolving nosepiece to hold minimum 6 objectives at a time with anti-collision mechanism.

• Automatic focus drift correct mechanism (750nm LED or better) continuously caused by thermal & mechanical changes during long term live cell imaging experiments. So that images remain in focus even working on higher magnification & higher resolution techniques. The Focus drift correction should work for all the objectives mentioned.

Additional Requirements:

- Ocular micrometer

Objectives:

Should be supplied with following high performance, highly corrected, Plan Apochromatic objectives suitable for Bright field / Fluorescence / DIC imaging.

High NA and highly colour/lambda corrected confocal grade

Objectives:

1) Plan Apo 10 x /N.A. 0.40 or higher.

2) Plan Apo 20 x /N.A. 0.70 or higher.

3) Plan Apo 40 x /N.A. 0.90

4) Plan Apo 60/63 / NA 1.49 or higher

5) Plan Apo 100 /NA 1.49 or higher.

Stage incubator:

• System should be equipped with best and highly sensitive onstage live cell imaging chamber with following specifications.

1) CO2 and O2 sensors.

2) Thermal and humidity monitor and controller, microscope enclosure with temperature control for long term imaging

3) Objective collar heater

• The stage should be compatible to hold slides, petri-plates of standard size and dimension.

- All parameters should be controlled by same imaging software.
- All the accessories required for the integration with the microscope and full functioning of the quoted stage incubator should be included.

DIC attachments:

All necessary components required for high quality DIC imaging from 20x - 100x objectives should be included.

Epi-fluorescence attachment:

- Motorized epi-fluorescence attachment with motorized 6 positions or better turret filter block.
- Noise Terminator mechanism incorporated for high signal to noise ratio images
- Pre-centered motorized Mercury/Metal Halide Fiber illuminator or of 120W/130W with facility for no heat and electrical noise transfer from lamp to the microscope body is conducted, lamp should have a lifetime of 2000 hrs or higher.
- Motorized High speed shutter compatible with episcopic fluorescence illumination to prevent photobleaching. Should have 5 or more position filter wheel with Neutral Density filters.

Filter cubes:

Highest quality Bandpass Fluorescent filter cubes and any other required components for fluorescent imaging applications.

- BFP/DAPI/Hoechst
- FITC/GFP
- YFP/EYFP
- CFP

Software:

The quoted software should have the following features:

- Most advanced level image acquisition, Complete microscope control, Camera control and Laser control.
- Saving of all instrument parameters along with the image for repeatable / reproducible imaging. Time series, Z – Stacking with Autofocus, Multi position, Stitching / Tiling imaging capabilities.
- Software should have real-time simultaneous control for all the motorized devices
- Diverse measurement and statistical processing.

- Software should have the capability of multi-dimensional acquisition namely XT, XZ,XY, XYT, XYZ,XYλ,XYZT,XYλT, XYλZT, reconstruction.

- Software should be capable of recording intensity profiles and other parameters of live cell imaging experiments along with Environment parameters as recorded data.

- It should be capable of handling & controlling Multi-laser for simultaneous two- colour imaging.

- It should be capable of standard geometry measurements like length, area, angles etc including intensity measurements.

- Advanced 3D image reconstruction with rendering from Z-stack image series.

- The system should have special experiment management/designing facility so that users can plan his experiments based on different system settings and different experimental conditions.

- Must be free and should be accessible for at least two offline users with features for data analysis and statistical measurements.

- Free lifetime software update

Software should be LIMS Compatible

Computer Workstation:

- INTEL latest and a fastest PROCESSOR based workstation having a latest configuration with DDR4 SDRAM 32GB RAM, 2TB SATA 7200 RPM and 512 MB SSD, NVIDIA GeForce gtx graphic card with High resolution 80 cm (1 no.) LED Monitor/TV should be supplied along with the system.

- The above system should essentially be supplied with a Real-Time control/command board for quick & real-time parallel execution & processing of experimental commands to various components of the system without any time lag.

- Operating system shall be windows 10 Pro 64 bit or higher and the instrument firmware shall be upgradable.

- Computer table for system

- UPS system to support the entire set-up

ANNEXURE A II

Details of Technical Specifications

Technical Specification for Liquid Chromatography system for estimation of Bromate in Water

S.No	Components	Requirements
1	Liquid Chromatograph System	**Liquid Chromatography system for estimation of Bromate in Water shall include the following requirements:-** 1. Eluent reservoirs, and a degassing unit for 2 eluents 2. Eluent Pump: pump with an option of upgradability for step gradient with the following parameters: i) Chemically inert, metal- free PEEK pump heads and flow path; compatible with aqueous eluents from pH range 0-14. ii) Pump flow rate :0.001 ml/min to 10ml/min or more with ability to set flow increments at 0.001ml/min, iii) flow precision: $\leq$0.1%. flow accuracy: $\leq$0.1% 3. An auto sampler device and sample delivery device consisting of minimum 50No. of vials with volume capacity of each 10ml or more. 4. Column switching valves (ex: 6-port valve) including a device for timing and controlling valves and pump. 5. Concentrator column and a guard column: Non metallic PEEK based Ion exchange column and its guard column compatible and suitable for pH range 0-14. 6. Separator column: Peak resolution (R) of the Separator column shall not fall below 2 between bromate and nearest peak (which is usually chloride). The combination of separator column and eluent shall conform to this resolution requirement. 7 Conductivity detector (CD) with an anion suppressor device Assembly. 8 Range of estimation: 0.5 ppb-100 ppb or better 9 Recovery range: 80% to 120% 10 Method to calibrate overall procedure for determination of Bromate.(Calibration shall be carried out in accordance with ISO 8466-1 or ISO 8466-2)

		11 Provision for up-gradation for testing other anions/cyanide
2	**Accessories**	1. All essential accessories, spares and consumables except chemicals & CRM required for regeneration and smooth running of the system during warranty & CAMC period shall be provided. However, required chemicals including CRM shall be supplied for satisfactory training and commissioning. 2. Instrument Manual should be provided
3	**Interface**	Power supply: 230V, 50HZ
4.	**Features**	1.Microprocessor controlled system for continuous monitoring of various stages of operation of the system. 2. Monitor display: System status, performance and maintenance needs indicators including alarms 3. The software must be able to provide full automatic control of the Process of analysing samples. This must include acquiring data, quantification, producing a report, and the option to upgrade to an incorporated excel like spread sheet for report flexibility.
5.	**Warranty, After Sales support & Training**	1. Should provide after sales support through a combination of warranty and Comprehensive Annual Maintenance contract (CAMC) on all parts for a period of 6 years from the date of successful installation at site as per tender conditions. 2. Should provide all accessories, spares and consumables except chemicals & CRM for a period of six years (during Warranty + CAMC period) from the date of successful installation at site as per tender conditions. However, required chemicals including CRM shall be supplied for satisfactory training and commissioning. 3. Two Preventive maintenance visits per year with Preventive maintenance kit to be provided. 4. During CAMC period, unlimited breakdown visits to be included. 5. Required onsite training for the normal operation of the equipment to be provided.
6.	**Other requirements**	1. Pre installation requisites shall be informed by the supplier. 2. Licensed Software should be provided & it should be 21 CFR part 11 compliant 3. On site IQ, OQ of instrument along with document to be provided & supplier to assist till satisfactory PQ of instrument.

		4. The supplier shall have to carry out validation of method for analysis of bromate in water as per ISO 15061. 5. HARDWARE: Reputed brand , Intel core i5 or better processor, 16 GB RAM or more, 1 TB HDD or more, LED Flat-Color size-27" or bigger, DVD Multidrive, USB Port minimum 03 Nos, Optical mouse with pad, Keyboard, laser Jet Printer or higher configuration for use with the above system to be provided. Computer should have latest version of Windows operating system and other supporting softwares installed. 6. UPS : Online UPS of 5KVA capacity with at least 60min backup. UPS should have atleast one year warranty. 7. Third party items should be provided with at least 1 year warranty.

ANNEXURE A12

Technical Specification of Ultrapure Water Purification System

S No	Components	Requirements
1	General	Water purification systems providing Ultra pure water and type – 2 water from a Potable Water Feed supply .The system shall include: a) Pre filtration up to 1 micron. b) Pre treatment –Activated carbon filters for removal of Chlorine, dissolved organics etc. and R.O. system for providing ideal /optimum feed water quality for Main Ultra purification Unit. c) Main Ultra purification unit - R.O Module, UV disinfection and Deionization module. d) Suitable & Separate dispensers for type I & type II water.
2	Ultra pure water system (type I)	1. Feed water: Potable water feed supply 2. TOC(ppb) < 5 4. Resistivity: 18.2 MΩ.cm@25°C 5. pH : Effectively neutral 6. Production rate : 7 liter /hr minimum 7. The system shall have facilities for recirculation of product water through the reservoir to maintain consistent peak water purity. Recirculation tank shall be provided of minimum 20 litre. 8. The water purification system shall have dispense flow rate of minimum 0.5 lit per minute or better for Type-1 water.
3	Accessories	1. All essential accessories required for running the system like cartridges and filter pumps, UV lamps etc. to be included. 2. Standard tools kit should be provided for general maintenance.
4	Inter face	Power supply: 230V, 50/60 HZ
5.	Features	Microprocessor controlled system for continuous monitoring of water quality. Monitor display: Resistivity, system status, performance and maintenance needs like Cartridge change indicators including alarms.
6	Warranty & training	Should have a warranty period of 3 years from the date of successful installation at site as per tender conditions. Warranty should include consumables also. Required training for the normal operation of the equipment to be provided.
7.	After Sales Service	Onsite Comprehensive Annual Maintenance Contract to be provided for three years after warranty as per tender conditions.

ANNEXURE A13

Pc itiometric Auto Titrator system with Parallel Titration and Karl Fischer titration facility with the following specifications is required.

1 The system should be microprocessor based, capable of doing all types of Titrations like Acid base, Non Aqueous, Redox, Complexometric, Back-titration and precipitation.
2 The system should also have the facility to perform Volumetric Karl Fischer Titration. The accessories for the same should be quoted.
3 The system should be completely software controlled and should have atleast two galvanically isolated measuring interfaces within the same system, for performing two titrations simultaneously with separate work stations.
4 The system should be quoted with the sensors and accessories to perform chloride, calcium, magnesium, aluminium and iron in food and cement samples.
5 The instrument should have the following measurement range

a)	pH	: 0 to + 14.0 with Resolution of 0.001
b)	mV	: ± 1200 with Resolution of 0.1 mV or better
c)	I_{pol}	: ± 120 µA or better
d)	V_{pol}	: ± 1100 mV or better

6 As a security measure the basic instrument and all the peripheral devices connected to it should be recognized automatically by the software as soon as it is connected to the software.
7 The system should have the possibility to connect up to Four Titrating burettes for different types of titrations.
8 Burette should have a resolution of 1/10000 steps or better of its burette volume and the flexibility to handle more than one solvent for liquid handling.
9 Preparation of burette with new titrant and emptying the burette, with a single command should be possible.
10 Burettes volume of 2, 5, 10, 20 and 50 ml should be available if required. 20 ml (LC: 0.01 ml) burettes for potentiometric titration and 10 mL (LC: 0.01 ml) burette for Karl Fischer volumetric titration should be given with the system.
11 Dosing drives with chip on board technology with the capability of read and write should be provided. It should detect the burette volume once connected. The chip on the burette should store the important data like titrant name, concentration, date of preparation, expiry date, etc.
12 The instrument should have the option to connect intelligent sensors with chip on board technology to capture all data related to calibration and performance of sensors.
13 The instrument should also have the facility to perform pH measurements with the capability of 5 points calibration. Suitable electrode should be provided with the system.
14 The instrument should also have the facility to perform ion measurements with suitable ion selective electrodes if required.
15 Two magnetic stirrers one each for potentiometric titration and Karl Fischer titration, with control on stirring speed and direction should be provided. The magnetic stirrer provided for Karl Fischer titration should have a membrane pump used for the aspiration of titrated solutions and addition of methanol for titration.
16 Suitable automation facility for handling sample preparation and titration of minimum 15 samples should be available if required in future.
17 Latest windows based software should be provided with the system, with the following facilities.
   a) It should be possible to connect unlimited number of instruments to the software.
   b) Software should be LIMS compatible and facilitate parallel multi-tasking functions. Software should support client-server version if required.
   c) Result monitoring, customized report and automatic data back-up should be available.
   d) Automatic inquiry of sample size and/or ID number after start of titration on request.
   e) Variable Start Delay for poorly soluble samples.
   f) Should be possible to do two titrations parallely in the same window.
   g) Result trend analysis, History about the each determination should be available.
   h) Export and import of data(s) in different formats like CSV (to excel), XML (to LIMS) etc should be possible.

i) Should have unique user login facility with passwords for multiple users.
j) Should be 21 CFR Part 11 compliant.

18 The potentiometric titration system should have the above features and should be offered with all the necessary accessories for performing the applications mentioned above.
19 Instrument performance verification (IQ,OQ, PQ): To be done with traceable standards for the first 2 years (at the time of installation and on each maintenance visit)
20 Required documents, kits and required standards as required
21 Warranty: as per tender document
22 On-site demonstration to the users and Operation and Maintenance Training

ANNEXURE A14

ANNEXURE-~~A~~14

Technical Specification FOR XRF SPECTROMETER

1	Name of the Equipment	**XRF SPECTROMETER**
2	Application	For measuring purity of Gold and Gold Alloys, jewellery/artifacts.
3	Relevant Indian Standard	IS 1417 : 1999
4	Specification	
a)	Detection Range	0 to 99.99%
b)	Least count	0.01% or better
c)	Measurement uncertainty	±0.05% or better
d)	Sensitivity to temperature in the range of 20-30°C	±0.01% max.
5	Design features: It shall have the following design features:	
a)	The X- Ray Tube shall be micro focused to get high intensity. Primary radioactivity shall be controlled by suitable number of primary filters .It shall also have programmable energy saving arrangement.	
b)	The detector used shall be silicon drift detector with peltier cooling and having atleast 1,00,000 pulses per second. The resolution of the detector shall be 160eV (Mn-Kα) or better.	
c)	It shall detect metals Gold, Silver ,Copper , Zinc ,Indium ,Lead,Nickel, Palladium, Cadmium including Platinum group metals such as Ruthenium & Iridium.	
d)	It shall have approval for radiation safety by highest national or international approved authority .Exposure protection features should be there, for example ,X-ray is cut off when the door is open.	
e)	It shall be able to measure the purity at any point including at soldered joints	
f)	It shall have the provision to make computerized measurement.	
g)	It shall have provision to do self calibration using standard reference traceable to NIST, PTB or equivalent along with the certificates.	

h)	The operating software shall have the following features: i) Quantitative analysis of solids for upto 24 elements simultaneously. ii) In quantitative mode software should be able to measure platinum group of metals along with gold alloy in single measurement. iii) Automatic drift compensation during the measurement. iv) Automatic identification of elements in qualitative mode. v) There should be one software for both qualitative and quantitative analysis. vi) Should be able to give warning, if different unknown elements are present during the quantitative measurement.
i)	The vendor should supply gold alloy pieces with identification and certificate from Govt of India Mint or NABL accredited laboratories having gold content around all fineness specified in IS 1417:99 for calibration purpose.
j)	It should have at least three collimators, with at least one having measuring spot size in the following three ranges with automatic changeovers: i) 0.15 mm to 0.25mm ii) more than 0.25 mm but less than 2 mm and iii) 2 mm to 3.5 mm
k)	Arrangement should be made available to focus on desired spot on the sample without any human error/ judgment with true colour video image.
6	Technical information / Certificate / Accessories to be supplied
a)	Full Technical information about: i) H.V. Generator and its X-ray tube. ii)Type of Detector iii) Measuring method and the relevant information
b)	Safety devices and the cooling system available in the equipment.
c)	Input power supply requirement
d)	Details of dimensions of equipment

7.1	COMPUTER	
	Make	Reputed brand
	Processor	Intel core I7 (4th generation) processor
	RAM	8 GB RAM
	Hard Disk	1 TB
	Monitor	LCD Flat-Color size-21"
	DVD Writer	DVD Multidrive
	Key board	Latest multimedia
	Mouse	Optical mouse with pad
	Printer	laser Jet Printer Black
	Softwares	Pre-loaded Window 10 professional operating system with licensed CD compatible with operational software
		MS office 2013 professional with licensed CD compatible with operational software
		Pre-loaded Antivirus with latest version of 3 years lifetime along with Licensed CD
8	UPS	Branded UPS for providing uninterrupted power supply to the instrument with backup of minimum 2 hrs.

Annexure-A 15

Technical Specification of Microbalance

S.No.	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Capacity	1.1 gm or more
2	Readability / Least Count	0.001mg
3	Stabilisation time	5 sec or better.
4	Linearity	0.006 mg or better
5	Repeatability	0.003 mg or better

ANNEXURE B 1

134

Technical Specification of All Cut Machine

	Parameters	Specification
1.	Cutting Height	≥ 600 mm
2.	Cutting Width	≥ 550 mm
3.	Cutting Length	≥ 1250 mm
4.	Allowed cutting taper	±0.2/1000 mm
5.	Work Table	≥ 1250 x 900 mm
6.	Bed size	≥ 750 x 1250 mm
7.	Blade size (approx)	1.1 x 41 x 4860 mm
8.	Blade speed	VFD (variable frequency drive, 20 – 300 Meter./min. or better
9.	Cutting Feed	Hydraulic (1mm – 300mm/Min.)
10.	Motor (Saw)	≥ 5 HP
11.	Motor (Hydraulic)	≥1 HP
12.	Motor (Coolant)	≥ 0.12 HP
13.	Hydraulic Reservoir	≥ 50 Liter
14.	Coolant Reservoir	≥ 25 Liter
15.	Work table	Metallic work table with suitable "T" slot and surface hardness.
16.	Bed	Fabricated with EN 8 plate and machined.
17.	Table movement	Automatic controlled movement
18.	Cutting accuracy of height as well as length	1 mm / meter
19.	Material suitable for cutting	All ferrous and non-ferrous metals, plywood etc.
20.	Blade guide	Carbide (Hydraulic Operated)
21.	Speed attachments	Fixture with scale for quick job setting
22.	Wheels	Cast Iron
23.	Work table maximum load withstanding capacity	≥500 kg
24.	Wire brush	2 Nos.
25.	Work light	2 Nos.
26.	Chip collection tray	2 Nos.
27.	Tool kit	One set

	Essential Spares:	
1.	Pressure and feed valve	2 no. Each type
2.	Cutting Blades (HSS Bimetal Bandsaw blade) suitable to cutting stainless steel material	5 no. Each (TPI – 3/2 , & 4/6)
3.	Contactors and switches	2 sets
4.	Flow control valve	2 nos. Each type
5.	DC Solenoid valve	2 nos. Each type

ANNEXURE B2

TECHNICAL SPECIFICATIONS FOR COMPUTER CONTROLLED IMPACT TESTING MACHINE WITH IZOD AND CHARPY NOTCH BROACHING MACHINE

I. TECHNICAL SPECIFICATIONS FOR COMPUTER CONTROLLED IMPACT TESTING MACHINE	
Test to be Carried out	Izod Impact Test as per IS 1598:1977 and Charpy Impact Test as per IS 1757 (Part 1): 2014/ISO 148-1, IS 1757 (Part 2)/ISO 148-2 and IS 1757 (Part 3)/ISO 148-3.
Scope:	The pendulum impact tester allows performing Charpy impact tests on metals, Izod impact tests. Impact tester must have the choice of implementing a pendulum hammer with 170 J (17 kgf-m) and 300 J (30 kgf-m) energy. Provision shall be provided in the machine to increase the working capacity up to 450 J.
Basic Unit:	i. The Machine suitable to perform Charpy test as well as Izod Test. ii. To carry out the functions of zero cleaning and automatic return, capturing the value of lost or absorbed impact energy and pendulum cycle by means of setting up the computer program and the results can be monitored. iii. Machine shall be computer controlled and closed loop operation. It shall be capable of controlling the test procedures as the pre-set programs & also displaying, recording & Printing the test results, the testing curves can be drawn automatically in real time.
Clamping Fixtures and Jigs	i. Designed according to, IS 1598:1977, IS 1757 (Part 1): 2014/ISO 148-1, IS 1757 (Part 2)/ISO 148-2 and IS 1757 (Part 3)/ISO 148-3. ii. Clamping device for Izod Impact test shall be capable of holding square and round section test piece as per Cl 3 of IS 1598:1977. iii. Clamping device for Charpy Impact test shall be capable of holding V-notch or U-notch test piece for test pieces of 10 mm, 7.5 mm, 5mm and 2.5 mm width as per Figure 1 & 2 (Table 2) of IS 1757 Pt-1. Self-centering tongs as per Fig A.1 of Annex A (IS 1757 Pt-1/ISO 148 Pt-1).
Machine construction	i. Other components of the machine shall be as per Cl 4 of IS 1598:1977 & IS 3766:1977 for Izod and shall be as per IS 1757 (Part-2)/ISO 148 Pt 2 for Charpy impact and compliance with relevant ASTM standards. ii. The basic unit of the pendulum impact tester shall be made up of a rigid, box-type machine column with optimized vibration isolation. iii. The pendulum impact tester must be installed on a concrete foundation with steel frame and same shall be part of supply, installation and commissioning. Detailed drawings of Foundation with dimensional specification shall also be provided. It shall be provided complete in all respect in a ready to use condition. iv. The machine shall have quick-change system, the striker can be

TECHNICAL SPECIFICATIONS FOR COMPUTER CONTROLLED IMPACT TESTING MACHINE WITH IZOD AND CHARPY NOTCH BROACHING MACHINE

	changed easily and rapidly. v. The striker must be mounted in the way that it is impossible to mount it incorrectly. vi. On the central anvil block, exchangeable support plates can be mounted, depending on the specimen dimensions.
Machine Operating features	i. The impact energy can be adjusted and displayed with a digital display. It can either be displayed as angle or as potential energy. ii. Option friction compensation allows determining the lost work due to friction. The displayed value is subtracted from the consumed impact energy depending on the pendulum travel. iii. With the help of the electromechanical pendulum lift and brake, the start position of the pendulum can be continuously adjusted. iv. Alternatively, to the digital display, a touch screen can be used by means of the computer with touch screen integrated in the machine frame. The pendulum impact tester can be completely operated via the evaluation software. Adding the tool for instrumentation, measurement results are displayed along with force-time characteristics. v. Shall have provision for data interface with computer system.
Safety Features:	i. The pendulum impact tester must be equipped with a complete safety enclosure with safety door. The safety enclosure surrounding the swinging area of the pendulum fulfills all technical safety requirements. It must be impossible to trigger the pendulum when the door is open; after triggering the pendulum and opening the door, the pendulum hammer is stopped immediately. The sides are swivel-mounted. Safety enclosures shall be such that dismantling is not required while calibrating or repairing. After inserting the specimen and closing the door of the test area, the door is locked in the way that the door is unlocked only when the automatic test cycle is finished. ii. Surveying and protecting safety control for setting and testing mode. iii. Signalling of wrong handling by signal lamps and error message in the digital display. iv. Safety and danger analysis included in the delivery of the pendulum impact tester. v. Suitable locking mechanism for the door
Other requirements	i. Electrical safety trigger of pendulum ii. Resolution of Impact Energy: 0.01 J or better iii. Indication range 0.01 to 450.00 J iv. Hammer can be triggered either by pressing the start button or by closing the door - saves time when testing cooled specimens

TECHNICAL SPECIFICATIONS FOR COMPUTER CONTROLLED IMPACT TESTING MACHINE WITH IZOD AND CHARPY NOTCH BROACHING MACHINE

	v. Computers can be connected via Ethernet interface vi. Safety box for collecting specimen remnants
Calibration/Verification	Direct and indirect verification (using reference test pieces traceable to national/international standards)/calibration certificates shall be provide as per Cl 6 & Cl 7 of IS 1757 (Part-2)/ISO 148 Pt 2 traceable to national/international standards.
Standard Accessories	
Anvil Inserts and Supports	**Anvil inserts Charpy according to IS 1757 (Part-2)/ISO 148-2** The exchangeable anvil inserts can be used up to four times by turning them in case of wear-out. - Free angle 0 ° - Relieve cut 11 ° - Radius of curvature 1 mm **Anvil Supports for Size of specimen:** 10 mm, 7.5 mm, 5mm and 2.5 mm width as per Figure 1 & 2 (Table 2) of IS 1757 Pt-1/ISO 148 Pt-1.
Centering tong	Tong to center the notched specimen (v-notch) between the anvil inserts (for specimen size 10 mm, 7.5 mm, 5mm and 2.5 mm width as per Figure 1 & 2 (Table 2) of IS 1757 Pt-1)/ISO 148 Pt-1.
For Izod test	**Support for tests by Izod** - Equipment for tests and specimens according to IS 1598:1977 - Specimen cross-section 10 x 10 mm - Or specimen diameter 11.4 mm **Vice for Izod specimen:** - Horizontal and vertical parallelism ± 0.025 mm - Radius of the upper edge of the anvil ≤ 0.4 mm
Software:	i. Software to acquire measurement values and to generate reports and statistics for impact tests. Beside the graphic display of measurement values, automatic algorithms are included to evaluate the measured values and uncertainty of measurement. ii. After each impact test, measured values are recorded automatically given that there is a connection to the pendulum impact tester. Before each impact test, the specimen-specific information (specimen denomination, specimen temperature and position) can be adapted. The adapted information is applied for the next impact test. iii. Software can be installed on every common computer (operating system at least Windows 10). iv. LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be

430

TECHNICAL SPECIFICATIONS FOR COMPUTER CONTROLLED IMPACT TESTING MACHINE WITH IZOD AND CHARPY NOTCH BROACHING MACHINE

	automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system. **Result field:** The result field in the main window shows an overview of overall impact tests of the current series of measurement and specimen-specific information as well as date and time of the current test. Corresponding to the pre-set number of continuous tests, groups of out of individual tests are formed. Each line in the statistics fields contains statistical values of the group of tests. **Testing report:** By means of the evaluation program, test results can be documented in a report. This report can be filed electronically. All results can be saved in files. The result files can be exported to process them with other programs (e.g. MS Excel). The standard report contains editable elements, which can be removed or adapted.
Computer System	Display 40 cm or better LCD/LED with keyboard, Mouse, CPU, at least 1 TB Hard drive, 8GB RAM or better, UPS, laser printer, windows OS must be supplied.

2. IZOD AND CHARPY NOTCH BROACHING MACHINE
Hydraulic Notch Machine for providing the specimens used in the impact testing with one spare set of broach. The machine shall cut notch which according to 1) Izod Impact Test piece as per Cl 3 of IS 1598:1977 (V- notch for square and round test pieces) 2) Charpy Impact Test as per Fig 2 and Table 2 of IS 1757 pt 1:2014/ISO 148-Pt 1 (U-notch and V- notch for all sizes). 3) Measuring gauges shall be provided for verification of U-notch and V- notch for all sizes of test specimens.

ANNEXURE B3

Technical Specification of Computerised Cupping Testing Machine

Sl. No	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Types of tests to be performed	Erichsen Cupping test on Metal/Alloy sheets as per IS 10175/ISO 20482
2.	Materials to be tested	Metals and Alloys
3.	Dimensions	Various dimensions of components of the equipment shall be as per Annex-I
4.	Holding Force	10 kN ±0.5 with digital display
5.	Construction	i) Provision to operate the machine for various combination of thickness and width/diameter of test piece as per Annex-I. ii) Camera shall be provided to observe the crack in the test piece during testing with their display on screen. iii) Surfaces of blank holder and of the die in contact with the test piece shall be plane and perpendicular to the axis of the movement of the punch. iv) The forming die shall be self-aligning to the fixed blank holder.
6.	Punch travel	i) Shall have motorized system of Punch travel. ii) Rate of punch travel shall be adjustable from 5 mm/min to 20 mm/min. iii) Resolution of punch travel: 0.01 mm or better
7.	Hardness of Die, Blank Holder and Punch	750 HV 30 (Minimum)
8.	Surface of Punch	i) Spherical and Polished Surface ii) Mean value of roughness (Ra) ≤0.4 µm (as defined in ISO 4287)
9.	Operational requirement	i) Complete operation through a connected computer device after placement of test piece in the equipment. ii) Punch shall not turn during the test. iii) Distance from the axis of the die to the centre of the spherical part of the punch shall be less than 0.1 mm throughout its range of movement during operation.
10.	Data acquisition system	i) Measurement of following parameters for complete operation during test: ➢ Punch Travel ➢ Drawing Force ➢ Holding Force ➢ Speed of punch travel ii) Graphical display of drawing force v/s punch travel iii) Shall have provision to get the values of drawing force and punch travel at selected point at graph. iv) Shall have provision to export the measured values to excel, pdf format.

123

11.	Spares	One set of punch and former die for all set of dimensions as per Annex-1.
12.	Computer System	40 cm or better LED/LCD with Mouse, keyboard, CPU, 1 TB or higher Hard drive, 8GB RAM or more, UPS, laser printer, windows OS must be supplied.
13.	Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.

Annex-I

Symbol	Designation	Test piece and tool dimensions and Erichsen cupping indices				
a	Thickness of the test piece	$0.1 \le a \le 2$	$2 < a \le 3$	$0.1 \le a \le 2$	$0.1 \le a \le 1$	$2 < a \le 3.15$
b	Width or diameter of the test piece	≥ 90	≥ 90	$55 \le b < 90$	$30 \le b \le 55$	≥ 90
d1	Diameter of the spherical end of the punch	20 ± 0.05	20 ± 0.05	15 ± 0.02	8 ± 0.02	20 ± 0.05
d2	Bore diameter of the die	27 ± 0.05	40 ± 0.05	21 ± 0.02	11 ± 0.02	40 ± 0.05
d3	Bore diameter of the blank holder	33 ± 0.1	33 ± 0.1	18 ± 0.1	10 ± 0.1	30 ± 0.1
d4	Outside diameter of the die	55 ± 0.1	70 ± 0.1	55 ± 0.1	55 ± 0.1	70 ± 0.05
d5	Outside diameter of the blank holder	55 ± 0.1	70 ± 0.1	55 ± 0.1	55 ± 0.1	70 ± 0.1
r1	Outside corner radius of the die, outside corner radius of the blank holder	0.75 ± 0.1	1.0 ± 0.1	0.75 ± 0.1	0.75 ± 0.1	1.0 ± 0.1
r2	Inside corner radius of the die	0.75 ± 0.05	2.0 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	2.0 ± 0.05
h1	Height of the inside rounded part of the die	3.0 ± 0.1	6.0 ± 0.1	3.0 ± 0.1	3.0 ± 0.1	6.0 ± 0.1
IE[1]	Erichsen cupping index	IE	IE40	IE21	IE11	IE40

ANNEXURE B4

Draft

Details of requirements and technical specifications of machine

Sl No	Parameters	Requirements
1.	Name of the Machine	Profile Projector (Vertical) Inverted
2.	Diameter	300 mm or more
3.	Screen Material	Fine Ground Glass or better
4.	Angle Reading	Digital Counter (LED) ABS/INC mode switching Zero set
5.	Resolution	Angular: 1 second Linear: 1µ or better
6.	Projection Lens	10x (Standard) and 5x, 20x, 25x, 50x & 100x
7.	Magnification Accuracy	+/-0.1% in Contour illumination +/-0.15% in Surface illumination
8.	X-Y & Angle counter	Inbuilt
9.	Mechanism	Fine Feed & Coarse Feed
10.	Work piece Diameter	Maximum 200mm with 10x Lens
11.	Work piece Height	Maximum 100 mm with 10x Lens
12.	X-Y Measuring Range	100 x 100mm or better
13.	Quick Release Mechanism	X and Y Axis
14.	Swivel Adjustment Range	+/- 10° or better
15.	Top Surface Size of Table	350 x 250mm (minimum)
16.	Optical System	Tele centric Lens
17.	Cross Hairs	90 Degree Solid Lines
18.	Test Specimen Load	Up to 10 Kg
19.	Resolution	1µ /degree or minute or second (selectable) or better
20.	Program Function	Part Program creation, execution, editing
21.	Statistical processing	Number of Data, Max Value, Min Value, Mean Value, Standard Deviation, Range, Histogram, statistics on a measuring function basis (by command)
22.	Display System	Color TFT LCD
23.	Data Acquisition System	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc,) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system. Latest configuration Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.

ANNEXURE B5

U26

Technical Specification of Fully Automatic Digital Micro Vickers Hardness Tester with Anti Vibration Table, PC and Software

Sr. No.	Description	Specification
System specifications		
1.	Test to be Carried out	Vickers Hardness Test as per IS 1501 (Part 1) : 2013/ISO 6507-1 : 2005 to IS 1501 (Part 4) : 2013 /ISO 6507-4 : 2005
2.	Test Load	0.009807 N to 4.903 N or better (0.001 HV to 0.5 HV)
3.	Loading Mechanism	Automatic loading and releasing
4.	Load Applying Speed	Adjustable with software
5.	approach speed of the indenter	shall not exceed 0.2 mm/s as per Cl 7.4 of IS 1501-1
6.	Velocity of the indenter	the indenter should contact the test piece at a velocity between 15 µm/s and 70 µm/s
7.	Turret	Automatic for multiple testing
8.	LCD touch panel	Color LCD touch panel
9.	Indenter	3 Nos. of HV indenters as per IS 1501-1/ISO 6507-1 with traceable certificate Suitable toolkit for indenters and shall be provided
10.	OK/NG Criteria	Judging to the results by setting max. and min.
11.	Data Editing	Data display, edit, output, retry, assist function
12.	Max. height of specimen	200mm or better
13.	Max. depth of specimen	160mm or better
14.	Uncertainty of measurement	According to IS 1501 (Part-2)/ISO 6507-2
15.	Power Supply	As per Indian power supply conditions
16.	Error reduction Functionality	System must have capability of self correction of hardness value.
Automatic reading function		

17.	Test Mode	Automatic mode(Two or more mode indents must be sticken by setting the pattern of an automatic stage-Dents continuous reading) single mode(The dent is sticken to one point-Dent reading)
18.	Camera	Suitable camera
19.	Unit of minimum measurement	0.1µm or better
20.	Minimum Indentation Reading	10µm(For 40x object lens)
21.	Manual Reading	shall have provision for manual measurement in PC monitor.
22.	Display Magnification	Minimum 400x (as per table 3 of IS 1501-2/ISO 6507-2)
23.	Measurement View	Minimum 70µm (For 40x object lens),
24.	Test Data preservation form	XLS format
25.	Graph Display	Hardened layer depth, maximum value, minimum value, X and Y axis single distance display, Parameter settings
26.	Other Functions	Judgment functions by diagonal length ratio. Flexible reading function(Four automatic reading setting values arbitrarily set are easily selected) Confirmation mode
27.	Print Output	System must have at least three standard format selection (Graph only, Data only, Graph and Data), incase special formats are needed, supplier has to support the user.
Automatic Operation X-Y axis stage		
28.	Drive system	Stepping motor
29.	Stage operation	Must have stage control box operation (An arbitrary speed can change) or icon operation in software.
30.	Least command increment	1µm or better
31.	Other functions in stage	Real-time graphical display of test position, click movement function, dry run function, offset function indentation position when replacing the indenter as an option

Automatic Z axis stage		
32.	Drive system	Stepping motor must be built in tester body
33.	Least command increment	0.05µm or better
34.	Other functions	Stage evasion function when turret rotates Automatic focus optional function (Four automatic reading setting values arbitrarily set are easily selected)
35.	Safeguard against malfunction	XY automatic stage immediate end with emergency stop button and a standard function, Operation must immediate end by auto turret lathe rotation collision in auto focus and over running.
	Anti Vibration Table	Anti vibration table accommodating adequately the machine having sufficient space for the operations must be supplied with the machine. Suitably designed to avoid transfer of vibrations to the machine.
36.	i.Software must be capable of measurements after completion of test, in case needed, software must promptly follow up the work and once again measure images on the data edit screen. ii.Software must have auto trace functionality of the shape of the specimen. iii.The starting point of the measurement line must be set by the shape trace based on the image(straight line division/arc division/straight line trace) iv. The illumination device of the measuring microscope shall produce uniform lighting of the whole observed field and maximum contrast between the indentation and the surrounding surface.	
37.	Display 40 cm or better LCD/LED with Mouse, keyboard, CPU, 1 TB or higher Hard drive, 8GB RAM or better, UPS, laser printer, windows OS must be supplied.	
38.	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.	

ANNEXURE B6

Technical Specification of Fully Automatic Digital Vickers Hardness Tester with Anti Vibration Table, PC and Software

Sr. No.	Description	Specification
System specifications		
1.	Test to be Carried out	Vickers Hardness Test as per IS 1501 (Part 1) : 2013/ISO 6507-1 : 2005 to IS 1501 (Part 4) : 2013 /ISO 6507-4 : 2005
2.	Test Load	1 to 50 kgf or better (9.807 to 490.35 N or better)
3.	Loading Mechanism	Automatic loading and releasing
4.	Load Applying Speed	Adjustable with software
5.	approach speed of the indenter	shall not exceed 0.2 mm/s as per Cl 7.4 of IS 1501-1
6.	Velocity of the indenter	the indenter should contact the test piece at a velocity between 15 µm/s and 70 µm/s
7.	Turret	Automatic for multiple testing
8.	touch panel	Color touch panel
9.	Indenter	3 Nos. of HV indenters as per IS 1501-1/ISO 6507-1 with traceable certificate Suitable toolkit for indenters and shall be provided
10.	OK/NG Criteria	Judging to the results by setting max. and min.
11.	Data Editing	Data display, edit, output, retry, assist function
12.	Max. height of specimen	200mm or better
13.	Max. depth of specimen	160mm or better
14.	Uncertainty of measurement	According to IS 1501 (Part-2)/ISO 6507-2
15.	Power Supply	As per Indian power supply conditions
16.	Error reduction Functionality	System must have capability of self correction of hardness value.
Automatic reading function		

422

17	Test Mode	Automatic mode(Two or more mode indents must be sticken by setting the pattern of an automatic stage-Dents continuous reading) single mode(The dent is sticken to one point-Dent reading)
18	Camera	Suitable camera
19	Unit of minimum measurement	0.1 µm or better
20	Minimum Indentation Reading	10µm(For 40x object lens)
21	Manual Reading	shall have provision for manual measurement in PC monitor.
22	Display Magnification	Minimum 400x (as per table 3 of IS 1501-2/ISO 6507-2)
23	Measurement View	Minimum 70µm (For 40x object lens),
24	Test Data preservation form	XLS format
25	Graph Display	Hardened layer depth, maximum value, minimum value, X and Y axis single distance display, Parameter settings
26	Other Functions	Judgment functions by diagonal length ratio. Flexible reading function(Four automatic reading setting values arbitrarily set are easily selected) Confirmation mode
27	Print Output	System must have at least three standard format selection (Graph only, Data only, Graph and Data), incase special formats are needed, supplier has to support the user.
Automatic Operation X-Y axis stage		
28	Drive system	Stepping motor
29	Stage operation	Must have stage control box operation (An arbitrary speed can change) or icon operation in software.
30	Least command increment	1µm or better
31	Other functions in stage	Real-time graphical display of test position, click movement function, dry run function, offset function indentation position when replacing the indenter as an option
Automatic Z axis stage		
32	Drive system	Stepping motor must be built in tester body
33	Least command increment	0.05µm or better

34	Other functions	Stage evasion function when turret rotates Automatic focus optional function (Four automatic reading setting values arbitrarily set are easily selected)
35	Safeguard against malfunction	XY automatic stage immediate end with emergency stop button and a standard function, Operation must immediate end by auto turret lathe rotation collision in auto focus and over running.
	Anti Vibration Table	Anti vibration table accommodating adequately the machine having sufficient space for the operations must be supplied with the machine. Suitably designed to avoid transfer of vibrations to the machine.
36.	i.Software must be capable of measurements after completion of test, in case needed, software must promptly follow up the work and once again measure images on the data edit screen. ii.Software must have auto trace functionality of the shape of the specimen. iii.The starting point of the measurement line must be set by the shape trace based on the image(straight line division/arc division/straight line trace) iv. The illumination device of the measuring microscope shall produce uniform lighting of the whole observed field and maximum contrast between the indentation and the surrounding surface.	
37.	Display 40 cm or better LCD/LED with Mouse, keyboard, CPU, 1 TB or higher Hard drive, 8GB RAM or better, UPS, laser printer, windows OS must be supplied.	
38	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.	

ANNEXURE B7

Technical Specification of Automatic Load cell based, Rockwell cum Superficial Rockwell Hardness Testing Machine

Sr. No.	Description	Specification
1.	**Test to be Carried out**	Rockwell hardness test as per IS 1586 (Part 1): 2018/ISO 6508-1: 2016 to IS 1586 (Part 3): 2018/ISO 6508-3: 2016
2.	**One touch, easy hardness measurement**	All testing cycle (Pre. test force – Test force – Release force) must be easily done only by touching the start button of a touch panel. The testing cycle shall conform to the testing cycle defined in IS 1586 (Part 1): 2018/ISO 6508 Part-1
3.	**Closed-loop test force control with load cell**	Test force is controllable with high precision from the output of a load cell. Feedback control must control the vibration from the outside.
4.	**Test methods**	Rockwell hardness test as per IS 1586 (Part 1): 2018/ISO 6508-1: 2016
5.	**Variable test force**	The variable test force function must change pre. test force at a 100gf step from 29.42N to 98.07N (3kgf to 10kgf), and it must change test force power at a 0.9807N(100gf) step from 147.1N to 1840N (15kgf to 187.5kgf).
6.	**Top surface based measurement**	The top reference measurement must less be affected by the bottom of the sample than the conventional bottom reference measurement.
7.	**Touch Pad**	In additinn to test machine operation, machine must have data management, printing, network connection.
8.	**Pre-Test Load**	3, 10kgf (29.421 N, 98.07 N)
9.	**Test force:**	Superficial: 15,30, 45kgf (147.105, 294.21, 441.315 N) Rockwell as per IS 1586/ISO6508 Scale A, B,C,D,E,F,G,H,K
10.	Test Cycles:	The testing cycle shall conform to the testing cycle defined in IS 1586 (Part 1): 2018/ISO 6508 Part-1
11.	Mounting Base	Diameter: ø60mm to 200 mm or better
12.	Controller:	1-axis controller
13.	Operation Panel:	24 cm or better touch panel and computer desktop with software
14.	Maximum Height of Sample:	140mm or better
15.	Maximum Depth:	100mm or better
16.	Uncertainty of measurement	According to IS 1586/ISO 6508 all parts
17.	**Hardness Measurement Range**	**Rockwell Regular scale** Scale A: 20 HRA to 95 HRA Scale B: 10 HRBW to 100 HRBW Scale C: 10 HRC to 70 HRC Scale D: 40 HRD to 77 HRD

		Scale E: 70 HREW to 100 HREW Scale F: 60 HRFW to 100 HRFW Scale G: 30 HRGW to 94 HRGW Scale H: 80 HRHW to 100 HRHW Scale K: 40 HRKW to 100 HRKW **Rockwell Superficial scales** Scale 15N: 70 HR15N to 94 HR15N Scale 30 N: 42 HR30N to 86 HR30N Scale 45N: 20 HR45N to 77 HR45N Scale 15T: 67 HR15TW to 93 HR15TW Scale 30T: 29 HR30TW to 82 HR30TW Scale 45T: 10 HR45TW to 72 HR45TW
18.	**Reference Hardness Blocks Range**	As per Table-1 (Cl 5.2) of IS 1586 (Part 2): 2018 /ISO 6508-2: 2015 for Scale A,B,C and superficial scale (N,T)
19.	**Indenter**	i) Diamond cone ii) Tungsten Carbide (Ball 1.587 5 mm, 3.175) All indenters shall be as per IS 1586/ISO6508 all parts With 5 spares of each type
20.	**Print Output**	System must have at least three standard format selection (Graph only, Data only, Graph and Data), in case special formats are needed, supplier has to support the user.
21.	**Connectivity**	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.
22.	**Anti Vibration Table**	Anti vibration table accommodating adequately the machine having sufficient space for the operations must be supplied with the machine. Suitably designed to avoid transfer of vibrations to the machine.
23.	**Accessories to be supplied along with machine**	i) Shall have provision for data interface with computer system. ii) Shall provide the Auxiliary Tools frequently used for operation of machine. Flat Anvil: 60mm (Diameter) or equivalent V shape Anvil: 60mm (Diameter) or equivalent
24.	**Power Supply**	As per Indian Power supply conditions

ANNEXURE BB

Draft

417

Technical Specification of Metallurgical Optical Microscope

Type	Inverted
Main body	**A. Focusing mechanism** Adjustment knob: Coaxial focusing system with fine adjustment of 0.2 mm or less per rotation with facility for Coarse adjustment. **B. Illumination** Illuminator: Built in Koehler's incident illuminator with Halogen Lamp/ LED Lamp/ HG Fibre Illuminator, adjustable brightness, field and aperture diaphragm with yellow, green, blue and ground filters. Light distribution 100%, between camera port and binocular Included. Filter: Double turret (ND16, ND4/GIF, NCB), Polarizing block
Polarizer & Analyzer	Reflector polarizer module & Analyzer Slider or better
Observation method	Fully apochromatic, Bright filled, Darkfield, Polarizing, DIC
Resolving nosepieces	7 position nosepieces
Stage	Stage including two stage inserts (ø20mm and 40mm opening or similar sizes) and control handle
Trinocular eyepiece	Interpupillary distance adjustment 50-75 mm, magnification: 10x or better. The eyepiece shall be suitable for graticule Insertion. Accessories for measurement of grain size.
Objective lens	1.25x, 2.5x, 5x, 10x, 20x, 50x, 100x magnification
Optics	Fully Apochromatic optics and microscope optics should be corrected two stages for spherical and three stages for chromatic aberration.
Camera	High resolution camera of 5 MP or better, Microscopic color & monochrome digital camera with minimum 2000 X 1900 Pixels (5 MP or more) chip resolution, live image display with CMOS sensor or better. Chip size 1/2.5" (minimum). Camera should have Autofocus System for fast and accurate focusing with wide capture range up to 100 micro meter or better at full (100X objective) resolution.
Software	Compatible software to view and analyse images. (Grain size, Inclusion, Phases of microstructure etc) Capable for measurement and annotation, Area fraction analysis. Software should capable to store, manage, analyse and export the data in the user format. Automatic Grain Size analysis as per relevant ASTM / IS.
Multiple Phase Analysis	Capable to identify the phases in the microstructure.
Contrasting Techniques Module	Automatic Component recognition
Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall

	be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.
Computer	Windows 10 OS, Intel core 5 or better processor, 8 GB or more RAM, 128 GB or more SDD, 1 TB HDD, Colored 21 inch Full HD IPS 16M color display system or better display system
Calibration/Verification	Calibration Certificate for the applicable parameters of Metallurgical Microscope traceable to National/International Standard.

ANNEXURE B9

Technical Specifications for Pressurized Consistometer or Thickening Time Tester Unit for well oil cement As per IS 8229

Based on the information gathered with study of IS and other details available on internet, draft specifications are as follows:

1		**Name of the Equipment**	**Pressurized Consistometer or Thickening Time Tester Unit**
2		Application	For Thickening Time test (as per A-4 of IS 8229:1986) & Determination of Free Water Content of Slurry (as per Cl. A-2 IS 8229:1986)
3		Relevant Indian Standard	IS 8229:1986
4		Specification	
	i)	Required pressure & Control	Atmospheric Pressure to Maximum 150MPa or better With pressure control at any pressure. The final pressure should be held Constant as per IS 8229:1986.
	ii)	Required temperature & Control	27°C - 200°C or better with temperature control option at any temperature. The final temperature should be held Constant within ±1 °C till completion of the test.
	iii)	Heating Element & temp. Measurement	Provision of a heating element capable of raising the temperature of this oil-bath at the rate of at least 3°C per minute or better. Provisions of thermocouple for determining the temperature of the oil-bath and also that of the cement slurry.
	iv)	Consistency Range:	0 to 100 Bc (Bearden Units) or better with resolution of 1 Bc or better
	v)	Drive speed	Precision magnetic drive assembly or better to achieve constant slurry cup drive speed of 150 rpm or better for improving testing accuracy and consistency
	vi)	Pressure Medium	The space between the slurry container and the walls of the pressure container shall be completely filled with white mineral oil, Grade 95 N)" (National Formulary) or equivalent.
	vii)	Corrosion-Resistance Properties of Equipment	The stirring paddle and all metal parts of the slurry container exposed to the slurry are made of corrosion-resistant alloys
	viii)	Cooling	Automatic cooling & oil reservoir cooling or better
	ix)	Timer	Provision of timer upto 200 minutes or better

	x)	Determination of Free Water Content of Slurry	Provision shall be available to measure Free Water Content of Slurry as per Cl. A-2 of IS 8229:1986
	xi)	Display	Colour touch-screen for display of testing parameter and access to programmable features
	xii)	Safety/ Alarm Provisions	Provisions for programmable/adjustable alarm for viscosity and other parameters as applicable.
	xiii)	Software for data acquisition, analysis and control	Latest software for control of the Machine, Online Data acquisition to PC for controlling option as well as Data analysis and integration to LIMS for reporting of results Easy net LAN connection for remote viewing in real time & USB drive for data export.
	xiv)	Accessories	To provide tool kit, latest windows based Computer, laser jet printer, spares and other accessories as applicable.
	xv)	Calibration	All measuring devices shall be provided with certificates traceable to national/international standards

ANNEXURE B10

Technical Specification of Computerised Universal Testing Machine (100kN)

Sl: No	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Types of tests to be performed	Tensile at ambient and at high Temperature, compression, Shear and 3-point bending. The supplied machine must have all standard accessories/fixtures required for performance of the above mentioned tests.
2.	Materials to be tested	Metals and Alloys
3.	Load capacity	100kN (Resolution 0.001 kN or better)
4.	Load accuracy	Class 1 or better
5.	Load Frame	Robust load frame with Tension and Compression test space. Accurate force measurement through Load cell with provision for change of load cell desirable if needed.
6.	Displacement resolution	0.01mm or better
7.	Testing speed range	Adjustable (0.5-100) mm/min
8.	Control Mode	Servo Controlled Hydraulic Drive (Displacement control, Load Control, Strain Control, Stress Control, etc) Computerized cum Manual Displacement and Load control mode with digital display
9.	Distance b/w Tension jaws	Minimum 900 mm (Including Piston Stroke)
10.	Dimension of the platform bed	Length: Minimum 500 mm Width: Minimum 500 mm
11.	Day light area	Tension: Minimum 700 mm Compression: Minimum 700 mm
12.	Compatibility with test specifications	IS 1608 (Part-1):2018 / ISO 6892-1:2016
13.	Grips for holding tensile samples	Self-Loading Wedge grips suitable for MS, SS Sheets & Rods • Grips for flat specimen: Thickness 0.5 - 10 mm; • Grips for round specimen: Φ12-Φ15 mm;
14.	Compression platens	Diameter minimum 200 mm
15.	Bend fixture	Bend fixture with continuous adjustable spacing. Span: minimum 600 mm Depth: minimum 200 mm and suitable holder

412

16.	Mandrel Diameter	Range of diameters: for sample diameter of 8 – 15 mm for all sizes and grades as per IS 1786.
17.	Extensometer	Non-contact (Laser Type) Extensometer interfaced with system software (Field of view from 50 mm to 200 mm and accuracy class 0.5 as per IS 12872/ISO 9513), for testing at room temperature. Suitable extension measuring attachment for extension at high temperature up to 1200 deg C. Additional Electronic Extensometer: Variable Gauge Length (covering range 10 – 200 mm) & Class 0.5 as per IS 12872/ISO 9513.
18.	Materials Testing Software	1- Shall have features for Windows-10 (or better) based graphical user interface. 2- The software package shall have different application modules for tension and compression testing of different materials such as metals and alloys. 3-The software package shall have provision for user defined loading Patterns along with provision for changing rate of loading during testing. 4- Test Curves Mode: Load- Time, Load -Displacement, Stress- Strain. 5-The software shall also have report format editor. 6- Parameter Processed with computer: Upper & Lower Yield point strength, Max Load point, breaking strength, Stress, deformation, Elastic Modulus, Proof stress. 7-Validation of software for testing parameters as per IS 1608 (Part-1):2018 / ISO 6892-1:2016. 8- All testing data shall be stored and retrievable.
19.	Power Supply	As per Indian supply conditions
20.	Operating & Service Manual	Soft copy in .pdf format and 2 sets of hard copies.
21.	Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.
22.	Computer	Latest configuration branded Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.
23.	Safety Feature	Machine shall have provision for Emergency stop. Mechanical stroke protection: When the ram arrives at upper limited position, the machine shall stop.
24.	Training	As per tender document
25.	Calibration	All the measuring devices shall have traceability to national/international standards.

ANNEXURE B11

Technical Specification of Computerised Universal Testing Machine (500kN)

Sl. No	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Types of tests to be performed	Tensile at ambient and at high Temperature, compression, Shear and 3-point bending. The supplied machine must have all standard accessories/fixtures required for performance of the above mentioned tests.
2.	Materials to be tested	Metals and Alloys
3.	Load capacity	500kN (Resolution 0.001 kN or better)
4.	Load accuracy	Class 1 or better
5.	Load Frame	Robust load frame with Tension and Compression test space. Accurate force measurement through Load cell with provision for change of load cell desirable if needed.
6.	Displacement resolution	0.01mm or better
7.	Testing speed range	Adjustable (0.5-100) mm/min
8.	Control Mode	Servo Controlled Hydraulic Drive (Displacement control, Load Control, Strain Control, Stress Control, etc) Computerized cum Manual Displacement and Load control mode with digital display
9.	Distance b/w Tension jaws	Minimum 900 mm (Including Piston Stroke)
10.	Dimension of the platform bed	Length: Minimum 500 mm Width: Minimum 500 mm
11.	Day light area	Tension: Minimum 700 mm Compression: Minimum 700 mm
12.	Compatibility with test specifications	IS 1608 (Part-1):2018 / ISO 6892-1:2016
13.	Grips for holding tensile samples	Self-Loading Wedge grips suitable for MS, SS Sheets & Rods • Grips for flat specimen: Thickness 0.5 - 20 mm; • Grips for round specimen: Φ12-Φ30 mm;
14.	Compression platens	Diameter minimum 200 mm
15.	Bend fixture	Bend fixture with continuous adjustable spacing. Span: minimum 600 mm Depth: minimum 200 mm and suitable holder

16.	Mandrel Diameter	Range of diameters: for sample diameter of 8 - 25 mm for all sizes and grades as per IS 1786.
17.	Extensometer	Non-contact (Laser Type) Extensometer interfaced with system software (Field of view from 50 mm to 200 mm and accuracy class 0.5 as per IS 12872/ISO 9513), for testing at room temperature. Suitable extension measuring attachment for extension at high temperature up to 1200 deg C. Additional Electronic Extensometer: Variable Gauge Length (covering range 10 – 200 mm) & Class 0.5 as per IS 12872/ISO 9513.
18.	Materials Testing Software	1- Shall have features for Windows-10 (or better) based graphical user interface. 2- The software package shall have different application modules for tension and compression testing of different materials such as metals and alloys. 3-The software package shall have provision for user defined loading Patterns along with provision for changing rate of loading during testing. 4- Test Curves Mode: Load- Time, Load -Displacement, Stress- Strain. 5-The software shall also have report format editor. 6- Parameter Processed with computer: Upper & Lower Yield point strength, Max Load point, breaking strength, Stress, deformation, Elastic Modulus, Proof stress. 7-Validation of software for testing parameters as per IS 1608 (Part-1):2018 / ISO 6892-1:2016. 8- All testing data shall be stored and retrievable.
19.	Power Supply	As per Indian supply conditions
20.	Operating & Service Manual	Soft copy in .pdf format and 2 sets of hard copies.
21.	Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.
22.	Computer	Latest configuration branded Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.
23.	Safety Feature	Machine shall have provision for Emergency stop. Mechanical stroke protection: When the ram arrives at upper limited position, the machine shall stop.
24.	Training	As per tender document
25.	Calibration	All the measuring devices shall have traceability to national/international standards.

ANNEXURE B12-

109

Technical Specification of Computerised Universal Testing Machine (1000kN)

Sl. No	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Types of tests to be performed	Tensile at ambient and at high Temperature, compression, Shear and 3-point bending. The supplied machine must have all standard accessories/fixtures required for performance of the above mentioned tests.
2.	Materials to be tested	Metals and Alloys
3.	Load capacity	1000kN (Resolution 0.001 kN or better)
4.	Load accuracy	Class 1 or better
5.	Load Frame	Robust load frame with Tension and Compression test space. Accurate force measurement through Load cell with provision for change of load cell desirable if needed.
6.	Displacement resolution	0.01mm or better
7.	Testing speed range	Adjustable (0.5-100) mm/min
8.	Control Mode	Servo Controlled Hydraulic Drive (Displacement control, Load Control, Strain Control, Stress Control, etc) Computerized cum Manual Displacement and Load control mode with digital display
9.	Distance b/w Tension jaws	Minimum 900 mm (Including Piston Stroke)
10.	Dimension of the platform bed	Length: Minimum 500 mm Width: Minimum 500 mm
11.	Day light area	Tension: Minimum 700 mm Compression: Minimum 700 mm
12.	Compatibility with test specifications	IS 1608 (Part-1):2018 / ISO 6892-1:2016
13.	Grips for holding tensile samples	Self-Loading Wedge grips suitable for MS, SS Sheets & Rods • Grips for flat specimen: Thickness 0.5 - 40 mm; • Grips for round specimen: Φ12-Φ60 mm; • Grips suitable for testing of wire/strands/sheets etc. as per IS 1785 & IS 6003, IS 2141, IS 14268, IS 6006
14.	Compression platens	Diameter minimum 200 mm
15.	Bend fixture	Bend fixture with continuous adjustable spacing. Span: minimum 600 mm Depth: minimum 200 mm and suitable holder

16.	Mandrel Diameter	Range of diameters: for sample diameter of 8 - 50 mm for all sizes and grades as per IS 1786.
17.	Extensometer	Non-contact (Laser Type) Extensometer interfaced with system software (Field of view from 50 mm to 200 mm and accuracy class 0.5 as per IS 12872/ISO 9513), for testing at room temperature. Suitable extension measuring attachment for extension at high temperature up to 1200 deg C. Additional Electronic Extensometer: Variable Gauge Length (covering range 10 – 200 mm) & Class 0.5 as per IS 12872/ISO 9513.
18.	Materials Testing Software	1- Shall have features for Windows-10 (or better) based graphical user interface. 2- The software package shall have different application modules for tension and compression testing of different materials such as metals and alloys. 3-The software package shall have provision for user defined loading Patterns along with provision for changing rate of loading during testing. 4- Test Curves Mode: Load- Time, Load -Displacement, Stress- Strain. 5-The software shall also have report format editor. 6- Parameter Processed with computer: Upper & Lower Yield point strength, Max Load point, breaking strength, Stress, deformation, Elastic Modulus. Proof stress. 7-Validation of software for testing parameters as per IS 1608 (Part-1):2018 / ISO 6892-1:2016. 8- All testing data shall be stored and retrievable.
19.	Power Supply	As per Indian supply conditions
20.	Operating & Service Manual	Soft copy in .pdf format and 2 sets of hard copies.
21.	Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.
22.	Computer	Latest configuration branded Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.
23.	Safety Feature	Machine shall have provision for Emergency stop. Mechanical stroke protection: When the ram arrives at upper limited position, the machine shall stop.
24.	Training	As per tender document
25.	Calibration	All the measuring devices shall have traceability to national/international standards.

ANNEXURE B 13

407

Technical Specification of Computerised Universal Testing Machine (2000kN)

Sl. No	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Types of tests to be performed	Tensile at ambient and at high Temperature, compression, Shear and 3-point bending. The supplied machine must have all standard accessories/fixtures required for performance of the above mentioned tests.
2.	Materials to be tested	Metals and Alloys
3.	Load capacity	2000kN (Resolution 0.001 kN or better)
4.	Load accuracy	Class 1 or better
5.	Temperature Furnace	UTM shall be integrated with 1200 deg C closed loop temperature furnace to perform tensile test at high temperature.
6.	Load Frame	Robust load frame with Tension and Compression test space. Accurate force measurement through Load cell with provision for change of load cell desirable if needed.
7.	Displacement resolution	0.01mm or better
8.	Testing speed range	Adjustable (0.5-100) mm/min
9.	Control Mode	Servo Controlled Hydraulic Drive (Displacement control, Load Control, Strain Control, Stress Control, etc) Computerized cum Manual Displacement and Load control mode with digital display
10.	Distance b/w Tension jaws	Minimum 900 mm (Including Piston Stroke)
11.	Dimension of the platform bed	Length: Minimum 500 mm Width: Minimum 500 mm
12.	Day light area	Tension: Minimum 700 mm Compression: Minimum 700 mm
13.	Compatibility with test specifications	IS 1608 (Part-1):2018 / ISO 6892-1:2016
14.	Grips for holding tensile samples	Self-Loading Wedge grips suitable for MS, SS Sheets & Rods • Grips for flat specimen: Thickness 0.5 - 40 mm; • Grips for round specimen: Φ12-Φ60 mm; • Grips for high temperature: both the grips flat and round shall be compatible for temperature upto 1200 deg C.

		• Grips suitable for testing of wire/strands/sheets etc. as per IS 1785 & IS 6003, IS 2141, IS 14268, IS 6006
15.	Compression platens	Diameter, minimum 200 mm
16.	Bend fixture	Bend fixture with continuous adjustable spacing. Span: minimum 600 mm Depth: minimum 200 mm and suitable holder
17.	Mandrel Diameter	Range of diameters: for sample diameter of 8 - 50 mm for all sizes and grades as per IS 1786.
18.	Extensometer	Non-contact (Laser Type) Extensometer interfaced with system software (Field of view from 50 mm to 200 mm and accuracy class 0.5 as per IS 12872/ISO 9513), for testing at room temperature. Suitable extension measuring attachment for extension at high temperature up to 1200 deg C. Additional Electronic Extensometer: Variable Gauge Length (covering range 10 – 200 mm) & Class 0.5 as per IS 12872/ISO 9513.
19.	Materials Testing Software	1- Shall have features for Windows-10 (or better) based graphical user interface. 2- The software package shall have different application modules for tension and compression testing of different materials such as metals and alloys. 3-The software package shall have provision for user defined loading Patterns along with provision for changing rate of loading during testing. 4- Test Curves Mode: Load- Time, Load -Displacement, Stress- Strain. 5-The software shall also have report format editor. 6- Parameter Processed with computer: Upper & Lower Yield point strength, Max Load point, breaking strength, Stress, deformation, Elastic Modulus, Proof stress. 7-Validation of software for testing parameters as per IS 1608 (Part-1):2018 / ISO 6892-1:2016. 8- All testing data shall be stored and retrievable.
20.	Power Supply	As per Indian supply conditions
21.	Operating & Service Manual	Soft copy in .pdf format and 2 sets of hard copies.
22.	Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.

23.	Computer	Latest configuration branded Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.
24.	Safety Feature	Machine shall have provision for Emergency stop. Mechanical stroke protection: When the ram arrives at upper limited position, the machine shall stop.
25.	Training	As per tender document
26.	Calibration	All the measuring devices shall have traceability to national/international standards.

Annexure-B/4

Technical Specifications

SCOPE: To perform short term and long term hydrostatic pressure test on UPVC, CPVC, HDPE, Lateral and Sprinkler pipes and fittings.

Details of Technical Specifications

1	**Name of the Equipment**	**Hydrostatic Test Apparatus**
2	Application	For Hydrostatic Pressure Test on UPVC, CPVC, HDPE, Lateral and Sprinkler pipes and fittings.
3	Relevant Indian Standard	IS 4984, IS 4985, IS 15328, IS 15778, IS 14151(P-1)& IS 14151(P-2), IS 16647, IS 10124(1-13), IS 7834 (1-8), IS 12231, IS 13593, IS 15265, IS 14735, IS 16098, IS 16088, IS 16534, IS 14787, IS 12786, IS 14333 etc.
4	Specification	
	No of Stations	08 (for long term and short term)
	Operating range	i) One Station with pressure range (0-1) MPa , LC- 0.001 MPa, Accuracy 0.25% FSD
		ii) One Station with pressure range (0-5) MPa, LC- 0.001 MPa, Accuracy 0.25% FSD
		iii) Two Stations with pressure range (0-10) MPa, LC- 0.001 MPa, Accuracy 0.5% FSD
		iv) Two Stations with pressure range (0-10) MPa, LC- 0.002 MPa, Accuracy 0.5% FSD
		v) One Station with pressure range (0-20) MPa, LC- 0.002 MPa, Accuracy 0.5% FSD
		vi) One Station with pressure range (0-30) MPa, LC- 0.005 MPa. Accuracy 0.5% FSD
	Master Gauge	Separate master gauge for range 0-10 MPa, LC-0.001MPa with accuracy Class 0.25% of FSD and range 0-30 MPa, LC-0.005MPa with accuracy Class 0.5% of FSD shall be provided to check online pressure of any station.
5	Design Feature	
	Accuracy	Pressurizing equipment capable of applying the required pressure gradually and smoothly in accordance with Cl 7.1 of IS 12235(Part 8/ Sec 1) and then kept it constant to within $^{+2}_{-1}$ Percent of the required pressure for complete duration of test.

403

	Pressure Control System	All pressure control system shall be capable to apply the test pressure progressively and smoothly ±5% of the desired test pressure in shortest possible time preferably between 30s to 1h and then keeping it constant to within $^{+2}_{-1}$ percent of the required pressure for the duration of the test. Provision shall be provided for removal of pressure gauges and master gauges for outside calibration.
	Computer Interface programmable of data storage in hard disk	Software to collect & print data at specified intervals upto 10000 h. LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system. CPU with Hard disks, monitor, printer etc. Each station shall be provided with time totalizer, isolation valve bleed etc.
6	Signal Conditioner	i. Computer Interface. ii. Shall conform to all the requirements of IS 4984, IS 4985 etc (Hydrostatic Characteristics). iii. Fully automatic with provision of automatically turning the individual pressure station ON/OFF and record time duration. iv. Timer to cut off pressure station after completion of test. v. Data acquisition, storage and analysis shall be fully automatic. vi. Air compressor with silencers and auto cut-off/restart device. vii. Hose connection and hoses to sustain water at 95 Deg C min. viii. Manual emergency control button. ix. Logged data printing facility. x. Automatic display of bursting/leakage pressure. xi. Real time clock check to keep automatic track of the date, time and runs. xii. Master pressure gauge to connect all pressure stations for calibration checking facility. xiii. Automatic pressure release facility. xiv. Data transmission with USB port. xv. Compatible with latest MS operating system.

		xvi. Facility to download/save/edit /delete along with another sample information such as sample code, batch, date of start, date of completion, IS no, testing personnel name etc.
6	Features	i. Manual/tutorial shall be provided along with a hard copy and CD/DVD. ii. Software to collect data in hard disks. iii. Operational precautions and safety requirements. iv. System shall consist of 2 nos. air Hydro boosters capable of developing pressure. v. Cabinet shall be fabricated from 2mm (Minimum) thick CRC sheet duly powder coated. vi. Shall print data at fixed intervals. End caps 3 sets of each size of SS (as per cl 3.1.1) IS 12235(Part-8) covering the range size 12mm to 400mm as per IS 4984, IS 4985, IS 15328, IS 15778, IS 14151(P-1)& IS 14151(P-2), IS 16647, IS 10124(1-13), IS 7834 (1-8), IS 12231, IS 13593, IS 15265, IS 14735, IS 16098, IS 16088, IS 16534, IS 14787, IS 12786. IS 14333 etc.
7	Special Conditions	i. All measuring instruments shall be provided with traceable certificate with national/international standards. ii. The Water Bath for Acceptance Test and Type Test shall be supplied along with Hydrostatic Machine. Specification of water bath are enclosed as **Annexure-I and Annexure-II.**
8	Accessories	i. Set of tool Kit ii. Spare parts/ consumables (if any).
9	Data Acquisition System	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system. Latest configuration Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.

ANNEXURE-I

TECHNICAL SPECIFICATION OF WATER BATH

SCOPE: To maintain Water temperature during Hydrostatic testing of UPVC, CPVC , HDPE, Lateral and Sprinkler pipes and fittings.

1		Name of the Equipment	Water Bath with Heating and cooling arrangement for Acceptance Test
		Quantity	02 Numbers
2		Application	For Hydrostatic Pressure Test on UPVC, CPVC, HDPE, Lateral and Sprinkler pipes and fittings.
3		Specifications	IS 4984, IS 4985, IS 15328, IS 15778, IS 14151(P-1) & IS 14151(P-2), IS 16647, IS 10124(1-13), IS 7834 (1-8), IS 12231, IS 13593, IS 15265, IS 14735, IS 16098, IS 16088, IS 16534, IS 14787, IS 12786, IS 14333 etc
	a	Temp Range	15°C to Ambient, LC 0.1°C
	b	Accuracy	±1°C
	c	Working Temp.	20°C, 23 °C ,27 °C
	d	Test Duration	Continuous upto 170 h
	e	Type of Temp Controller.	PID with sensor or Better
	f	Internal size	2000mm (L) X 1500mm (W) X 2000mm (H)
	g	Test Temperature	Shall attain working temperature within 2 hrs
4		**Material of Construction**	
	a	Internal Chamber and Top Cover	SS304
	b	Outer Cover	Metal sheet with Powder coating
	c	Bottom Grill	SS304
5		Equipment shall also comply following:	Digital display of temperature Equipment shall have shock protection and overload protection. A water circulating pump shall be provided to keep the temperature uniform throughout the bath to maintain mean temperature within +1°C. The system shall be as per cl-3 of IS 12235(Pt-8/Sec 1). For cleaning of water tank a drain plug should be provided at the bottom of the tank. Provision shall be made for proper overflow and drain out of tank. Supports enabling the test specimen to be placed into tank in such a way that, there is no

			contact between the samples and also side of the tank.
		Special Conditions	i. All measuring instruments shall be provided with traceable certificate with national/international standards.

ANNEXURE-II

SCOPE: To maintain Water temperature during Hydrostatic testing of UPVC, CPVC , HDPE, Lateral and Sprinkler pipes and fittings.

1		Name of the Equipment	Water Bath with Heating arrangement for Type Test
2		Application	For Hydrostatic Pressure Test on UPVC, CPVC , HDPE, Lateral and Sprinkler pipes and fittings.
3		Specifications	IS 4984, IS 4985, IS 15328, IS 15778, IS 14151(P-1)& IS 14151(P-2), IS 16647, IS 10124(1-13), IS 7834 (1-8), IS 12231, IS 13593, IS 15265, IS 14735, IS 16098, IS 16088, IS 16534, IS 14787, IS 12786, IS 14333 etc
	a	Temp Range	Ambient to 100°C, LC 0.1°C
	b	Accuracy	±1°C
	c	Working Temp.	55°C, 60°C, 65°C, 70°C, 80°C & 95°C
	d	Test Duration	Continuous upto 10000 h
	e	Type of Temp Controller.	PID with sensor
	f	Internal size	2000mm (L) X 1500mm (W) X 2000mm (H)
	g	Heating Load	12kW (3kW X 4 nos heater)
4		**Material of Construction**	
	a	Internal Chamber and Top Cover	SS304
	b	Outer Cover	Metal sheet with Powder coating
	c	Bottom Grill	SS304
5		Other requirements	Digital display of temperature Equipment shall have shock protection and overload protection.
	a		

	b		A water circulating pump shall be provided to keep the temperature uniform throughout the bath to maintain mean temperature within ±1°C. The system shall be as per cl-3 of IS 12235(Pt-8/Sec 1).
	c		For cleaning of water tank a drain plug should be provided at the bottom of the tank.
	d		Provision shall be made for proper overflow and drain out of tank.
	e		Supports enabling the test specimen to be placed into tank in such a way that, there is no contact between the samples and also side of the tank.
	g		
		Special Conditions	i. All measuring instruments shall be provided with traceable certificate with national/international standards.

ANNEXURE B15

Technical Specification of Power Press

Description	1000 KN
Bed size LRXFB	Minimum: 900x900 mm
Bed to Ram Bottom	Minimum: 550 mm
Stroke	Minimum: 160 mm
Adjustment of slide	Minimum: 45 mm
Bolster Thickness	Minimum: 100 mm
Bed opening	Minimum: 175 mm
Floor to top of bed	Minimum: 800 mm
No of strokes per min	Minimum: 30 mm
Motor power required	Minimum: 25/1440 RPM
Required air pressure	Minimum: 5 kg/sq.cm.
DIE CUSHION	
Stroke length	Minimum: 1000 mm
Air pressure	Minimum: 6 kg/sq.cm

ANNEXURE B16

Technical specifications for Automatic Digital Brinell Hardness Testing Machine

Sl. No.	Description	Technical Specifications
1.	Test to be Carried out	Brinell Hardness Test as per IS 1500 (Part 1): 2019/ISO 6506-1 to IS 1500 (Part 4): 2019/ISO 6506-4.
2.	Test Load	Automatic Brinell Hardness Test Machine from 10 to 3000 kgf loads in compliance with IS 1500 (Part 1): 2019/ISO 6506-1 to IS 1500 (Part 4): 2019/ISO 6506-4.
3.	**Indenter**	i) Polished Tungsten Carbide composite ball indenter with diameter: 1, 2.5, 5 and 10 mm as per Cl. 4.3 of IS 1500-2/ISO 6506-2 along with certificates of conformity traceable to national/international standards.
4.	**Force Range**	**Brinell**: 9.807 - 29403 N (1 - 3000 kgf)
5.	**Accuracy**	Test Force: ± 1.0% of the nominal test force or better Indentation: The scale of the measuring system shall be graduated to permit estimation of the diameter of the indentation to within ± 0,5 % or better Testing Cycle: Shall conform with the testing cycle specified in IS 1500 (Part 1): 2019 /ISO 6506-1: 2014 and shall be timed with an uncertainty less than ± 1,0 s or better
6.	**Temperature Range**	Operating range of temperature is from 10 °C to 35 °C.
7.	Indenter Holding Mechanism	Swivelling Motorized turret. Automatic turret with one indenter and one inter-changeable objective as standard. Auto-rotating, auto-tool-switching and auto-centring for a completely automatic single or multi indentation measurement cycle. Each tool must be easily changed by screwing manually. From round to flat surfaces, the tester automatically and quickly must make contact with any test area, up or down, outside or inside it.
8.	Optical Magnification	Automatic focus adjustment for the selected optic with precise positioning at any magnification by mean of real image brightness scanning for ensuring high reading accuracy and reducing reading time.
9.	Loading Mechanism	Load forces should be applied through load cells and electronically controlled close loop with a frequency of 1 kHz, assuring perfect linearity in every range (Range from 10 to 3000 Kgf). Results are must not be affected by any structural deflection, misalignment, vibration or problems associated with dead weight systems on traditional testers. The tester must also run in an inclined position.
10.	**Self Compensating and Clamping System**	When testing unstable samples or deflective parts, the System must follow the sample and not lose contact, compensating any frame deflection during the test cycle. Accurate results must be assured even with oiled, dusty or dirty pieces.
11.	**Touchscreen and Software**	30 cm or better wide touch screen for easiness in test planning and a clear view of results. User friendly interface with conversion tables and round correction values for tests on convex cylindrical surfaces or

		various diameters. Statistics and charts must be automatically generated. Standard and custom reports must be generated at a touch of a button. All results and testing sessions must be stored on the large archive using the on board software database.
12.	**Peripheral Connection**	Shall have provision for data interface with PC's and printers, to download data or for final custom reports. LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.
13.	**Automatic Measurement**	The preinstalled software must control the whole instrument avoiding setting errors or operators mistakes. Powerful software must be supplied for test cycle management. Wide settings parameters must be available for measurement setup, image adjustments, statistics and data storage.
14.	**Power Supply**	As per Indian power supply conditions
15.	Indentation Visibility	Automatic light and contrast adjustment with live immediate correction. The lighting feature must optimize the visibility on any dark or bright sample surface without any manual action. The indent must be visible with sharp diameter or edges for both manual and automatic reading.
16.	**Depth Capacity**	190 mm or better
17.	**Height Capacity**	220 mm or better
18.	**Basic Accessories**	Flat Anvil: 150mm (Diameter) or equivalent V shape Anvil: 150mm (Diameter) or equivalent Reference Block with national/international traceability certificate: a) 10/3000 (Minimum thickness:16 mm) ≤ 200 HBW 300≤ HBW≤400 ≥ 500 HBW b) 5/1500 (Minimum thickness:12 mm) ≤ 200 HBW 300≤ HBW≤400 c) 2.5/1000 (Minimum thickness:6 mm) ≤ 200 HBW d) 1/500 (Minimum thickness:6 mm) ≤ 200 HBW
19.	**Anti-Vibration Table**	Anti vibration table accommodating adequately the machine having sufficient space for the operations must be supplied with the machine. Suitably designed to avoid transfer of vibrations to the machine.

ANNEXURE B 17

Technical Specification of CNC Milling Machine (3-Axis Vertical Milling)

S. No.	DESCRIPTION OF REQUIREMENT	REQUIRED
	Technical Specification	
	Capacity	
1	Length of table	Minimum: 700 mm
2	Width of table	Minimum: 400 mm
3	load on table	Minimum: 300 kg
4.	X travel	Minimum: 700 mm
5	Y travel	Minimum: 400 mm
6	Z travel	Minimum: 300 mm
	Machine Spindle	
1	Spindle Speed	≥ 8000 RPM
	Accuracy	
1	Positional accuracy	0.01 mm in full length
	Coolant System	
1	Tank capacity	Minimum: 100 Litre
2	Filtration system	Minimum: 20 Bar
	Axis drive and Control	
1	Digital controlled drive and motors	For all Axis
2	Guide way	LM guide way
3	Rapid Speed	Minimum: 20m/min
4	Feed rate	Minimum: 6m/min
	CNC Control unit Features	
1	Controller	3 axes simultaneous controllable
2	Least increment with decimal input	0.001 mm
3	Controller memory	Minimum: 500 MB
4	Connectivity	USB Port, Ethernet
5	Features	Emergency stop on control panel Emergency brake knob Tool Load monitoring and Tool Life Management
6	Compensations and Feedback	CNC controller to take care of stored pitch error compensation. Backlash compensation for cutting traverse. Backlash compensation for rapid traverse. Friction compensation control Thermal Compensation Feed forward control
7	Display System	Minimum 12" LCD colour monitor with soft Key. Panel with inbuilt keyboard, monitor & operating knobs, Machine hour reading,
	Programming System	Latest configuration Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS.
8	Feed control potentiometer	0 – 120% in incremental steps of 10%.
9	Spindle speed control potentiometer	0 – 120% in incremental steps of 10%.

394

12	Essential Accessories	i. Fully enclosed splash guard with slide windows ii. Fully encapsulated housing with safety type window iii. Levelling pads (6 Numbers) iv. Door safety interlock v. Full Enclosure for safety operation vi. Inbuilt air conditioner for CNC Control Cabinet
13	Documentation to be supplied	Operating and programming instructions, Installation and Commissioning instructions, Quality Test records, Circuit Diagrams, Maintenance / repair charts, Preventive maintenance instructions, Lubrication chart & parameter list, Requirement/recommendation for power supply, controlled stabilizing has to be given. Lifting instruction mentioned in packing list. Detailed invoice and packing list of all items and devices and detailed prospect of machine and all other accessories enclosed in respective boxes
	Training at the place of installation	
1	Programming course	Shall be part of training as per tender document

ANNEXURE B 18

Technical Specification of Automatic Computerized Compression Testing Machine (ACTM) – 3000KN for Compressive Strength test of Precast Concrete Blocks for Pavingas per IS 15658:2006 and other similar products like Concrete Cubes 150mm Min. and Cylinders dia. 150 mm Min.

Equipment Description &Purpose: Automatic Computerized Compression Testing Machine (ACTM) – Capacity 3000KN for Compressive Strength test of Precast Concrete Blocks for Paving as per IS 15658:2006 and other similar products like Concrete Cubes 150mm Min. and Cylinders dia. 150 mm Min., equipped with automatic pace rate control, capable of applying load without shock continuously at a rate of 15±3 N/mm² per minute, conforming to all requirements of Annexure D of IS 15658:2006, diameter of bearing block face 320mm min., complete with all required fixtures, tools, accessories etc.and as per details given below:

S.No.	Parameter, Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Machine Capacity	3000kN
2.	Least count	0.1 kN
3.	Platen size	Min. 320mm diawith steel plates size 14"
4.	Clearance between platens	400mm
5.	Automatic Pace Rate control with printable load rate graph indicating the specified limits	Range of pace rate control to any present value between 0.5KN/s to 20KN/s
		Capable of applying load without shock continuously at a PRESET rate within ±3 N/mm² per minute for testing of concrete paving blocks
		Numerical indication of load/ stress rate with Graphical view of load / stress rate indicating the specified limits printable on test report via software
6.	Steel bearing blocks and plates for holding specimen	Bearing blocks shall have Minimum hardness of 60 (HRC) and a minimum thickness of 25 mm with top block spherically seated and shall comply all requirements of Clause D-1 of IS 15658:2006.
		The surfaces of the steel bearing blocks and plates shall not depart from the plane by more than 0.025 mm in any 15mm dimension
7.	PC Connectivity	LAN/Ethernet connectivity with data reporting system shall be present and system shall auto-connect whenever equipment is switched on. The operations of the equipment (switching on, switching off, testing start, testing stop, maintenance, measurement data, results etc.) shall be automatically logged with date and time. This recorded data shall be non-temperable and users shall be able to remotely observe this data logged or stored in the data acquisition system.

392

		Latest configuration Computer system (with minimum 16 GB RAM, 1 TB HDD with i5 or better processor along with Peripherals, UPS and Laser Printer.
8.	Software for data acquisition, analysis and control	Latest Windows based software for control of the Machine, Online Data acquisition to PC as well as Data analysis.
9.	Digital Indicator	Peak Load, Peak Stress, Unique Record No. is displayed.
		EDI has provision to configure more than one Mode. Mode1-Compression/Mode2-Flexure/Mode3-Prism Testing/Mode4-Tensile Splitting strength. Each mode will have independent calibration points and calibration points shall be flexible.

S.No.	Parameter, Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
		Data storage approx. 2000 records.
		Data Download thru RS232/USB. User can set break point.
		Stored records can be viewed & print.
		Peak stress calculation based on sample type and shape.
		Password protection for system & calibration setup.
		2% overload facility to calibrate the machine upto full capacity. Start, Stop, Pause & Reset.
		Auto close / release.
		Communication with through Serial Port(Rs232)/ USB. Machine can be operated with software through computer.
		CVT supplied to ensure constant voltage to digital Indicator.
10.	Key features of software include:	Test Method Library.
		Test Editor.
		Multiple Machine Control.
		Output Editor.
		Multilingual.
		Method Editor.
11.	Load accuracy	+/- 1% or better
12.	Accessories	All standard fixtures, tools, accessories etc. including operating manuals, circuit diagrams etc.
13.	Safety features	Emergency Stop, Over travel protection. Electronic Overload Protection Front door for operator safety, overheating of oil and contamination of oil protection etc.
14.	Control Mechanism	Through PC with programmable sample parameters and rate of loading (pace rate).
		Auto release/ Auto shut down of system facility after sample failure.
		Facility to hold and restart loading during the test.
		Facility to save test data along with job card information about the specimen such as size, age, grade, dimensions, specimen no. , sample ID etc. in user defined file/ directory and same should be printed on test report generated by the machine.

15.	Software	Windows based software for control of the computerized ACTM. Online Data acquisition to PC as well as Data analysis. It should offer user friendly features such as:
		1. Real time display of test data like Live Load, Peak Load, Live Stress, Peak Stress including numerical indication of Real Time Load rate (KN/s) and stress rate (N/mm2 per minute).
		2. Real time display of test curves LIKE load rate with indication of upper and lower limits, stress rate with indication of upper and lower limits, Load Vs Time, Displacement Vs Time, Load Vs Displacement etc.
		3. Calculation of results like Compressive strength, Compressive strength calculation for paving blocks as per requirements of IS 15658:2006, split tensile strength etc. with facility to print test report.
		4. Provision to feed sample ID, operator name shall be provided and the same shall be displayed/ printed on test report generated by the system.
		5. Comparative analysis using multi graphs
		6. Load/ stress rate curve indicating the upper and lower limits shall also be be printable on test report.
		7. Software password protection.
		8. Batch summary report
		9. Detailed test report of batch (More than one sample) and individual

S.No.	Parameter, Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
		sample.
		10. Easily accessible file system to retrieve, view , transfer and print stored data.
16.	Units	Metric, Imperial & SI; User Programmable
17.	Power Supply	As per Indian Power Supply conditions
18.	Calibration	All measuring devices shall be supplied with calibration certificates traceable to national/internation standards.

ANNEXURE BM

TECHNICAL SPECIFICATION OF MECHANICAL SHAPER

DESCRIPTION	Details
Purpose	Machining of ferric and non-ferric metals
Capacity	
Length of Ram-Stroke	Minimum: 750 mm
Length of Ram	Minimum: 1400 mm
Max / Min distance of Table from Ram	140 to 400 mm or better
Table	
Working Surface of Table	700 mmx350 mm or larger
Horizontal Table Travel	Minimum: 400 mm
Vertical Table Travel	Minimum:200 mm
Tool Head	
Swivel of Tool Head	±60 deg.
Speed & Feeds	
Range of Table Feeds/Stroke	0.2 mm -1.0 mm
Tool Head Feed	Hand Feed
Electric Equipments	
Main Motor	Minimum: 3 H.P.
RPM	Minimum: 800

ANNEXURE B20

3 90

Technical Specifications

Scope: The specifications cover supply, Installation and Commissioning of Tube Bending Machine.

Details of Technical Specifications

S No.		Name of the Equipment	Tube Bending Machine
1		Application	Equipment is intended to test 'Bending Properties' of Ungalvanized and Galvanized tube of nominal bore upto and including 50 mm with an outside diameter upto 65 mm as prescribed IS 1161:2014, IS 1239(P-1):2004, IS 3601:2006 as per the test method given in IS 2329:2005 for determining the ability of full section to undergo plastic deformation in bending.
2		Relevant Indian Standards	IS 1161:2014, IS 1239(P-1):2004, IS 3601:2006, as per the test method given in IS 2329:2005.
3		Principle	The tube is bend in full section around a grooved former of a specified radius r until the angle of bend a reaches the value specified in the relevant product standard. Tube bending machine shall be designed to prevent the section of tube from becoming oval. The tube bend former of the machine shall have a groove corresponding in the profile to the outside tube. The radius at the bottom the groove shall be specified in the relevant product standards.
4	Specifiaction		
	a	Machine shall be capable to bend Ungalvanized tubes upto 180° and galvanized tube upto 90°	
	b	Metallic component of the equipment shall be rust free	
	c	Power supply: Three phase, 440 VAC	Single phase, 220/230 VAC or Three phase 440 VAC
	d	Safety protection	Overload protection and Stroke protection
	e	Machine should be motorized with all fittings and fixture, dies,	

		clamps, coupling etc. and also conforming to the following requirements	
	t	Emergency stop button should be provided on load frame for pressure release. The cable connecting the load frame, load cell, extensometer etc. to the control consol should be of adequate length for easy handling.	

Annexure-E 1

Technical Specification of Dynamometer and vibration test equipment with computer controlled test bench

1) **Purpose :**

To carry out Full Load Test, Temperature-Rise Test, Locked Rotor Test and Momentary Overload Test, Vibration Severity on Single phase ac Induction motor for General Purpose as per IS 996:2009 and Locked Rotor Test on Duty Fan motors as per Annexure F of IS 996:2009.

2) **Technical Requirements :**

a. Dynamometer setup should consists following:

1. Full load test
2. Temperature rise test
3. Momentary overload test on general purpose motors

b. Lock rotor set up consist of mechanical jigs for locking shaft as per Annexure F of IS 996:2009.

c. Vibration meter with mounting setup shall be provided separately.

d. Each setup consists of following instruments, integrated or separately adjusted: Digital power meter(0-500V, 0-20A of accuracy 0.5 % of reading or better. Regulated Power Source (1 No.), Tachometer (1 No.), and Torque meter (1 No.) with mounting and coupling arrangement. Tachometer may be provided either in panel or separately.

Specification of meters:-

S. No.	Name of Meters	Type	Range/LC (Duty Motor Setup)	Range/LC (General Purpose Motor Setup)	Accuracy
1.	Power meter	Digital	0-3000 W/ 0.01W	0-7000 W/0.1W	0.2%
			0-600V/0.01V	0-600V/0.01V	0.2%
			0-20A/0.001A	0-100A/0.01A	0.2%
			Up to 100 Hz/0.01Hz or better	Up to 100 Hz/0.01Hz or better	0.2%
			Power factor Up to 1.0/0.01	Up to 1.0/0.01	
2.	Tachometer	Digital	0-5000 RPM	0-5000 RPM/	1 RPM or better
3.	Torque meter	Digital	0 to 10 N-m /0.001 N-m	0 to 200 N-m/ 0.01N-m	0.2%
4.	Temperature Indicator with (J or K thermocouples, 10 channel)	Digital	0-300°C/0.1°C	0-300°C/0.1°C	0.5°C

540

e. Digital temperature indicator shall be provided with test setup of general purpose motor only.
f. Vibration meter shall be in accordance with IS 11726:2017.
g. Dynamometer setup for duty fan motors shall be capable of generating torque (N-m) for loading to test duty motor (Rated output – 2.5, 4, 7, 12, 18, 25, 40, 60 90, 120 Watt and Preferred Rated speed shall be corresponding to two poles, four poles and six poles).
h. Dynamometer setup for general purpose motor shall be capable of generating torque (N-m) for loading to test general purpose motor (Rated output- 180, 250, 370, 550, 750, 1100, 1500, 2200 Watt and Rated speed shall be corresponding to two poles, four poles and six poles).
i. Dynamometers shall be of Eddy Current Type.
j. Mode of cooling shall be water cooling.
k. Speed range of dynamometers: 0-4000 rpm.
l. Accuracy of dynamometers: 1 rpm
m. Dynamometer for general purpose motor test setup should have the suitable mounting provision for general purpose motors as per Cl. 9.1 of IS 996:2009 and duty motors (Desert cooler motor, fresh air fan motor etc).
n. Dynamometers shall have Bi-directional operation (clockwise and anti-clockwise).
o. Dynamometer calibration Kit in "Nm" shall be provided.
p. Suitable coupling for testing motors in the range of (2.5W to 120W) & (180W to 2200W) shall be provided.
q. One Regulated Power Source (10 KVA) shall be provided to control voltage and frequency fluctuations and provide stable/constant voltage (preferably 230V and 240V) and stable/constant frequency (preferably 50Hz and 60Hz) at its output.
r. The test setup shall be provided with good workmanship and powder coated exterior with proper appearance.

3) **Dynamometer and Vibration test Control Unit with Monitoring, Data Acquisition and Control Software:**

a. Dynamometer Control Unit with Monitoring, Data Acquisition and Control Software must be interface with both dynamometers test setup i.e. duty fan motor test setup and general purpose motor test setup.
b. PC control base panel having facility to measure torque (Pull out torque, Breakaway starting torque and Pull up torque), speed, input power, input current, power factor, efficiency of motor, temperature (motor outer surface and winding) and vibration (in mm/s).
c. PC with Control & Data processing software along with printer for various functions of testing machine like data control, collection of data, processing of data, storage of data, transfer of data (by the means of USB and Ethernet/Network cable) and printing of test results etc.
d. Formula/Interpreter
e. Online Graph/Trend
f. Configurable test results & customized report printing.
g. Modular Software Interface/ Add-On Third Party Software.
h. Software shall be able to integrate with LIMS (Lab software for online reports preparation). The data observation with instrument (s) shall be saved in the system.
i. Digital control system with response time less than 200milli seconds.
j. Will have features for Windows-10 based graphical user interface.
k. Whenever there is revision in software version of the equipment, the supplier shall provide the same free of cost.
l. Branded Computer system shall be provided with minimum 4 GB RAM, 500 GB HDD with Intel processor. Printer cum scanner and UPS for PC will also be provided.

4) **Safety Features :**

Dynamometer setup shall have the following safety features

a. Supply off-break
b. Withstand Voltage fluctuations of ±10%
c. Emergency stop of the machine
d. Over Current Protection
e. System should be Class I with Class II accessible part.
f. The control panel along with accessories shall be easily movable from one place to another.

5) Calibration and validation

a) All measuring instruments shall be calibrated for full range from laboratory accredited as per ISO/IEC 17025.
b) The protocol for validation of DAS shall be provided and same to be verified at the time of installation.
c) The equipment shall comply to the requirements of IS 996:2009 (with latest amendments) in all respects.

ANNEXURE C2

Technical Specification of Dynamometer

Specifications	Eddy current Dynamometer To test 3 ϕ squirrel cage induction motors in 2, 4, 6 or 8 poles for frame sizes upto 315L having output ratings (of sample i.e. motor) upto 30 kW as per IS 12615: 2018 Measuring feature: Power: upto 30 kW Torque: 0-500 Nm; Least count: 0.1 nm Speed: 0-4000 rpm; Least count: 1 rpm Calibration arm with standard weight Cooling: Water cooled
Direction of rotation	Bidirectional (CW & CCW)
Torque	0 to 500 Nm, accuracy 0.1 Nm
Speed	0-4000 rpm, Accuracy 1 rpm
Motor energizing unit with instrumentation and data acquisition system: Selector switch for 3 ϕ to 1 ϕ switching	
Auto-dimmer	0 – 1000V
Servo auto transformer	50 kVA
Digital Voltmeter	0-1500V; Accuracy class 0.2
Digital Ammeter	0-500 A; Accuracy class 0.2
Digital Wattmeter	0-50 kW, Accuracy class 0.2
Digital Frequency Meter	Upto 100Hz, Accuracy ±0.1%
Power factor meter	0-1
Servo voltage stabilizer	50 kVA
Temperature	0-300°C, with 10 channel
Control: Computer and software	Fitted with latest PC (with printer) with adequate software that shall be able to integrate with LIMS (Lab software for online reports preparation). The data observations with instrument(s) shall be saved in the system. Software shall show measurement of torque, speed, input &

537

	output power, current, power factor, efficiency of motor, temperature (motor outer surface, winding, bearing); Formula interpreter, online graph; configuration test results & customized report printing; customization of software. Backup of software shall be provided.
Calibration and validation	a) All measuring instruments shall be calibrated for full range from laboratory accredited as per ISO/IEC 17025. b) The protocol for validation of Data Acquisition System shall be provided and same to be verified at the time of installation. c) The equipment shall comply to the requirements of IS 12615:2018 (with latest amendments) in all respects.

ANNEXURE C3

534

Technical Specification of EMI/EMC test

Sl.No.	Equipment Name	Specifications
1	Surge/Impulse Tester	Standard: IEC61000-4-5 Open-circuit voltage: 1.2/50 µs ,0.2 - ±15kV Short-circuit current: 8 /20 µs ,0.1 - ±7.5kA Surge polarity: Positive/Negative/Asynchronism Phase: Synchronism 0 °– 360 ° selectable, Asynchronism Output Complex impedance: 2 Ω, 12 Ω Coupling path: Three phase three lines, max. 32A Surge count: 1 - 9999 Surge interval: 10 – 9999 s ISO 17025 accredited calibration certificate
2	CE / RE / Radiated Immunity/ Disturbance Power Measurement	**Chamber :** Anechoic Chamber (Size : Approx. 6mx4mx3.3m) **Field power Amplifier :** IEC 61000-4-3 test system 80 MHz - 3 GHz 10 V/m & 30V/m **Chamber Calibration Measurement Field** Uniformity Area 1.5m x 1.5m (16 points), 0.5m x 0.5m (4 points] 0.8m above ground level, Uniformity : 0db to 6db at 75% of all points **Receiver :** 1m to 3m test distance EMI test receiver 9 kHz to 6 GHz (ISO 17025 accredited calibration certificate) **LISN:** Line V-Network, 9kHz to 30 MHz, 32A continuous current, for disturb. voltage measurements with calibration **RF Antenna** - 0.8 to 6 GHz (Log Periodic Antenna & Biconical log-periodic antenna) Disturbance Power Measurement : Coupling Clamp (As per IS 6842)
3	Electric Fast Transient Burst	EFT/Burst Generator as per IEC (EN) 61000-4-4 Output Voltage: 0 .2 - ± 5KV Coupling Path CDN: Built-in, Three phase five lines, AC&DC Max 32 A (including ISO 17025 Accredited Calibration) Capacitive Clamp as per IEC (EN) 61000-4-4 Three phase five lines, AC&DC Max 32 A
4	Conducted Susceptibility	Conducted Immunity Test System (IEC 61000-4-6) Frequency Range: 150 kHz – 80 MHz Level: 10 Vrms Including - Spectrum Analyzer Module 9 kHz - 2 GHz Signal Generator Module 9 kHz - 2 GHz Power Amplifier Module 150 kHz- 80 MHz / 100W COSAT Test Automation Software RF CDN M5 power line 25 amp RF CDN USB A RF CDN USB B BCI Clamp and Monitoring Clamp Cable and Adapter Set

533

6	Electro Static Discharge	Output voltage: 0.2--± 20kV ± 5% Output polarity: Positive / Negative /Switchable Discharge capacitor: 150pF Discharge resistor: 330 Ω Current rise time: 0.7 ~ 1ns Working form: Discharge interval 0.05 ~ 99.99s, Testing form20PPS Discharge ; Setting less than0.05s, be called single discharge Testing functions: Contact Discharge, Air Discharge times: Pre-setting times 1-9999 or Infinite times Trigger mode: 1.Automatic 2.Manual 3.automatic voltage rises Working power supply: AC220V ± 10%,50 Hz Ambient temperature: 15 ℃ -35 ℃ Outline dimensions and weight: 50×360×175 mm / ~10kg.
7	Dampe Oscillatory Wave Generator	According to IEC/EN 61000-4-18 (Latest Edition) Oscillation frequencies 3 MHz, 10 MHz, 30 MHz ± 10 % Voltage OC direct out 0.4 kV – 4.4 kV Voltage OC CDN out 0.4 kV – 4.0 kV Voltage calibrated 0.5 kV – 4 kV ± 10 % Voltage waveform decay Pk5 > ½ - Pk1, Pk10 < ½ - Pk1 Output impedance 50 Ω Voltage rise time 5 ns ± 30 % Pulse repetition max. 6666 / s Burst duration 1 ms – 20 s Burst repetition 10 ms – 200 s Current SC direct & CDN 8 A – 88 A @ all frequencies Current SC calibrated 10 A – 80 A ± 20 %. Current rise time < 330 ns @ 3 MHz < 100 ns @ 10 MHz < 33 ns @ 30 MHz Current waveform decay Pk5 > ½ - Pk1, Pk10 < ½ - Pk1 Polarity positive, negative, alternating

ANNEXURE C4

Technical Specification

Test for Vibration Test as per IS 13779:1999, IS 16444, IS 15884 and IS 14697

Sl. No.	Details of equipment required
1.	Programmable Vibration Test Apparatus: Accuracy as per IS 9000 (part 8) Range: 10-150-10 Hz Transition frequency: 60 Hz Acceleration: 2g (g=9.8m/sq. second) Amplitude of movement±0.15mm Single point control No of sweep cycles per axis: 10

Technical Specification

Test for Shock Test as per IS 13779:1999, IS 16444, IS 15884 and IS 14697

Sl. No.	Details of equipment required
1.	Programmable Shock Test Setup: Please take at least – Table size : 400 mm x 400 mm - Max mass of DUT : 50 Kg - Acceleration (Shock) : 3g – 1200g - Pulse Duration : 1 ms to 60 ms - Max Velocity Change : 11.5 m/s w/o load and 9.4 m/s with max load - Accelerometer - Controller - Software along with waveform monitor -Pure half sine wave shock (with Pre-shock and after shock)

ANNEXURE C-5

Specification for a Fully Automatic Meter Test Equipment for testing of Three-phase/Single Phase energy meters, 10 Numbers simultaneously

Scope:

This specification defines the requirement of a Three Phase Fully Automatic, Computer Controlled Meter test bench associated with Reference Standard Meter (RSM) of 0.01% accuracy class. The Meter Test bench shall be suitable for testing of electromechanical, hybrid & static whole current, CT operated and CT / PT operated type of energy meters of accuracy class 0.2S, 0.5S, 0.5, 1.0 or 2.0 conforming to various national or international metering standards for active (P), reactive (Q) & apparent(S) energy.

The fully automatic test bench shall be capable of testing the following types of energy meters for Active, Reactive & Apparent Energy:

1. Three-phase four wire whole current meter, 10 numbers simultaneously using ICT
2. Three-phase four wire CT operated, 10 Numbers, simultaneously.
3. Three-phase three wire, CT / PT operated. Three phase four wire, CT / PT operated, both 10 numbers simultaneously.
4. Three Phase 4-Wire, 0.2S Class ABT meters, 10 numbers simultaneously.
5. Three phase RSM (Ref. Standard Meter) of accuracy class up to 0.2S, 10 numbers simultaneously

Test bench shall be capable to perform the following additional tests:

1) Voltage Dips & Interruption
2) DC Immunity
3) ODD & Even Harmonics
4) DLMS Communication protocol

This specification covers design, manufacture, delivery, installation, testing and commissioning of a 10 position, fully automatic test bench for testing all types of three phase energy meters as well as RSM of lower accuracy class than test bench

at each position. The test bench shall be comprised of a complete set of Computer system equipped with related hardware, testing software and Printer to take printout of the desired test results.

- Major components used in the test bench:
  - **Power Source**
  - **Reference Standard**
  - **Error Evaluation System**
  - **ICT (Isolation Current Transformer)**
  - **Meter Communication System**
  - **Software**

-Should be from the original equipment manufacturer only, without which the offer shall be summarily rejected.

- All the major components of the test bench:
  - **Power Source**
  - **Reference Standard**
  - **Error Evaluation System**
  - **Scanning Head**
  - **ICT (Isolation Current Transformer)**

Applicable Standards:

The meter test equipment shall comply with the requirements of IS 12346 or IEC 60736 With latest amendments. All special requirements specified in the specification shall also be complied.

Operating Conditions:

• Voltage	3X240 Volts ± 10% with ground.
• Frequency	50 Hz ± 5%
• Ambient Temperature	: +10 deg C to +50 deg C
• Relative humidity	Up to 95% (Non condensing)
• Environment	For Laboratory use.

Main Components:

The fully automatic test bench shall comprise the following main components:

Static Power Supply Unit connected with a high Precision electronics Reference Standard Meter of 0.01 class, designed and housed in a Standard cabinet of modular structure.

Three phase Isolation Current Transformer (ICT) for at least 10 positions test system for three phase meters with closed current-voltage links.

1. Meter mounting test rack shall have individual error calculator, display unit and scanner head for each meter position.

Personal Computers with latest Windows operating system and User friendly testing software with the optional modules if any, designed by the manufacturer as per the requirement. The PC shall be for controlling, supervising various tests and test results. It shall also display all measurement values and test results of meter under test and shall provide data management. A4 size Black & White laser printer for printout of test result, wave forms and phase diagrams.

PC shall be able to integrate with JJMS software through LAN/ ethernet/ Wifi.

The *detail specification of* various components of the fully automatic test bench is specified as below:

STATIC POWER SUPPLY UNIT:

The static Power Supply Unit shall be fully computer controlled, designed as a standard cabinet of modular structure includes

three sets of voltage and current amplifier units with all the necessary controlling, indicating & display features. The static power source unit shall have auto range selection facility and serial communication ports for communication with PC and the meter under test. The source should generate voltage interruption and voltage dips as specified in IS 13779, IS 14697 and CBIP TR. 304. In addition to the generation of standard test values, the meter test equipment should have following features:

- Generation of unsymmetrical test values of polyphase test systems.
- Generation of test values synchronous to network frequency for examination of extremely network sensitive measuring instruments.

VOLTAGE AMPLIFIER:

The voltage amplifier shall have VA output burden rating at least 500 VA per phase. The electronic voltage amplifier shall be computer controlled and shall allow step less & continuous adjustment of output voltage for testing of meters. The test voltage outputs shall be computer controlled with accuracy measurement range from 30 V to 300 V (Phase to neutral) with a resolution of 0.01 or better. It shall have following typical characteristic features:

- Protections against Overload, short-circuit and open circuit. Indicated by audio visual alarm.
- High efficiency (better than 85%) preferably with PWM (Pulse Width Modulation) switching technology.
- The basic accuracy of Voltage Output shall be < 0.05% of set value.
- Low distortion factor (better than 0.5%) for linear loads.
- Better stability (0.005%) at inductive, capacitive and non-linear loads to carry out testing of various types of energy meters.
- Precision and high quality of output test voltage under applicable load conditions.
- Provision for superimposition of single and multiple harmonics up to 40% of the fundamental wave over range of 2nd to 31th harmonics in steps of 1% or better. Facility to control the phase angle of harmonics shall be provided.

CURRENT AMPLIFIER:

The current amplifier shall have VA output burden rating at least 500 VA per phase. The electronic current amplifier shall be computer controlled and shall allow step less & continuous adjustment of output current for testing of meters. The test current output shall be computer controlled with a range from 1mA to 120 A with a resolution of 0.01 or better. It shall have following typical characteristic features:

- Protections against over-load, short-circuit and open circuit. Indicated by audio visual signal.
- High efficiency (better than 85%) preferably with PWM (Pulse Width Modulation) switching technology.
- The basic accuracy of current output (10mA ... 120A range) shall be 0.02% of set value.
- Low distortion factor (better than 0.5%) for linear loads.
- Better stability (0.005%) at inductive, capacitive and non-linear loads to carry out testing of various types of energy meters.
- Precision and high quality of output test current under all load conditions.
- Provision for superimposition of single and multiple harmonics up to 40% of the fundamental wave over range of 2 to 31st harmonics in steps of 1% or better. Facility to control the phase angle of harmonics shall be provided.

Short Term Power Stability of Power Source:

2 min: P, Active Power: < 0.015 % (time base: 1 - 1.5s)

Long Term Power Stability of Power Source:

1 hour: P, Active Power: < 50 ppm (time base: 150s)

Signal Generator (Frequency / Phase Angle)

The output power factor adjustment shall be computer controlled and shall allow step less & continuous adjustment of power factor from 0.0 to 1.0 in all four quadrants in the steps of 0.01 or better, without affecting the test voltage or test current. Quick selection of any power factor shall be possible through meter testing software. The signal generator shall be digitally controlled to give output frequency independent of mains supply with the provision to vary the output frequencies from 45 Hz to 65 Hz in steps of 0.01 Hz.

HARMONIC INJECTION UNIT:

The source shall have harmonics injection unit with capability of generating harmonics up to 40% of magnitude and over the range of 2nd to 31th harmonics or higher to test voltage and current. Magnitude of each harmonics shall be adjustable from 0 to 40% from 2nd to 31th harmonics of fundamental wave in steps of 1%, facility to control the phase angle of harmonics shall be provided. **The harmonic injection unit should preferably be a part of complete source.**

Precision Electronic Reference Standard Meter:

The high precision electronic reference standard used shall have a wide range, highly precise measurement capability and shall be directly connected type to the test circuit. The class of accuracy of the reference standard meter shall be 0.02% for active, reactive and apparent energy for current range 10mA ... 120A.

The equipment shall incorporate digital technology and shall offer multimetric measurement function. The high precision electronic reference standard meter shall be capable of measuring following minimum electrical parameters, which during testing shall be directly displayed on the computer screen. The reference standard meter shall have auto range selection facility and serial communication port for communicating with PC.

- True RMS value of voltage (each phase)
- True RMS value of current (each phase)
- Power factor / Phase angle (each phase)

- Active, Reactive and Apparent power (each phase & Total)
- Active, Reactive and Apparent Energy (each phase & Total)
- Voltage and Current Phase sequence.
- Frequency
- Error
- Harmonic measurement for voltage, current, Power (Active, Reactive & Apparent)

Technical Data of Reference Standard Meter

- Active, Reactive and Apparent power measurement in three wire or four wire circuits with integrated error measurement and High Frequency pulse output for energy should be possible.
- Measurement of current and voltage should be possible.
- Vector diagram, harmonics spectrum wave form for analysis of power source signal shall be possible on the equipment display as well.
- Frequency range 45 to 70 Hz
- Voltage range 5 V to 520V
- Current range:1mA...120A
- Accuracy class: 0.01% for Current, Voltage, Power and Energy in any mode

THREE PHASE ISOLATION CURRENT TRANSFORMER (ICT)

The automatic test bench shall be supplied with lightweight electronically compensated ICT, for at least 3 positions in the current circuit of the test rack so as to test single phase or three phase energy meters in close link condition the rated current ratio of ICT shall be 1:1. Technical data of the ICT is as follows

- Nominal primary/secondary current 100A
- Maximum primary/secondary current 120A
- Ratio Error of < 0.02% for current range of 100mA ... 120A
- Phase Error of < 0.8 minutes for current range of 100mA ... 120A

- ICT shall be able to feed at least 25VA at the connection points where 1m current cables are connected
- Additional Error in meter test system due to ICT +/- 0.01% for the current Overall Current Range: 0.1A ...

120A.

Personal Computer System:

Personal Computer System, for controlling, supervising the testing and displaying all measurement values in addition to error and data management.

***Personal Computer* and Printer:**

One reputed make PC shall be provided loaded with user application software. Minimum specification of the PC hardware shall be as follows:

- Intel i5 8th Generation, 1.8 GHz or better.
- MS Windows 7/10 professional or better (registered copy).
- MS Office 2016(registered copy).
- Antivirus software - latest at the time of delivery (registered copy).
- 8 GB RAM memory.(800 MHz)
- 8 MB Cache memory.
- DVD RW latest high speed.
- ~~21" LCD Color Monitor.~~
- 1 TB SATA Hard disk.

- Online UPS, 1000VA with minimum 10 min backup capacity to operate PC system.
- Multimedia Keyboard & optical Mouse with dedicated ports.
- All accessories for connecting RSM, Power source, Test Bench and other equipments shall be supplied.
- One laser Printer suitable for A4 size paper.

User Application Software (Testing software)

Windows based testing software shall be user friendly, menu driven type to facilitate sequential fully automatic and continuous testing of meters. The program shall support the following tasks.

- Fully automatic test runs for meter testing.
- Database for meters and test sequences
- User interface to operate the system
- Easy to prepare test points
- Supervision and control of the test procedure
- Indication of the errors of the meters under test
- Capable of storage of test results automatically at the end of testing.
- The attribute of test result file shall be Read only which will be stored permanently. It should also be possible to convert *these files into* ASCII, XML or excel.
- *It shall have facility to* interrupt the testing at any point of time and restart it again
- Printout facility for test reports
- All types of generated reports shall be layout in A4 size,
- Backup facility on the CD/DVD drive
- Testing facility of meters with different constants
- Search and retrieval of the saved meter test results shall be available only by referring

- Some special identification, such as Meter serial number, date of testing etc.
- In case RSM is used for independent testing outside the bench /lab necessary software
- For testing and storing data shall be supplied.

The software shall have facility to display the following measuring parameters on PC screen:

- True RMS value of voltage (each phase) - 000.0 V
- True RMS value of current(each phase) - 000.00A
- Power factor / Phase angle (each phase) - 0.000
- Active, Reactive and Apparent power (each phase & Total) - 00.000W -;Active ,Reactive and Apparent Energy (each phase & Total) 00.0000Wh Voltage and Current Phase sequence.
- Frequency: 00.00 Hz
- Error: +/- 00.000%
- Vectorial display of: Applied Voltage, Current, Power Quadrant
- Real Time waveform (Voltage & Current display)

Meter Test Rack

The test rack shall consist of a fixed frame for mounting of meters under test, scanning heads, Quick connecting system and error display units. **The test rack shall preferably be constructed out of aluminum extruded sections with meter mounting cross at every measuring position**. There shall be suitable provision for both vertical and horizontal adjustment of scanners so that each meter position shall be accessible by the scanning head. Design of the frame shall be such that 10 numbers of 3-phase, 4-wire meters can be safely and easily accommodated on the front. **The meter test rack should have**

the facility to accept high frequency input to test RSM (Reference Standard meter up to 0.1S) equal to the number of meters. The scanning heads can also be adjustable both in depth and height. Meters mounting rack shall have provision of emergency stop switch / buzzer indication. There shall also be a warning lamp provided on the top of the rack to indicate that testing is in progress. The test rack should preferable be constructed out of Aluminum extruded sections with Power coated MS table top. The table top to be covered with PVC sheet, if made of MS sheet

Scanning Heads:

Each meter position of the test rack shall be provided with suitable photoelectric scanning head and shall be capable to scan for rotor mark detection for electromechanical type meters and LED/LCD and infrared pulse detection for hybrid or static meters. During testing these photoelectric scanners shall give optical indication of pulses by LED to indicate the status of scanning/sensing. Each scanning head support shall enable quick accurate and precise positioning, in the three planes, vertical, horizontal and lateral adjustment. **Each scanning head shall also have a provision of selector switch to select either to scan the marking on disk, LED/LCD or Infrared pulse.**

Error Calculator and Display Unit:

For simultaneous error measurement of meters under test, each meter position in the test rack shall be equipped with individual error calculator and integrated display unit, preferably LED/OLED graphic type. The system shall also have the facility to download data from internal memory of the meter under test from every test position. For the purpose of communication, the bidder should provide RS232/RS485 communication interface at every measuring position for READOUT of DATA from MUT based on IEC-62056 Mode C Communication / DLMS Communication protocol. The Error Evaluation system at every

522

measuring position shall display the following parameters during test:

- Pulse count of MUT (Meter under Test) and Reference Standard at the end of Error Test.
- Remaining Pulses of MUT (Meter Under Test) during ERROR Test
- Energy recorded by Reference Standard at the end of REGISTER Test.
- Text Display during Attributive Test.

Voltage and Current Test lead sets :

- Two sets of Voltage to be provided to test 10 meters simultaneously.
- One set of Current leads suitable for 40A and one set of current leads for 120A to be provided for 10 meter testing at a time.

Calibration and validation

a) All measuring instruments shall be calibrated for full range from laboratory accredited as per ISO/IEC 17025.
b) The protocol for validation of DAS shall be provided and same to be verified at the time of installation.
c) The equipment shall comply to the requirements of IS 13779:1999, IS 15884 and IS 14697 (with latest amendments) in all respects.

Test Certificates:

Test certificates of the RSM, Power Source, Isolation Current Transformers duly tested in the ISO17025 accredited laboratory shall be submitted.

Certificates for Test of Insulation properties and Test of Immunity against EMI / EMC for: Power Source, Reference Standard, Isolation Current Transformers, Scanning Head shall be submitted with the offer, without which the offer shall be rejected.

Drawings and Manuals:

The drawing showing complete layout of the fully automatic Test bench system for testing 10 three phase meters with dimensions should be submitted with offer. Operation and maintenance manual including drawings and detail wiring diagram shall be given in soft as well as hard copy.

ANNEXURE C6

519

Technical Specification

Test for climatic influence (Dry test, Cold Test, Damp Heat Test, Ambient Temp influence) as per IS 13779:1999, IS 16444, IS 15884 and IS 14697

Sl. No.	Details of equipment required
1.	Programmable Environmental Chamber with touchscreen display Temp. Range: -40°C to 100°C Accuracy: Temp: ±0.3°C Humidity: ±2.5%RH, upto 95% Provision for data logging, data backup Size of chamber: 1.5m x 1.5m x 1.5 m Water cooled Ramp Rate: upto 5°C/Minute Stability: ±1°C

ANNEXURE C.7

5/18

BUREAU OF INDIAN STANDARDS
WROL (Electrical)
EQUIPMENT SPECIFICATION

EQUIPMENT/SPECIFICATION CODE	WROL/E/Socket-plugs/2019-20/1
NAME OF THE EQUIPMENT	Test set up to carry out Breaking Capacity Test as per Cl 20 of IS 1293 : 2019 and Normal Operation Test as per Cl 21 of IS 1293 : 2019 on Plugs and Socket outlets
PROPOSED FOR BIS LABORATORY	WROL - ELECTRICAL
TOTAL QUANTITY REQUIRED	One Set

1) Purpose : Test set up to carry out Breaking Capacity Test as per Cl 20 of IS 1293 . 2019 and Normal Operation Test as per Cl 21 of IS 1293 : 2019 on Plugs and Socket outlets (Flush type and surface type, semi flush type, panel type, architrave type, Portable type Table Type (single/ multiple) floor recessed type, appliance type, with shutters and without shutters combined, according to Plugs of Class I and Class II, rewirable & non-rewirable, rated voltages up to 250 and rated current up to 16A.

2) Test set up shall consist of three parts . i) Control panel, ii) Electrical Load bank as per Cl 20 and 21 of IS 1293 : 2019. and iii) Test fixture (endurance test Machine to operate Plugs / Socket (IS 1293) specimens under test.

3) Technical Requirements :

i)Control panel:

A. The machine shall be capable for testing either three, two pin Plugs (rewritable / Non-rewirable specimen (2.5A, 6A and16A) or 2p, 2p + earth socket-outlet (2.5 A, 6A, 16A or 6/16A combined for all type of specimen as mentioned above (as per Cl 20 and 21 of IS 1293) and voltages 230V/240V/250V. And shall have facility to test three specimen of plugs / socket outlets.
B. The complete test set up shall be capable of operating on normal supply voltages 440 volts, AC, three phase.
C. Control panel shall have three stations to test three specimens powered by each phase.
Each station shall have:
Digital Voltmeter (single phase) Range: 0 to 600V, LC : 0.1 V , Accuracy 1 % or better,
Digital Ammeter: Range: 0-100A, L.C.; 0.1A, Accuracy; 1% or better,
Digital Power factor meter: 0 to 1, L.C 0.01, Accuracy; 1% or better,
Digital counter: 0-999999 with presetting and memory
Power ON indicator, Test ON indicator, Specimen failed Indicator with audio buzzer with resetting facility or by pass facility.

517

Facility to adjust test voltage, Selector switch to Adjust the test current with both fine and course adjustments, Selector switch to select Power factor 0.6 and 0.8 as per Cl 20 and Cl 21 of IS 1293: 2019

Facility to indicate force applied on plug / socket during engagement.

Contact open / contact weld Fault indicator with audio / visual Indication shall be provided. In case of any specimen failure (Contact open/ contact weld), machine shall stop operating. The counter of that particular failure specimen shall stop counting. There shall be the facility of bypassing the failure specimen/ station so that remaining station shall continue testing.

Control panel shall have facility of data logger for each parameter to record the data. Control panel shall be micro-processor based and shall be proved with facility to transfer the data to LIMS through lan or wi-fi.

ii) Electric Load Bank:-

a) Three separate Electric loads for three stations shall be provided by using three phase supply.
b) Electric Load Conditions as per Cl. 20 of IS 1293 : 2019 :- Refer Circuit diagrams as per Fig 20 of IS 1293:2019. Test voltage is 1.1 times the rated voltage and test currents are 1.25 times the rated current. Accessories (specimens) are tested using an alternating current ($\cos \phi = 0.6 \pm 0.05$) No current is passed through the earthing circuit, if any.
Resistors and inductors are not connected in parallel, except that if an iron core is used, a resistor, taking approximately 1 percent of the current through inductors connected in parallel with it. Iron- core inductors may be used, provided the current has substantial sine waveform. Accessible metal parts and any metal frame supporting the base of flush type socket outlet are connected through selector switch C (Fig 20 of IS 1293: 2019), for 2 pole accessories, to one of the poles of supply for half number of strokes, and to the other pole for remainder, for three pole accessories, they are connected consecutively to each pole of the supply for one third of number of stroke.
Electric Load Condition as per Cl. 21 of IS 1293 : 2019 :- Refer fig 20 of IS 1293 : 2019. The test specimens are tested with rated alternating current 2.5A, 6A, 16A (as per rated current) and rated voltages 230V or 240V or 250V (as per the rated voltage of the specimen), in a circuit $\cos \phi = 0.8 \pm 0.05$. The test current is passed during each insertion and engagement of the plug. Test is made with the connection as prescribed in Cl 20.

iii)Test fixture (Endurance machine) to operate Plugs / Socket outlets (IS 1293) specimens under test

a)) Test fixture shall be Pneumatically operated PLC based (Endurance machine) to operate three socket-outlet speciments (all type as mentioned above) or Three plug with 2p or 2p + earth (rewirable/ Non-rewrable) (2.5A / 6A / 16A).

b) Specimen mounting arrangement shall be such that it shall be possible to test three Socket-outlets or Plugs of different shapes (ISI marked normally available in market) at a time. Test specimen mounting arrangement shall be feasible easy to fit the specimen.

c)) Test Plugs (as per Cl 20) shall be provided to test Socket-outlet specimen of different ratings (6A and 16A).The dimensions and material of test plugs (Brass pins) shall be as mentioned in Cl 20 of IS 1293 : 2019. Brass Pins of Test Plugs shall be replaceable.

d) The length of the stroke of the apparatus shall be between 50 mm and 60 mm.

e)The plug inserted into and withdrawn from the socket-outlet at a rate 30 strokes per minute (A stroke is an insertion or a withdrawal of the plug)

f) The period during which the test current is passed from engagement of the plug until the subsequent disengagement shall be $1.5^{+0.5}_{0}$ s

g) Digital Stroke counter shall be provided on the Test Fixture with presetting and memory .

h) Timer shall be provided to measure current passing time from engagement of the plug until the subsequent disengagement.

j) Facility to measure the force applied on test specimen for engagement of Plug and socket shall be provided.

k) Facility to control and measure the air pressure / pneumatic pressure used for operating the fixture shall be provided.

l) Provision of Air compressor for pneumatic operating system shall be provided with test set up.

m) Test specimen (Plug/ Socket outlet) mounting arrangement shall be flexible and easily to mount the test specimen (under test) of different shapes and sizes (avellable in market ISI marked) on the test fixture.

n) Pneumatic operating system shall be controllable through software.

D. All measuring instruments shall be calibrated for full range from laboratory accredited as per ISO/IEC 17025.

E. The protocol for validation of DAS shall be provided and same to be verified at the time of installation

F. The equipment shall comply to the requirements of IS 1293 (with latest version and amendments) in all respects.

G. There shall be suitable arrangement for over load protection in case of abnormal condition or variation in input supply.

H. The cable size used for main wiring / internal wiring of panel shall of capacity of carrying at least 30 A current for each station.

I. Cooling arrangement wherever required shall be provided, especially for Electric load bank etc

J. Complete test set up (Control Panel, Electric Load bank and Test Fixture), enclosure shall be rigid, sturdy and powder coated (corrosion resistant).

K. Rolling wheels along with locking arrangement shall be provided for easy movement of Electric load bank, Control Panel and test fixture.

L. There shall be arrangement of rigid earthing to the complete set up.

M. Fixture, jigs and tools required for fitting / mounting of Test specimens etc shall be provided.

N. Electrical Drawings, operating manual etc shall be provided.

ANNEXURE C8

Technical Specification of Making and Breaking capacity test and Normal operation test equipment for Switches as per IS 3854:1997

Purpose:

1) Test set up shall also have facility to test Switches having rated current 6A, 16A, 20A, 25A, 32A, 40A and 63A. and Rated currents 1A, 2A, and 4 A for push-button switches
2) Test set up shall also have facility to test Switches with single pole and double pole.
3) Test set up shall also have facility to test Switches: Tumbler, Rocker and Push-button type activation.
4) Test set up shall have facility to test switches as per Cl 18.1, 18.2, 19.1 and 19.2 for all ratings (current and voltage).
5) Test set up shall also have facility to indicate failure of Test Specimen through visual and audible alarm.

Requirements:

1. The Equipment shall be capable to test the switches for Making & Breaking capacity test (Cl.18.1 of IS 3854:1997) at controlled/adjustable number of operations, speed, voltage, current & power factor. One operation consists of "transfer of the moving contacts from one operating positions to another".
2. The Actuating Mechanism shall have controlled speed ranging from 5 to 50 operation / minute.
3. After completion of Making & Breaking Test the equipment shall be capable of switching over to Normal Operation Test (Cl. 19.1 of IS 3854:1997) manually at controlled / adjustable Number of Operation, Speed, Voltage, Current and Power Factor.
4. TEST VOLTAGE, CURRENT AND POWER FACTOR.

I) For Normal Operation Test – Test voltages are 230 V, 240 V and 250 V ac and Test currents are 6 Amp, 10Amp, 16Amp, 20Amp and 32 Amp., ac at power factor 0.6 ± 0.05. The tolerance for the test voltage is + 5 % & - 0 %.

II) For Making & Breaking Capacity Test – at 1.1 times the test voltages stated at serial no. 4(I) and 1.25 times to the test current stated at serial no. 4(I) at power factor 0.3± 0.05.

The system shall put the switches 'ON' and 'OFF' for adjustable time-period for the operation i.e. 50% 'ON' &50% 'OFF' for Making & Breaking Capacity Test and 25% 'ON' & 75% 'OFF' for Normal Operation Test as per the following table.

Rating of switches of all varieties	Sample size	Operation per min.	ON Time	OFF Time	Remarks/Reference
Making & Braking Test	6 Amp 10Amp 16 Amp 20Amp 32Amp	30 30 15 15 7.5	2 sec 2 sec 4 sec 4 sec 8 sec	2 sec 2 sec 4 sec 4 sec 8 sec	Please see clause 18 of IS 3854:1997
Normal Operation Test	6 Amp 10Amp 16 Amp 20Amp 32Amp	30 30 15 15 7.5	1 sec 1 sec 2 sec 2 sec 4 sec	3 sec 3 sec 6 sec 6 sec 12sec	Please see clause 19 of IS 3854:1997

5. The 'ON' period shall be (25 % +5% -0) of the total cycle and the 'OFF' period shall be (75 % -5% +0) for normal operation test.

513

6. The test system shall be capable to monitor/control/display/each switch separately at the time of operation/completion of test.
7. The system shall be capable to stop testing after completion of number of operation at 'OFF 'position only.
8. The apparatus shall have the provision to mount / fix the Switches as in normal use without using special type of tools.
9. The system should be safe from dust, corrosion and electric shock and have adequate mechanical strength.
10. The Equipment shall have Digital Ammeter, Voltmeter, Power Factor meter and Counter for each switch separately of accuracy class 1.0. These instruments shall be detachable / portable to facilitate their calibration/repair/replacement.
11. The test system shall be capable to test simultaneously 6 Nos. of switches for the 6 Amp,10Amp rating and/or 6 Nos. of switches of 16 Amp,20Amp and 32Amp rating in a three phase balanced load system. The swiches shall be operable pneumatically through a module controlled by separate microprocessor.
12. The system shall be capable to test the samples of different ratings (Current / Voltage) and types as per clause 7.1.6 of IS 3854:1997.
13. The System shall have manual controls for carrying out Normal Operation and Making & Breaking Capacity Test. The system shall comply with all the provisions of Cl. 18.1, 18.2 & 19.1 & 19.2 of IS 3854:1997.
14. The system shall have Integrated PLC controlled mechanism to operate switches as per the requirement of standard's clause with touch screen and multiple status display.
15. All measuring instruments shall be supplied with calibration certificates from NABL approved Calibration Agency.
16. The supplier shall provide all the literature related to the system such as Operation/Instruction Manual, Circuit Diagram, trouble shooting etc.
17. Service repair backup of the test system should be available in / around Delhi.
18. DAS shall log of the values as Current, Voltage and No. of operation with a capability to collect and store the data of 4 days and record of the same.
19. The device shall have Network cable (Ethernet)/ USB and LAN for PC communication.
20. The device shall have electro pneumatic system for operation and controllable through software.

Calibration and validation

a) All measuring instruments shall be calibrated for full range from laboratory accredited as per ISO/IEC 17025.
b) The protocol for validation of DAS shall be provided and same to be verified at the time of installation.
c) The equipment shall comply to the requirements of IS 3854 (with latest version and amendments) in all respects.

ANNEXURE C9

Specification of Computerized Tensile Testing Machine (Horizontal)

Specifications	
RANGE	Capacity / Force: 2500 kN, L.C. 0.01 kN
Holding Jaws grips & shapes	Compression type dead end clamp; V-grip: suitable size range to cover size upto 30 mm diameter
Digital Extensiometer	Variable length with self setting Elongation Speed : Variable using VFD Elongation Measurement : Using Digital sensor. Least Count: 0.1 mm
Drive	Servo drive Motor : 2 Hp standard motor with gearbox.
Cross beam separation	Upto more than 12 meter (adjustable compression type end clamp)
Safety features	Emergency stop, Over-travel protection, Electronic overload protection, Overheating of oil and contamination of oil protection, Oil level indicator etc.
Load arrangement	Load Measurement : Using a 'S' Type Load cell Axial load arrangement (with customized computer program for loading in steps of 500 kg for 10 second as per below stated Indian standards.
Interface with PC	Display: 7" Proface Touch Screen HMI Controls : Using PLC Software : Dedicated software to Plot load, elongation and calculated tensile force. Wi-Fi/GSM based system for status update of the various parameters. Fitted with latest PC with adequate software that shall be able to integrate with LIMS (Lab software for online reports preparation); Windows based Software customized to our needs (with Elongation at break, load at break, stress rate, separation speed, graph facility, with different units, sample codes, data saving and retrieving etc. features) Result : Separate result screen which can be saved on pen drive in BMP format to be printed or saved for later.
Calibration	Machine shall be supplied with calibration certificate from laboratory accredited as per ISO/IEC 17025

Tensile testing machine (Horizontal) to be used for Surface condition test (Cl. 13.9 of IS 398-2), Ultimate breaking test (Cl. 13.10 of IS 398-2), Stress-strain test (Cl. 13.11 of IS 398-2), Breaking load on complete conductor (Cl. 13.5 of IS 398-5), Surface condition test (Cl. 13.10 of IS 398-5)

ANNEXURE C 10

511

Technical Specification

Reference : Procurement of Humidity chamber
Purpose : To carry out Humidity Test and conditioning on all type of samples in Cable section.
Requirement : The test device shall be made as per following specifications.

Construction: Double Walled, Inner Chamber made of Stainless Steel, Outer chamber made of 18 SWG SS (304).
Inner Chamber Size: 36 x 36 x 36 (LBH in inches) of 18 SWG SS 304
Insulation: Suitable insulation between inner and outer wall.
Door - Twin door: Internal - Air tight polypex/Poly Carbonate
External -Double Walled Stainless Steel (304) sheet lined door with window made up of twin glass (hardened) and gas filled for insulation. with magnetic catchers and latches/locks.

Shelves (Perforated) - 3 Nos. SS with load bearing capacity of 100 kg each SS-304
Temperature Range: +10 to 50 degree C +/- 2 degree C, LC 0.1 degree C.
Temperature Controller: Specially designed heating / cooling digital On/Off type (PID can't be used with refrigeration.
Heating: Using coil heaters.
Humidity: Using Steam / Vapour generation, Non-condensing. A water tank is provided at the bottom of the cabinet to store the water. Water Level: Electronic water leveller opens of the water supply line using solenoid valve when the water levels falls.
Low Water level protection: The heaters in the water tank are cut off if the water is below a certain level.
Humidity control: Digital controller using microprocessor humidity sensor.
Humidity Range: 20% to 95% +/- 5%, LC 0.1 % RH.
Programmable temperature and Humidity control

Display : Touch Screen IPC with windows and internal Hard disk, graphic display
Control: Using PLC
Alarms : High / Low temperature, High / Low Humidity, Door Open, Power failure, Low water, Heater / Humidity generator failure.
Power Backup : Display and data logging power backup upto 1 hour. Auto off after set time is over.
Refrigeration Gas: Non CFC, environmental friendly gas.
Remote Data logging : Ethernet/LAN/Wireless Data logging and report generation. The status of the various parameters can be taken remotely. Test Summary: Complete data log with summary of average temperature, Humidity etc. Calibration: Temperature controller / Humidity to be calibrated by a laboratory accredited as per IS/ISO/IEC 17025

Working Range:

a) Working Temperature Range 27 °C ±1°C with L.C. of 0.1° C.
   Working Humidity Range 50 ±2% RH with LC 1% RH.
b) Working Temperature Range 27°C ±1°C with L.C. of 0.1° C.
   Working Humidity Range 65 ±2% RH with LC 1% RH.

510

Accuracy: 0.1 % or better

Additional feature:

a) Air Circulating fan: Heavy duty Imported Fan Motor for continuous Air Circulation inside the chamber.
b) Illumination: Fixed on the top.
c) Water tank/capacity - 100 litres, transparent, loft tank.
d) Wheels: Base fitted with four load bearing wheels of 75 mm dia. size, capacity 1.0 T.
e) Viewing window with wiper
f) Thermometer: For Cross Check an L type thermometer (0-100°C) shall be fitted on the panel.
g) Humidification: Humidity by trouble free Ultrasonic transducers.
h) Compressor: Standard make of suitable capacity.
i) Control & display panels will have the arrangement for locking to protect the set conditions.
j) Power supply: 220/230 V AC, single phase, 50 HZ
k) Voltage Stabilizer Wall mounted voltage stabilizer of 04 KVA

All measuring parameters shall be provided with Calibration Certificate from laboratory accredited as per IS/ISO/IEC 17025

The protocol for validation of DAS shall be provided and same to be verified at the time of installation

ANNEXURE C II

509

Technical Specification:

For Complete setup of Endurance test on Electric Immersion water heater and Mineral Filled Sheathed Heating Elements with Data logger

1) **Purpose :**

To conduct Endurance test as per Cl. 18 of IS 368: 2014 and Cl. 18 of IS 4159:2002.

2) **Technical Requirements :**

A test panel with the following:

a. As per IS 368: 2014 and IS 4159:2002, the water heater is connected to the supply such that the input is 1.15 times the maximum rated input which is measured throughout the test. The water heater is operated for 96 hours.
b. The water tank (depth 400mm minimum) shall be installed by supplier for each station with a capacity of 25 litres (3nos.), 37.5 litres (3nos.), 50 litres (3nos.) and 70 litres (1no.). And fitted with float valve for water control for the testing of Electric Immersion water heater as per IS 368: 2014.
c. The Thermal insulated water tank (depth 400mm minimum) shall be installed by supplier for each station with a capacity of 25 litres (2nos.), 37.5 litres (2nos.), 50 litres (2nos.), 70 litres (3nos.) and 100 litres (1no.). And fitted with float valve for water control for the testing of Mineral Filled sheathed heating Elements as per IS 4159:2002 with all amendments.
d. Digital Voltmeter range - 0 to 300V (10 Nos.), LC-1V
e. Digital Wattmeter range - 0 to 6000W (10 Nos.), LC-1W
f. Preset Timer range – 000:00(Hour: Minute) digital timer (10 Nos.)
g. Each station shall be provided with suitable individual constant voltage transformer (±1% or better) and shall be so connected that output of the variac is applied at the input of the CVT and output of the CVT is applied to Load via 6 pin 6/16 Amp. sockets with 1 pole MCB protection – 10 Nos.
h. Variac for each station which can rise the voltage up to 500 Volts suitable up to 5000 W (10 Nos.)
i. All measuring instruments shall be provided with Calibration Certificate from laboratory accredited as per ISO/IEC 17025.
j. A suitable UPS shall be provided to backup the power supply for at least 01 hour backup for 25000 W loads.
k. Suitable arrangements for mounting the heating elements as per IS 4159:2002.

3) **Control : Data logger**

a. Data Logger should have the facility of recording and storage of date of Time up to 100 Hours.
b. Data Logger should have the facility to transfer the stored data in other storage device.
c. Power backup shall be provided by UPS for minimum two hours to Data logger.
d. The device shall have Network cable (Ethernet)/ LAN and USB for PC communication.
e. The PC shall be provided with the system by supplier.

4) **Safety Features :**

It shall have the following safety features:

a. Power supply 230V ±10% @50Hz
b. System should be shock proof.
c. The test device shall be made of materials not causing corrosion.
d. Operating temperature 0°C to 55°C and humidity 10% to 95% RH.

ANNEXURE C 12

508

Draft Technical Specification for Data Acquisition System:

MODULAR SYSTEM FOR MONITORING & REPORTING OF TEST PARAMETERS FOR STORAGE WATER HEATER AS PER IS 2082:2018

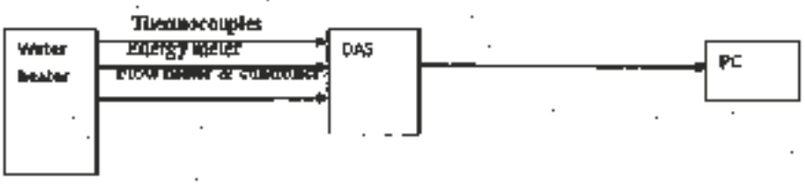
The system shall be modular type and shall consist of Data Acquisition System (DAS) along with Energy meters and water flow meters & controllers. One module shall be able to cover the test parameters as prescribed in 5.0 below for one water heater. The system shall be able to test eight water heaters at a time in a Single module or multiple modules. The output of the modules should be accessible by PC, Digital Display & Memory System and which should be able to calculate various parameters for water heaters as specified in 5.0 as per IS 2082:2018 (latest version with all amendments) and display the results in tabulated form and graphical form.

1.0 Data Acquisition System (DAS):

1.1 The equipment (DAS) should be able to collate data on a standalone basis without using the PC and additionally, should be able to integrate with PC by LAN and also by other suitable means. One DAS module may collect data for one water heater and thus multiple DAS may be required to test multiple water heaters or one DAS may collect data for multiple water heaters. It is required that in case one DAS collects data from multiple water heaters, it shall be able to collect data from at least eight water heaters at a time.

1.2 The DAS shall be able to take input from the thermocouples (multiple input channels i.e. four thermocouples for each water heater) at fixed selectable intervals (minimum 1 second or better) and should integrate the input to give output in the form of graph given at 5.6 below. The DAS may also be able to take inputs from energy meters (i.e. one energy meter of each Water Heater) and flow meters and integrate the same for specified period of time. The output of energy meter may also be given directly to PC which shall then correlate the data of DAS, energy meter and flow meter to give desired result as per ISS. The connection for one unit is explained schematically as follows:

Facility to connect DAS through UPS shall be provided. In case of power failure, DAS's capacity to function at least for 30 minutes should be provided and Data should be stored in permanent memory.



Schematic Diagram for one module when DAS collects data for energy and flow

507

1.3 The DAS should have on board user function keys to set up actions using the Event/Action function. It should also have analog Inputs for Analog Universal Input Modules.

1.4 The thermocouple to be used with DAS (to be declared), shall preferably be of Type J or K; with precision and accuracy of measurement of ± 0.5°C of reading or better. Additional 12 Stem type thermocouples (Steel stem of dia. approximately 4 mm) of approx length of 50 cm each and with wire length of 5 m each shall also be provided. Additional 100 m length of Thermocouple wire of the same type and Spot Welding Machine to fuse the junction shall be provided.

1.5 Data storage in the in-built Card with adequate memory to prevent Data Loss of measurements for at least four sets comprising eight Water Heaters each. DAS shall have a USB port through which the data can be transferred to PC. DAS shall have also the provision of LAN interface, Network cable (Ethernet).

1.6 Data recovery: If a power failure occurs during recording, the data up to the failure should be restored upon recovery from the failure.

1.7 Provision of relevant Mathematical & Statistical functions shall be available in the system as per ISS. Programming provisions for Data Acquisition shall be available to initiate, continue and end the complete testing as per 5.0 below.

1.8 Status indication of measuring, recording, computation, receiving data etc shall be provided.

1.9 Automatic File Transfer Functions: The Stand-alone system must support Built-in File Transfer Protocol to facilitate and transfer of recorded data from its memory to PC at pre-defined intervals.

1.10 Generic Monitoring Function from PC / workstation: System software pre-installed and configured for the following features:

1. Real time monitoring, Data archiving, Historical viewing
2. Display in multi display modes
3. Configuration of Hardware
4. MATH functions / Computation functions

2.0 Digital energy meter (incorporated in DAS or separate):

2.1 The digital energy meter shall be Single phase, 230V, 50 Hz suitable for upto 5kW load. The digital energy meter shall be of accuracy class 0.5 or better, with a least count of 0.01 kWh. It shall be able to record the energy consumed by the water heater continuously and integrate the same to give energy consumed for specific time.

2.2 It should also have a USB port, Network cable (Ethernet) and LAN for PC interface, for recording the data.

2.3 One energy meter shall be provided for each water heater. The output of the energy meter shall be given to the DAS or to the PC (as per the design) which shall indicate the energy consumed in required time as per the requirement of the Indian Standard.

3.0 Digital Display and Memory System:

3.1 Testing System shall provide Digital Display of acquired Data individually for each module or for all eight modules in one system and it shall store Data for analysis, calculations, graphical display, tabulation and facilitate transferring, printing by the means of LAN and USB port. If such a system requires special Software, it shall be integrated in the system.

3.2 Arrangement to prevent Data Loss in case of Mains Power Supply Failure shall be suitably provided such that a minimum of 30 minutes data is acquired and stored in memory.

3.3 In case PC is provided for Digital Display & Memory System, it shall have MS Windows (latest version), preloaded MS Office (latest version) with minimum 4 GB RAM and 1TB HDD configured on Intel Quad Core Processor or better and with an LED Monitor.

4.0 Flow meter and Controller:

Two flow meter cum controller (digital with connection to DAS or PC) for each Water Heater shall be provided (one at input & one at output).The flow meters and controllers shall have the capability for adjustment as per the requirements of ISS for Hot water output test and mixing factor test. The capacity of drawing water from water heater under test through flow meter cum controller shall be adjustable manually as well as through DAS/PC.

5.0 Tests required to be conducted:

5.1.Storage water heater is required to be tested for the following tests as per IS 2082:2018:

- Clause 11: Measurement of stored water temperature
- Clause 13: Measurement of Energy consumption
- Clause 15: Standing loss per 24 hours
- Clause 16: Hot water output
- Clause 17: Reheating time
- Clause 18: Mixing factor
- Clause 20: Cyclic temperature variation

5.2 The water temperature is to be measured as per Clause 11 of IS 2082:2018.

5.3 The DAS should be able to log in the temperature at the set time interval and then integrate the temperature readings to give the temperature of thermostat cut in and cut out. Later for the specific tests as per Cl. 11, 13, 15, 16, 17, 18 and 20. The DAS should give calculated temperature readings as required by these clauses.

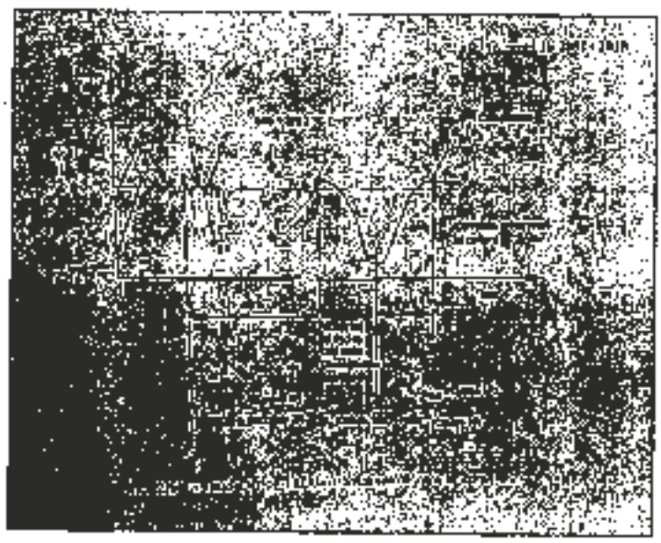
5.4 It should be possible to get the calculated temperature on DAS where all such calculations are done by the system.

505

5.5 In additon to above DAS should have following provisions:

i) Display of Energy measured of eight Storage Water Heaters,
ii) Display of Voltage applied to Storage Water Heater,
iii) Arrangement to control and measure the rate of flow of water at inlet and outlet of Storage Water Heaters,
iv) Arrangement to measure reheating time of water of Storage Water Heaters,
v) Arrangement to record the identity of sample in following manner;
  a) Date of start of test and finish,
  b) Code of individual sample, and
  c) Specifications of Storage Water Heater.

5.6 Temperature for tests as above shall be logged in the following way:



6.0 Safety Features

It shall have the following safety features:

a) Power supply 230V ±10% @50Hz.
b) System should be shock proof.
c) The test device shall be made of materials not causing corrosion.

ANNEXURE C13

Specification of Computerized TTM

Specifications	
RANGE	0-2 kN/ 0-10 kN/ 0-100 kN with deferent load cell
LC	0.1 N / 1 N / 5 N
Digital Extensiometer	Variable length with self setting (Laser sensor)
Power Input	230 V, AC (50 Hz)
Cross beam separation	600 mm
Jaw separation speed (with digital display)	10 to 500 mm/min. (adjustable); Different speed setting for up and down movement of jaw
Displacement resolution	0.01 mm
Working temperature	10-35 °C
Holding Jaws grips & shapes	Hydraulic type jaws; Flat grip and V-grip: suitable size range to cover size upto 16 mm diameter
Drive	Servo drive
Safety features	Emergency stop, Over-travel protection, Electronic overload protection, Overheating of oil and contamination of oil protection, Oil level indicator etc.
Interface with PC	Fitted with latest PC with adequate software that shall be able to integrate with LIMS (Lab software for online reports preparation); Windows based Software customized to our needs (with Elongation at break, load at break, stress rate, separation speed, graph facility, with different units, sample codes, data saving and retrieving etc. features)
Calibration	Machine shall be supplied with calibration certificate from laboratory accredited as per ISO/IEC 17025

ANNEXURE C 14

503

Technical Specification of Profile Projector

Purpose: To measure thickness and spot impression.

Type of Equipment: Digital profile projector
Control: Computer controlled and Manual controlled
Reference of IS: IS 10810 (Pt-6):1984
X-Y Range: 75mm x75mm (Resolution – 0.001mm or better)
Screen Diameter: 400mm or more
Magnification: 10X minimum or better
Magnification Accuracy: ±0.1 % or better
Optical Distortion: Below 0.1% or better
Rotation Range: 0°-360° with 90° cross line (Resolution 1° or better)
Movement: Automatic and Manual
Operating Temperature: 10 °C to 60 °C or better
Power Source: Single Phase ac supply of 50 Hz
Operation: Single push Button Operation
Illumination: Halogen Lamp with easy replacement facility
Illumination Intensity: Provision of increasing or decreasing of Illumination Intensity.
Memory Storage: Internally store up to 1500 test results.

Features:

- Single or continuous measurements with automatic data storage.
- Machine must have inbuilt PC interface and test results recording system to save data, transfer data and print data.
- Profile projector must have facility to interface with PC with USB and Network cable (Ethernet)/ LAN.
- In case failure of software, there shall be provision to operate the equipment manually.
- Whenever there is revision in software version of the equipment, the supplier shall provide the same free of cost.
- The Machine must be capable of measuring thickness of various cables and spot impression of various materials.
- There shall be automatic provision to present a clear focused image of test specimen.
- Rotary measuring stage should be provided.
- Calibration from laboratory accredited as per ISO/IEC 17025.

Accessories:

- Instruction/Operating manual.
- Extra sets of lens shall be provided with magnification 20X, 50X, 100X, 200X with software support
- Relevant software for data exchange.
- Set of slip gauge and angle gauge should be provided for intermediate check purpose (at least 5 gauges covering entire range).

ANNEXURE C 15

502

Tentative Specification of HV, RIV tester.

Specifications	
RIV (Radio interference Voltage) tester	
Fixing arrangement of conductor as per Cl. 13.10, Cl. 13.11, Cl. 13.12 of IS 398-5 (latest version).	
Voltage measurement	Upto 1000 kV(rms) with digital display
RIV value	Upto 10000 µV Error rate ±5% or better
Frequency	1MHz (Range 0.5 MHz to 2 MHz) also power frequency with digital display
Standard resistance	300 Ω and adjustable
Characteristics	RI characteristics Plotter as per IS 8263 (latest version).
High voltage source	
Voltage measurement	Upto 1000 kV with digital display
Timer	0-9999.99 Minute
Voltage application	Gradual and steps voltage increased and decreased facility as per IS 398-5, IS 1554-2, 7098-2.
Computer and software	Fitted with latest PC with adequate software that shall be able to integrate with LIMS (Lab software for online reports preparation). The data observations with instrument(s) shall be saved in the system.
Calibration	Machine shall be supplied with calibration certificate from laboratory accredited as per ISO/IEC 17025

High voltage upto 1000 kV and RIV tester for conductor as per Cl. 13.11 & Cl. 13.12 of IS 398 (part 5).

Technical Specification:

For Complete set of Thermostatic Stability test on Electric Irons with Data logger

1) **Purpose :**

To carry out Thermostatic Stability test on Electric Irons as per IS 366: 1991.

2) **Technical Requirements :**

A test panel with the following:

a. Digital Power meter (0-600V , 0- 20 A , 0- 10kHz) Accuracy 0.5 % of reading or better
b. Preset Timer, Range – 5 digit timer (000hour:00minute)-10Nos.
c. Variac for each station (i.e. 10 Nos.) which can raised to voltage – 500 volts.
d. Each station shall be provided with suitable individual constant voltage transformer (±1% or better) and shall be so connected that output of the variac is applied at the input of the CVT and output of the CVT is applied to Load via 6 pin 6/16 A sockets with 1 pole MCB protection – 10 Nos.
e. The ON – OFF operation of Iron will be detected by current sensing or temperature sensing on the digital display. In case the welding of contact i.e., it is ON for long time without off condition or for contact i.e., no current for long time. The test will be terminated declaring failed.
f. Data Recording 250 Hours.
g. PC with UPS.
h. There should be an arrangement to placed the iron on the three metallic supports and a thermocouple is attached at the midpoint of the sole plate. The temperature of this thermocouple should be recorded and stored through data logger up to 250 hours. The data logger should have the facility to transfer the store data in other storage device and also have the facility of back up of power supply.

3) **Control : Data logger 10 channel**

a. Data Logger should have the facility of recording and storage of data of Time up to 250 Hours.
b. Data Logger should have the facility to transfer the stored data in other storage device.
c. Data Logger should have the facility of Backup of power supply.
d. The device shall have Network cable (Ethernet), USB and LAN for PC communication.
e. The PC shall be provided with the system by supplier.

a. **Safety Features :**

It shall have the following safety features:

a. System should be shock proof.
b. The test device shall be made of materials not causing corrosion.

4) Calibration and validation

a) All measuring instruments shall be calibrated for full range from laboratory accredited as per ISO/IEC 17025.

b) the protocol for validation of DAS shall be provided and samg to be verified at the time of installation.

500

ANNEXURE C-17

Specifications	Specification of Ageing oven.
Ageing Oven for cables (IS 694, IS 1554-1 & 2, IS 7098-1 & 2, IS 9857, IS 9968, IS 14255) Chamber Size : 100mm dia.x 450mm ht, made of thick Aluminium Pipe. Final chamber size after lid 100 x 300 mm. Temperature Controller: 4 nos. of PID Temperature Controller. one each for each chamber. Readability 0.1oC, Accuracy +/- 1oC or better. Thermocouple: Each thermocouple will have two RTD sensors approx. 100mm apart, to measure the temperature at two different points in the same chamber. Temperature Control: The PLC will receive two inputs from each thermocouple and average the temperature of the two sensors. The average temperature shall then be fed into the controller for temperature control. Chamber Temperature Overshoot Protection: provision for temperature overshoot protection shall be provided. Air Flow: Measured by Digital Flow Indicator, 4 nos. of 0-10 LPM. Flow indicators one each for each chamber .The flow can be controlled using needle valves. Air Preheating system: Provision to preheat Air shall be provided. Air Temperature Controller: 4 Nos of Digital Temperature Controllers one each for each chamber to monitor and control air temperature. Lids: Lids made of Mild steel dully painted, approx. 4" thick with glass wool shall be provided to minimize the temperature lose from the top. Display: Chamber Temperature , Air Flow, and time shall be displayed on a touch screen IPC (Industrial PC) for individual chamber. Control : All the controls of the oven shall be done using PLC based modular temperature controllers. Data Logger: The HMI/PLC records and stores Chamber temperature, Air Flow, These readings are stored in tabular and graphical format and can be saved on USB drive for future usage. Power Backup : Display and data logging power backup upto 1 hour. Results: After the test, the result of the test shall be able to summarized with average temperature, air flow, graph and complete table in pdf format. Wi-Fi/GSM based system for status update of the various parameters.	
Reference	As per IS 10810 (Part 10 & 11) To carry out loss of mass and ageing in oven of sauples

493

Number of chambers	4 Tubes
Control and Power input	Electric thermostatic digital control; 230 V, 50 Hz, AC
Temperature range	Ambient to 300°C, ± 1°C; Least count: 0.1 °C; PID control with digital display
Timer	HHHH.HH with preset facility
Computer and software	Fitted with latest PC with adequate software that shall be able to integrate with LIMS (Lab software for online reports preparation). The data observations with instrument(s) shall be saved in the system.
Calibration	Machine shall be supplied with calibration certificate from laboratory accredited as per ISO/IEC 17025 for timer, temperature indicator, air flow

ANNEXURE C 18

Technical Specification of Skewing Machine

1) Purpose :

To reduce the thickness and to obtain parallel smooth surfaces of specimen of PVC, XLPE and Elastomeric rubber material according to IS 694, IS 1554 (P1), IS 1554 (P2), IS 7098 (P1), 7098 (P2), IS 9857, IS 9968 (P1), IS 9968 (P2), IS 14255, IS 14494

2) Technical Requirements :

a. Skewing machine / Slicing machine shall be capable of reducing the thickness of the above mentioned materials having thickness from 0.7mm to 12.0mm into reduced thickness ranging from 0.6 to 2.0mm (according to Cl.6.4.2.3 of IS 10810 (Part 7): 1984, Cl. 6.1(a) of IS 10810 (Part 10): 1984 and Cl.6.1 (b) of IS 10810 (Part 33): 1984 with Amendment no 2).
b. Blades shall be capable for reducing the thickness of PVC, XLPE, PE and Elastomeric rubber material.
c. Blades shall be capable of removing semiconducting coating.
d. Machine shall have a provision of cutting the material into smooth and parallel surface without burrs and without heating the specimen.
e. The skewed/sliced surface shall be smooth and care shall be taken not to overheat or otherwise to damage the specimen during the machining operation.
f. The machine shall have provision to accommodate specimen of 25mm width minimum.
g. All parts of machine including accessories shall be corrosion free and rust free.
h. One extra set of blade shall be provided.
i. Machine shall have facility for easy replacement of its accessories.
j. Operating manual, instructions and description of parts of the machine shall be provided with the machine.
k. There shall be provision to set required thickness of specimen (i,e. 0.6 to 2.0 mm) by automatic or manual operation.

ANNEXURE C 19

Technical specification for Power analyzer:

Purpose: To measure Power input, Electrical energy, Voltage, Current and Power Factor for Electrical Appliances as per IS 302-1:2008.

S.No.	Components/ Fixtures/ Accessories/ Spare parts/ CRMs etc.	Requirement
(1)	(2)	(3)
1.	Suitability	Suitable to measure Voltage(LC-1V), AC (rms and peak) and DC Input Current(LC-0.1 A), Power(LC-1W), Energy Consumption (LC-1WH), Power factor(LC-0.01), Current and Voltage frequency, Crest Factor of voltage and current with selectable display update rate (ranging from 100 ms till 10 s) and auto ranging of integration feature with range monitor indicator. Simultaneous display of mean and rms value of voltage and current.
2.	Display	5 digit with LED/LCD
3.	Front panel	All parameters shall be display individually (Power, Energy consumption, Voltage, Current, Frequency, and Power Factor).
4.	Frequency response	Up to 100kHz
5.	Accuracy	0.2 % or better
6.	Input ratings and type	Isolated, floating, unbalanced with line filter function, 25 Ampere AC / DC or better, current and 300 Volt AC/ DC or better, 1 phase 2 wire system. External current sensor input available for High current measurement with 100:5 CT (accuracy class 0.2 or better). Harmonics measurements up to 50th order (THD) or better.
7.	Input Other attributes	Power & Current values integrated separately for positive & negative polarities. Averaging function with Exponential average & moving average up to 64 numbers. The device shall have inbuilt Network cable (Ethernet), USB and LAN for PC communication. The device shall have capable of storing data (sets of measurements) or saving the data through software.
8.	Other requirements	Voltage test leads with alligator clip adapter and other suitable leads shall be provided (2 Sets each). Operating manual shall be provided.
9.	Safety Features	It shall have the following safety features: a) Power supply 230V ±10% @50Hz. b) System should be shock proof. c) The test device shall be made of materials not causing corrosion. d) It should be portable in nature, user friendly in operation and easy to read display. e) Operating temperature 0°C to 55°C and humidity 10% to 95% RH.

ANNEXURE C-20

Technical Specification of Impulse Tester

1) **Purpose :**

To measure Impulse withstands voltage test as per IS 60898:1:2015, IS 12640 (Part 1): 2016, IS 12640 (Part 2): 2016 and Transient over voltage as per IS 302-1:2008 and impulse test as per IS 13779, IS 15884 and IS 14697.

2) **Technical Requirements :**

a. Nature of Impulse wave: No load wave shape corresponding to 1.2/50 µs specified in IS2071 (Part 1): 2016.
b. Range of Impulse test voltage should be 0-5kV and 0-15kV, adjustable with both polarities, Least count 0.001kV for both range. The voltage shall be increased in step of 20 to 50 volts. A separate knob shall be provided for this.
c. The impulses given by a generator producing positive and negative impulses having a front time of 1.2µs, and a time to half value of 50 µs, the tolerances being as follow: ±5%for the peak value, ±30%for the front time, ±20%for the time to half value as per IS/IEC60898:1:2015.
d. The surge impedance of the test apparatus shall have a nominal value of 500Ω.
e. Programmable and fully automatic test sequence
f. LCD Display for indication of test parameters and result.

3) **Safety Features :**

It shall have the following safety features:

a. Short Circuit/ Overload protection with MCBs.
b. Withstand Voltage fluctuations of ±10%
c. System should be shock proof.
d. The test device shall be made of materials not causing corrosion.

4.0 Calibration and validation

a) All measuring instruments shall be calibrate for full range from laboratory accredited as per ISO/IEC 17025.