



TENDER DOCUMENT
(e-Procurement)

**Notice Inviting Tender (NIT) in *E-TENDER mode only* through
Central Public Procurement Portal (CPPP) of Government of India
under Two-Cover Bid System**

Tender No: IISc/Tender-IDS-BE-11/2023-24

For

**“Supply, Installation, Testing and Commissioning of laboratory furniture in the lower ground floor
at the IDR Building in IISc, Bangalore”**

Division of Interdisciplinary Sciences Indian Institute of Science Bangalore – 560012

Website: <https://iisc.ac.in/all-tenders>

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LIST OF DOCUMENTS TO BE SUBMITTED IN PRE-QUALIFICATION (Technical Bid)

1	Copy of Company or Firm Registration Certificate	
2	Certificate copies of GST, PAN, Contractor's Registration pass book	
3	Details of Past works performed reports and Single work performed in Govt. / Semi Govt. in prescribed format	
4	Satisfactory work completion report from the Authorities	
5	Profit and Loss Statement, auditor's report (Audited balance sheet) for the last five years and Income tax clearance certificate for the last 5 years	
6	Banker Certificate	
7	Certificate with membership number visible clearly validating your official membership with SEFA .	

8	Documents stating the lab name and location (as approved by SEFA) where you have the materials tested and approved as SEFA compliant.	
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III. FINANICAL BID

	DESCRIPTION	PAGE NO.
	Bill of Quantities (COMMERCIAL BID)	

1. Tender Notification

Tender No: IISc/Tender-IDS-BE-11/2023-24

Scope of Work	Supply, Installation, Testing and Commissioning of laboratory furniture in the lower ground floor at the IDR Building in IISc, Bangalore
Estimated value of work	Rs. 4 crores
Period of Work Completion	150 days
Name of the Client	Indian Institute of Science, Bangalore
Address of the Client	The Registrar Indian Institute of Science Bangalore – 560 012 Tel No. 080-2293 3688
Tender Fee	As per e-procurement portal
Submission of Tender Document	e-tender mode only through e-procurement portal- https://eprocure.gov.in/eprocure/app Helpline no: 0120-4001005
Earnest Money to be deposited with the tender	Rs. 8,00,000 EMD should be deposited in the form of Demand Draft Necessary bank details of IISc is enclosed with the tender
Last date and Time for submission of tender	3 rd July 2024 4:00 PM
Date and Time of opening of Tender (Technical Bid)	4 th July 2024 4:00 PM
Pre-Bid meeting (date, time and link is attached)	19 th June 2024 4:00 PM https://teams.microsoft.com/l/meetup-join/19%3ameeting_NzE0MzFjYjYtYWVjMS00YTUyLTgzNTUtZDg4MTIiYWI1Mzlh%40thread.v2/0?context=%7b%22Tid%22%3a%226f15cd97-f6a7-41e3-b2c5-ad4193976476%22%2c%220id%22%3a%22db57967e-ddd2-4023-ad52-60f222154fda%22%7d
Date and Time of opening of Tender (Financial Bid)	Shall be intimated to technically qualified bidders through CPP portal.

2. Notice Inviting Tender

The Registrar, Indian Institute of Science invites tenders from eligible Bidders, for **Supply, Installation, Testing and Commissioning of laboratory furniture in the lower ground floor at the IDR Building in IISc, Bangalore.**

The bidders who fulfil the following requirements are eligible to apply.

Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of India or any State Government of Union of India. (Authorized signatory should provide an undertaking). Tenders from joint ventures are not acceptable.

- 2.1 All Bidders shall provide the required information accurately and enough as per details in Section 4: Eligibility Criteria
- 2.2 The Tenderer shall submit the valid certificate copies of the documents as mentioned in the Chapter-4 (Eligibility criteria) in technical bid, **failing which the tender will be rejected.** If necessary, bidder shall produce all the original documents for verification.
- 2.3 The work shall be carried out as per the directions of the Project Manager identified by the purchase committee, IISc.
- 2.4 Blacklisted contractors in State / Central Govt. Departments / Autonomous bodies / Institutions are not eligible to quote, if found such tenders will be rejected. The contractors who are penalized due to delay in completion of the previous works will be rejected.
- 2.5 The successful Bidder shall execute an Agreement within 10 days from the date of receipt of intimation from this office. The Tender Document will form the part and parcel of the agreement, failing which the tender will deem to be get cancelled.
- 2.6 The material shall be approved by the Purchase Committee, IISc before execution of the work.
- 2.7 Further details of the work can be obtained from the purchase committee.
- 2.8 The rates quoted should reflect all taxes. The rates are as per Govt of India or state Govt rules. The bid evaluation will be done inclusive of all Taxes / Cess. / Royalty etc. The statutory levies as per Govt. guidelines will be deducted. The IISc reserves the right to accept / reject any or all the tenders without assigning any reasons.
- 2.9 The work shall be commenced with all men and machinery within 30 days from the date of purchase order, failing which it would be presumed that the successful tenderer is not interested in the work and action will be taken to get the work executed through alternate agency at the risk and cost of the former Tenderer.
- 2.10 Conditional tenders will not be accepted and is liable for rejection.
- 2.11 Bidders who meet the above specified minimum qualifying criteria, shall be eligible.
- 2.12 Even though the Bidders meet the above criteria, they are subject to be disqualified if they have:
 - Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
 - Record of poor performance such as abandoning the works, not properly completed the contract, inordinate delays in completion, litigation history, or financial failures etc.

2.13 Site visit:

The Bidder at his own responsibility is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the

Tender and entering into a contract for the project. The cost of visiting the Site shall be at the Bidder's own expense.

2.14 Tender document

The Tender document can be downloaded from e-procurement website: <https://eprocure.gov.in/eprocure/app>. It may be noted that all subsequent notifications, changes and amendments on the project/document would be posted only on the same website. The bidders are advised to visit e-procurement portal and get familiarized with the procedure for submission of the tenders.

2.15 Content of Tender documents

The bidders should go through the Tender Document and submit online response through e-procurement portal only.

2.16 Amendment of Tender documents

Before the deadline for submission of tenders, the IISc may modify the tender documents by issuing corrigendum / addendum.

Such corrigendum/ addendum thus issued shall be part of the tender documents and shall be published online at e-Procurement portal.

IISc reserves the right to extend the dates, if required.

2.17 Documents comprising the Tender

The Technical Bid submitted by the Bidder shall contain the documents in a sealed envelope as follows:

- a) Earnest Money Deposit paid in the specified form as mentioned in the e- Procurement platform.
- b) Qualification Information as per formats to comply the task created in the e-Procurement Portal under General Terms and Conditions and Technical parameters and Documents required from Bidder.
- c) Any other documents / materials required to be completed and submitted by Bidders in accordance with these instructions. The required documents shall be filled in without exception.

The bidder shall submit the hard copies of the documents / credentials which were uploaded in the tender portal. The tender documents shall reach the designated office within 3 days of the tender opening deadline.

The hardcopies should be sent to the following address:

Assistant Registrar, Purchase Section,

Indian Institute of Science,

Bengaluru, India – 560012

The Financial bid shall be submitted by the bidder through e-procurement portal only and no hard copy of financial bid should be attached or disclosed.

The contract shall be for category of works / whole works based on the priced Bill of Quantities submitted by the Bidder.

All prevailing duties, taxes, and other levies like CESS/Royalty payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Bidder.

2.18 Tender validity

Tenders validity will be for a period of 180 days and vendor bid validity for 90 days after the deadline date for tender submission. A tender valid for a shorter period shall be rejected by IISc as non-responsive.

In exceptional circumstances, prior to expiry of the original time limit, IISc may request that the Bidders may extend the period of validity for a specified additional period. The request and the Bidders' responses shall be made in writing or by email (office.be@iisc.ac.in, ar.purchase@iisc.ac.in). A Bidder may refuse the request without forfeiting his earnest money deposit. A Bidder agreeing to the request will not be required or permitted to modify his tender but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 2.18 and 2.22 in all respects.

2.19 Earnest money deposit:

The Bidder shall furnish, as part of his tender, earnest money deposit (EMD) of 800,000 (Rupees 8 lakhs only). The Bidder can pay the Earnest Money Deposit (EMD) in the form of bank guarantee to "The Registrar, IISc" payable at "Bangalore".

The bidder has to scan the demand draft and submit it with Technical Bid Documents for our reference. The original DDs has to be submitted along with the hard copies of all the documents in a sealed cover as a pre-qualification bid (Technical bid) which were uploaded through e-procurement portal.

The EMD amount and tender fee will have to be submitted by the bidder taking into account the following conditions:

- a) The entire amount must be paid in a single transaction.
- b) The earnest money deposit of unsuccessful Bidders will be returned after awarding the contract to the successful bidder.

The earnest money deposit may be forfeited:

- a) If the Bidder withdraws the tender after tender opening during the period of tender validity,
- b) If the Bidder fails within the specified time limit to
 - i) Sign the Agreement; or
 - ii) Furnish the required Security deposit

2.20 Provisions for Micro, Small and Medium Enterprises (MSME):

The MSME registered bidder should upload the registration certificate in the CPP portal along with the technical bid documents. The MSME registration to specify manufacturing / service of the tender item (s).

Policy is meant for procurement of only goods produced and services rendered by MSMEs. However, traders are excluded from the purview of Public Procurement Policy. The bidder must mention clearly if they are the manufacturer or a trader.

Relaxations to MSME (manufacturers) will be applicable as per government rules.

2.21 Format and signing of Tender

Successful Bidder shall sign all the pages of the tender document as a token of acceptance of all the terms and conditions of the contract.

2.22 Submission of Tenders

Tenders must be submitted on-line in the e-Procurement portal by the Bidder before the notified date and time.

2.23 Deadline for submission of the Tenders

The Bidder shall submit a set of hard copies of all the documents in a sealed cover to IISc required as a pre-qualification bid (Technical bid) which were uploaded through e-procurement portal. In the event of any discrepancy between them, the original uploaded document in e-procurement shall govern.

IISc may extend the deadline for submission of tenders by issuing an amendment, in which case all rights and obligations of the IISc and the Bidders previously subject to the original deadline will then be subject to the new deadline.

2.24 Late Tenders

In e-procurement system, Bidder shall not be able to submit the bid after the bid submission time and date as the icon or the task in the e-procurement portal will not be available. IISc will not be liable (or) responsible for any delay due to unavailability of the portal and the Internet link.

2.25 Modification and Withdrawal of Tenders

Bidder has all the time to modify and correct or upload any relevant document in the portal till last date and time for Bid submission, as published in the e-procurement portal.

The Bidder may modify or withdraw his tender before the notified last date and time of tender submission. No Tender may be modified after the deadline for submission of Tenders.

Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 2.21 above may result in the forfeiture of the earnest money deposit.

2.26 Tender Opening:

The IISc will open all the Tenders received through online mode, in the presence of the Bidders or their representatives who choose to attend on the specified date, time and place specified. In the event of the specified date of Tender opening being declared a holiday for the IISc, the tenders will be opened at the appointed time and location on the next working day.

The IISc will evaluate and determine whether each tender meets the minimum qualification eligibility criteria.

Bidder to submit all the Original Documents, which are submitted in e-procurement portal, to the IISc for verification at the time of opening of Tender. The IISc will record the Tender opening.

2.27 Process to be confidential

Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced.

2.28 Clarification of Tenders

To assist in the examination, evaluation, IISc may, at his discretion, ask any Bidder for clarification of his Tender. The request for clarification and the response shall be in writing or by e-mail along with the section number, page number and subject of clarification, but no change in the price or substance of the Tender shall be sought, offered, or permitted.

Subject to clause 2.31, no Bidder shall contact IISc on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the IISc, he/she should do so in writing.

Any effort by the Bidder to influence the IISc in the Tender evaluation, or contract award decisions may result in the rejection of the Bidders' Tender.

2.29 Examination of Tenders and determination of responsiveness

Prior to the detailed evaluation of Tenders, IISc will determine whether each Tender (a) meets the eligibility criteria (b) is accompanied by the required earnest money deposit and; (c) is substantially responsive to the requirements of the Tender documents.

A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the works; (b) which limits in any substantial way, inconsistent with the Tender documents, the IISc's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Tenders.

If a Tender is not substantially responsive, it will be rejected by the IISc., and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

2.30 Correction of errors

No corrections to the submitted bid is permitted by the portal. Tenders determined to be substantially responsive will be checked by IISc.

2.31 Evaluation and comparison of Tenders

Opening of the financial bid will be preceded by the evaluation of the Pre-qualification Offer (Technical bid), vis-a-vis the capability, capacity and credibility of the Bidder. Evaluation of the Prequalification Offer will be done by the Evaluation Committee constituted for the purpose. After evaluation is completed, all the Bidders who are qualified will be notified and will be intimated at the time of opening of the financial bid. Financial bid will be opened in the presence of those who choose to be present or even in the absence of any Bidder.

The IISc will evaluate and compare the Tenders as per comparative statement downloaded from e-procurement portal.

In evaluating the Tenders, the IISc. will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

- a) Making any correction for errors and
- b) Making appropriate adjustments to reflect discounts or other price modifications offered

The IISc reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the IISc shall not be taken into account in Tender evaluation.

2.32 TECHNICAL EVALUATION CRITERIA:

Evaluation of performance: Evaluation of the performance of the bidders for eligibility shall be done by the committee constituted by the Registrar, IISc Bengaluru. All the eligible similar works executed and submitted by the bidders may be got inspected by a committee.

The marks for the Performance of Works (Quality) shall be given based on this inspection or on the basis of the performance report given by the client.

Even though a bidder may satisfy the above requirements, he would be liable for dis-qualification if he has:

- (a) Made misleading or false representation or deliberately suppressed the information in the forms, statements and enclosures required in the pre-qualification document.
- (b) Records of poor performance such as abandoning work, not properly completing the contract, or financial failures /weaknesses etc.

2.33 Negotiations

The Bidder though technically qualified and whose financial offer is the lowest, fails to convince the Tender Evaluation Committee of his capability, capacity, credibility, his offer may be reviewed, and the Bidder intimated accordingly.

2.34 Award criteria

Subject to Clause 23, the IISc will award the Contract to the Bidder whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price. Only the technically qualified will be taken forward to the financial bid opening stage, and among the technically qualified bidders, the bidder with the lowest bid in the financial stage will be designated as L1.

2.35 Right to accept any Tender and to reject any or all Tenders

Notwithstanding Clause 2.35, the IISc reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the IISc's action.

2.36 Notification of award and signing of Agreement

The Bidder whose Tender has been accepted will be notified of the award by the IISc, prior to expiration of the Tender validity period by e-mail or confirmed by letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the IISc, will pay the Contractor in consideration of the execution, completion, and maintenance of the works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of clause 2.39.

The Agreement will incorporate all agreements between the IISc and the successful Bidder /Bidders. It will be kept ready for signature of the successful Bidder in the office of IISc. Following the notification of award along with the Letter of intent. The successful Bidder will sign the Agreement and deliver it to the IISc.

Upon the furnishing by the successful Bidder of the Security deposit, the IISc will issue formal purchase order.

The successful bidder is required to sign an agreement for the due fulfilment of the contract and start the work immediately on of the acceptance of his tender. A draft of the Articles of the Agreement is enclosed. The Earnest Money will be forfeited and at the absolute disposal

of the Employer if the Contractor defaults from signing the Agreement of in starting the work.

2.37 Further Security deposit (FSD)

Further percentage on the running bills and final bill in addition to Earnest Money Deposit shall be levied from the contractor. When the FSD deducted from R.A Bills of the contractor @ 5.5% of the bill amount exceeds Rs.1.00 Lakh, the amount in excess of Rs. 1.00 Lakh may, at the request of the bidder, be released to him against the production of the bank guarantee issued from a Scheduled Commercial Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.

If the security deposit is provided by the successful bidder in the form of a Bank Guarantee, it shall be issued by a Scheduled Commercial bank.

Failure of the successful Bidder to comply with the requirements of clause 2.38 shall constitute sufficient grounds for cancellation of the award and forfeiture of the earnest money deposit.

2.38 Corrupt or Fraudulent practices

The IISc requires that the Bidders observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, IISc.

- a) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.
- b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a IISc contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a IISc contract.

2.39 Payment Terms

- a. First 80% against the supply of material on prorata basis in 30 days.
 - All material (electronic or otherwise) must be supplied within 140 days of the generation of Purchase Order (PO).
 - If the material is not supplied within 140 days, the bidder must provide a written explanation of the causes for delay.
 - The purchase committee may provide a 10 day extension for delivery of any material that remains undelivered after review of the explanation and if they are satisfied with the reasoning. The committee may do this at its discretion.
 - Further delays beyond the extension period will result in a penalty fee, which will be 1% of tender value for every week of delay.
- b. Next, 20% will be paid after installation, testing and commissioning of all items in the tender, within 30 days.
- c. Maximum of 3 Running Bills for the duration of the project is allowable. These can be submitted against supply of material, wherein within 30 days of the supply of material (and approval from our side of receipt of material) payment will be made.
- d. It may be noted that payment from IISc may take up to 1 month after provision of appropriate invoice (such as for supply of material)

2.40 Work done as a sub- contractor under a prime contractor will not be considered for qualification. "Prime Contractor" means a firm that performs a construction work itself and that the work is directly entrusted to the firm by the owner/ government/ local body/ quasi government/ Government undertaking bodies.

2.41 Terms and conditions:

- a. The quotations should be on FOR-IISc Bangalore basis in INR only.
- b. Bidders offering imported products will fall under the category of non-local suppliers. They cannot claim themselves as Class-1 local suppliers/Class-2 local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training, and other sales service support like AMC/CMC, etc., as local value addition.

3 Declaration of Tenderer

Name of Work: Supply, Installation, Testing and Commissioning of laboratory furniture in the lower ground floor at the IDR Building in IISc, Bangalore.

- 3.1 I/We, declare that specifications, plans, designs and conditions of contract on which the rates have been quoted are completely studied by me/us before submitting this tender.
- 3.2 I/We declare that I/We have inspected the work spot and have made myself/ourselves thoroughly conversant and satisfied as regards the field conditions prevalent there, regarding the materials, labour and the particulars of various leads with which the materials required to be brought for the work.
- 3.3 I/We, declare that the rates quoted for items of works for which now tenders are called for are inclusive of leads with which I/We propose to bring the materials. I/We will not have any claims for higher leads, and my/our quoted rates are with all leads and lifts etc.,
- 3.4 I/We, declare that the rates tendered by me/us for this work have not been witnessed by any other contractor/s who has/have tendered for this work.
- 3.5 I/We, declare that I/We, have understood all the conditions mentioned above and also the specifications stipulated in tender condition either by going through myself/ourselves or by getting translated into my/our own mother tongue.

4 Eligibility Criteria

Technical Criteria:

- 4.1 The bidder should have satisfactorily completed as a Prime contractor during the last five years, ending March 2023 in any State / Central Govt. Departments (including PSUs) / and similar organizations of repute.
- a) The bidder should have experience in having successfully completed “similar” works in CFTIs or government laboratories/institutes during the last five years ending with the date of submission of tenders; should have completed at least one similar work costing not less than 4 crores or two similar works each costing no less than 3 crores. ***Similar work means: Supply and Installation of lab benches, fume hoods, bio safety cabinets, exhaust, gas distribution and electrical system. Works executed abroad shall also be considered for the purpose of experience in similar works provided documentary evidence is submitted from the competent authority. Documentary evidence cannot be just the certification from some agency. Only purchase orders without installations shall not be considered for the purpose of experience in similar works. Documentary evidence in the form of work completion certificate is required to be produced to get the tender issued and should include the institute’s name and contact information, where the work was completed.**
 - b) Work completion certificate for having completed work of similar nature of contract certified from the competent authority of the organization shall be uploaded. The work completion certificate shall mention the nature of work, items of work executed, the agreement number & date, the value of work, the date of commencement, the stipulated date of completion, the actual date of completion of the work and reason for delay (if any).
 - c) Only “Class-I and Class-II local supplier will be eligible to bid notified vide (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 4th June 2020 amended from time to time. (Submit duly filled Annexure-I for the same).
 - d) Tenderer should be the manufacturer / authorized dealer of all the items as per Annexure-II. A letter of Authorization from the original equipment manufacturer (OEM) specific to the tender should be enclosed for all of these mentioned items.
 - e) Non-compliance with tender terms, non-submission of required documents, lack of clarity of the specifications, contradiction between tenderer specification and supporting documents etc. may lead to rejection of the bid.
 - f) The bidder should have the ability to do ASHRAE testing at site through self or third party. The bidder should submit back-up documents verifying similar tests having been conducted at client site in the past.
 - g) The bidder / parent company should be an Official member with SEFA (Scientific Equipment and Furniture Association). Please provide the certificate with membership number visible clearly validating your official membership with SEFA. Please attach documents stating the lab name and location (as approved by SEFA) where you have the materials tested and approved as SEFA compliant.
 - h) Bidder should have sufficient number of Technical and Administrative employees for proper execution of the contract. The bidder shall have to submit a list of Key personnel available and proposed to be engaged for management and supervision of this project, their qualifications and experience.
 - i) The list of specialised agency who are to partner with the Bidder , along with their experience complying with the clause laid out under special conditions of contract along with Project planning and quality control procedures to be adopted, installation and commissioning

methodology to be submitted along with the tender.

- 4.2 The bidder should have a presence in the city of Bangalore, with at least 2 technical engineer and 2 more technical support staff present locally to perform periodic maintenance, corrections under warranty period, and fix any other issues that may arise following the testing and commissioning of the audio-visual systems. A declaration to this effect with name and contact information of the engineer and support staff must be provided in a separate document on company letterhead.
- 4.3 Should be solvent for a minimum of **Rs 1.00 Crore** as certified by a Scheduled Commercial Bank in India and the certificate must be obtained on or after 1st October 2019.
- 4.4 A line of credit, amounting to **Rs. 4 crores** for meeting the working capital of the project, issued by a Nationalized/Scheduled bank shall be provided by the bidder, as per the format provided in **Section 3, clause 1.6.**
- 4.5 Should not have incurred any loss (profit after tax should be positive) during the last two consecutive financial years, ending 31st March, 2023, duly certified by a Chartered Accountant in a separate certificate.

Financial Criteria:

- 4.6 The bidder should have registered for a minimum period of ten years. Proof of registration must be provided.
- 4.7 The average annual financial gross turnover should be at least 30% of the estimated cost of this tender, in the last five (5) years.
- 4.8 The minimum annual financial turnover for the two consecutive years should be at least 30% of the estimated cost of this tender.
- 4.9 The bidder should have not incurred any loss in more than two years.
- 4.10 The average net worth of the bidder as of **2022-23** should be not less than 25% of the estimated cost of this tender. Necessary certificate by the Chartered Accountant shall be submitted.
- 4.11 The bidder should have not been blacklisted by any State / Central Govt. Departments / Autonomous bodies / Institutions. A self-declaration of the same should be provided on the company letterhead.
- 4.12 The bidder should provide a self-declaration on their company letter-head stating that they understand the payment terms set in section 2.8 (above) and agree with the payment terms as well as the penalty clauses.
- 4.13 The bidding capacity of the bidder should be 75% or more of the estimated cost.

The bidder should possess the bidding capacity as calculated by the following formula. Available bid capacity = $A \times M \times N - B$, where

A = Maximum value of engineering (Civil/ Electrical/ Mechanical as relevant to work being procured) works executed in any one year during the last five years (updated at the current price level), taking into account the completed as well as works in progress.

M = Multiplier Factor (usually 1.5)

N = Number of years prescribed for completion of the work in question.

B = Value (updated at the current price level) of the existing commitments and ongoing works to be completed in the next 'N' years.

- 4.14 Information on works for which tenders have been submitted and ongoing works as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of work	Place & State	Contract number & date	Name & address of the customer	Value of Contract in Lakhs	Stipulated period of completion	Value of work remaining to be completed in Lakhs	Anticipated date of completion
1	2	3	4	5	6	7	8

[Details to be furnished with necessary work order signed from concerned project in-charge not below the rank of Executive Engineer or Competent Authority. The Work order/Testimonials will be verified, if required]

(B) Works for which Tenders already submitted:

Descript ion of work	Plac e & Stat e	Name & address of the custome r	Estima ted value of work in lakhs	Stipula ted period of complet ion	Date when decision is expected	Rema rk if any
1	2	3	4	5	6	7

4.15 Certificate from Chartered Accountant stating turn over for the last five years is also to be uploaded.

Sl. No	Year	Turn over amount	Profit / (Loss)	Remar k
1	2018-19			
2	2019-20			
3	2020-21			
4	2021-22			
5	2022-23			

Litigation and Arbitral Issues:

- 4.16 Net pending litigations should not be more than 50% of bidder's net worth.
- 4.17 No consistent history of court/arbitral award decisions against the bidder for the last five years. A self-declaration of the same should be provided on company letterhead.
- 4.18 From the date of the Purchase Order generation, within 60 days the company should deliver, assemble, and install all materials. A self-declaration that bidder will comply with this item should be provided on the company letterhead.

For any queries regarding the tender, the specifications or any other items, please contact office.be@iisc.ac.in
ar.purchase@iisc.ac.in

5. Special Conditions

- 5.1 Establishment of Labour Camp is strictly prohibited in the premises of Indian Institute of Science Campus. Essential labor for round the clock work at site will be allowed with prior permission of Project Engineer cum Estate Officer.
- 5.2 Any damage to the existing service lines during execution of work shall be got rectified by the bidder at his own cost and risk.
- 5.3 Debris shall be disposed-off to an undisputed place of Bangalore outskirts as per the direction of the Engineer-in-Charge, whenever required. If the item is not found in the Bill of quantities and the rate in the contract for haulage of debris, it shall be paid as per the KPWD SR.
- 5.4 Labor employed at the site will not be allowed to use cellphone while working at the site.
- 5.5 Supply of Electricity: Electricity required for construction shall be arranged by the contractor himself. Electricity if supplied to the contractor by the Institute will be metered and amount will be recovered in the bills as per actual at rates fixed by the Institute. Supply of electricity from the Institute is not mandatory. Non-supply of electricity by the Institute cannot be held as reason for shortfall in progress.
- 5.6 Water supply: The Contractor has to make his own arrangement for water supply. However, if water supply to the site at one convenient point is made available by the Institute, the charges for the consumption of water will be borne by the Contractor at 1.50% of the value of the work items which requires water.
- 5.7 Schedule of Quantities (Bill of Quantities) is attached herewith. It should, however, be clearly understood that these quantities are liable to alterations by omission, addition or variation, at the discretion of the Architects/Project Engineer Cum Estate Officer
- 5.8 The drawings together with specifications and conditions of contract are enclosed. These should be studied carefully by the intending tenderers. In the absence of specifications for any item of work, material or ingredient in the specifications, CPWD / KPWD specifications shall be followed and in the absence of specification for any item, materials are ingredient shall be fixed in all respects in accordance with the instructions and requirements of the Project Engineer Cum Estate Officer, the work will be the best of the kind.
- 5.9 The tenderer is expected to inspect the site and acquaint himself with the local conditions and will be deemed to have so done before submitting the tender. The rates quoted shall be for finished work and shall include for all necessary incidental work. GST or any other taxes on materials/services in respect of this contract will be payable by the Contractor. The Contractors cannot presume any details regarding the contract.
- 5.10 It is entirely the responsibility of the Contractor to arrange for and provide all materials required for successful completion of the work except such special materials that may be supplied if any.
- 5.11 Tenders determined to be substantially responsive will be checked by IISc for any arithmetic errors. Errors will be corrected by the Employer as follows.
- 5.12 Where there is discrepancy between the rates in figures and in words, the lower of the two will be governed.
- 5.13 Where there is a discrepancy between the unit rate and the line-item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will be governed.
- 5.14 Where there is a discrepancy in entries of unit rate between the Original and Duplicate, the lower will govern.

- 5.15 The Contractor should make his own arrangements to cover the all-round construction area, by providing polyester net/polythene sheet/barricading to avoid inconvenience to other surrounding departments, as directed by the Project Engineer-cum-Estate Officer of the work.
- 5.16 The debris arise during the period of construction will have to be cleared then and there to keep the surroundings clean and tidy. Such debris shall, if not cleared, be cleared at contractor's risk and cost.
- 5.17 The contractor shall vacate the campus premises with all his men/ materials immediately after completion of the project.
- 5.18 The equipment data sheet as per the technical specification to be filled by the bidder and uploaded along with the technical bid eligibility documents.
- 5.19 These special conditions will have the overriding effect on any of the terms and conditions of the contract elsewhere included in the contract document repugnant to each other and in such events, only the condition on the issue, if any as in special condition shall only be applicable and prevails. In case of disputes in interpretation of any clause the decision of the Director of IISc is final thereof and binding.

1) DEFINITION:

In the Contract (as hereinafter defined) the following definitions words and expressions shall have the meaning hereby assigned to them except where the context otherwise required.

- i. Institute shall mean the IISc Bengaluru.
- ii. The President shall mean the Board of Governors, IISc Bengaluru.
- iii. The Engineer-in-charge, who shall administer the work, shall mean the Project Engineer cum Estate Officer, IISc Bengaluru.
- iv. Accepting authority shall mean the Chairman, Building and Works Committee- Director, IISc Bengaluru or his authorized representative.
- v. Site Engineers shall mean the Project Manager appointed by Institute works department.

2) ASSIGNMENT & SUBLETTING:

The contractor shall not assign the contract or any part thereof without the written consent of the Engineer in-charge. The whole of the works included in the contract shall be executed by the contractor and sub contracting will not be allowed.

3) SCOPE OF CONTRACT:

- i. The contract comprises the supply, Installation, completion of works within six (6) months and maintenance of the works for twelve (12) months after actual date of completion and handing over to IISc , Bengaluru. The contractor shall carry out and complete the said work in every respect in accordance with this contract and as per the directions/ written instructions of the Engineer in-charge. These pertain to the following:
 - ii. The variation or modification of the design, quality or quantity of works or the addition or omission or substitution of any work.

- iii. All materials are to be supplied as per approved shop drawings. Any excess material brought to site shall be taken back by the agency and no claim for payment of the same shall be entertained by IISC.
- iv. Removal and substitution of material from the site.
- v. The dismissal from the works of any persons employed.
- vi. The opening up for inspection of any work covered up.
- vii. Any civil modifications required for installation of services (electrical, piping or exhaust system)
- viii. Amending / making good of any defects.

The contractor shall forthwith comply with and duly execute any instructions of work comprised in such Project Engineer cum Estate Officer's instructions, provided always that the verbal instructions and explanations given to the contractor or his representative upon the works shall, if involving a variation, be confirmed in writing by the contractor within seven days and if not dissented in writing within a further seven days by the Project Engineer cum Estate Officer, shall be deemed to be instructions of the Engineer in-charge within the scope of the contract.

4) CONTRACT DOCUMENT:

- 1.1 All documents, forming the contract, are to be taken as mutually explanatory of one another and in case of ambiguities or discrepancies the same shall be explained and adjusted by the Project Engineer cum Estate Officer who shall thereupon issue to the contractor its interpretation directing in what manner the work is to be carried out.
- 1.2 The successful tenderer shall be required to enter into an agreement as per approved format given in the tender document with the Institute. The Bill of Quantities & rates filled by the successful tenderer, technical bid document, minutes of the pre bid meeting, negotiation letter and the award letter shall form part of the agreement to be signed by the successful tenderer. The cost of stamp paper and stamp duty, required for the agreement, shall be borne by the contractor.
- 1.3 The contractor shall study the Tender drawings thoroughly before the commencement of work. In case of any discrepancy the contractor shall seek clarification before proceeding with the works.

5) AS BUILT DRAWINGS:

On completion of work, the Contractor shall submit at his own cost four prints of "as built" drawings and commissioning reports along with O&M manual to the Project Engineer cum Estate Officer within 6 weeks of completion of the work.

- a) The drawings shall have the following information.
 - i. Layout showing lab benches, fume hoods & bio safety cabinets.
 - ii. Layout of Exhaust system with all details.
 - iii. Layout of all Gas Distribution with locations of all control valves and connections.

- iv. Layout of connection to water supply and drainage line including locations of control valves etc.
 - b) The commissioning report for the Exhaust system , gas piping system shall be submitted in the format to be agreed .
 - c) The O&M manual for the Lab Furniture's, Exhaust System , Gas piping and Electrical works shall be submitted .
- 6) The contractor shall make recesses, holes, opening etc. as may be required, nothing extra shall be payable on this account, including finishing the same.
- 7) The contractor shall be fully responsible for the safe custody of materials brought by him to site.

8) SPECIALISED WORK

Following specialized works should be got executed only through agencies specialized in the field and the contractor shall be required to submit the details of such agencies to the Project Engineer cum Estate Officer and obtain necessary approval:-

- a) Exhaust Fans
- b) Exhaust Piping and Scrubbing system.
- c) Gas Utility Piping System.

8.1 The specialized agency should have an experience of minimum five years in his area of specialization.

8.2 The specialized agency should have successfully completed at least one work of similar nature having a magnitude equal to at least 80% of the quantum of work provided in the tender.

8.3 The specialized agency shall have sufficient experience in execution of turnkey projects.

8.4 The contractor shall submit the following details of the specialized agency along with the Technical bid

- a. Proof of the agency in operation since last five year.
- b. List of works carried out by the agency in last five years along with the name of work, name and address of clients, year of execution, value of work done and brief specification of the work
- c. Completion certificate of one work of similar nature of magnitude equal to at least 80% of the quantum of work proposed in the tender.

9) SAFETY, HEALTH AND ENVIRONMENT

- i. The Contractor(s) shall take all precautions to avoid accidents by exhibiting necessary caution boards. He shall be responsible for all damages and accidents caused to existing/new work due to negligence on his part. In case of any accident of labour / contractual staff the entire responsibility will rest on the part of the contractor and any compensation under such circumstances if becomes payable shall be entirely born by the contractor.
- ii. Appropriate personnel protective equipment's such as helmets, gloves, goggles, aprons, safety belts etc.. shall be provided to the workers employed at work site.
- iii. All hazardous materials shall be labeled with the name of the materials, the hazards associated with its use and necessary precaution to be taken.
- iv. Contractor shall ensure that during the performance of the work, all hazard to the health of personnel, have been identified, assessed and eliminated.
- v. The contractor has to keep a record of all the workers employed at site, make daily attendance along with the location of the work. All the labour record shall be made available for inspection and verification as and when required.

10) PROGRAMME CHART:

The Contractor shall prepare an integrated bar chart for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, material and equipment required for the fulfillment of the contract within the stipulated period or earlier and submit the same for approval within ten days of award of the contract.

The programme chart should include the following:

1. Descriptive note explaining sequence of the various activities.
2. Network (PERT / CPM / BAR CHART).
3. Programme for procurement of materials / equipment / labour by the contractor.

If at any time, it appears that the actual progress of work does not conform to the approved programme referred above, the contractor shall produce a revised programme showing the modifications to the approved programme to ensure completion of the work. The modified schedule of programme shall be approved by the Engineer in charge.

The submission for approval of such programme or the furnishing of such particulars shall not relieve the contractor of any of the duties or responsibilities under the contract. This is without prejudice to the right of Project Engineer cum Estate Officer to take action against the contractor as per terms and conditions of the agreement.

11) QUALITY ASSURANCE:

- i. The contractor shall establish, document and maintain an effective quality assurance system as outlined in the specifications and various codes and standards.
- ii. The bidder shall understand scope of the work, drawing, specifications and standards etc. attached with the tender or to be followed and shall seek clarification, if any before submission of the tender
- iii. The quality assurance system plans / procedures / method statement to be followed shall be furnished in the form of quality assurance manual. It should cover quality assurance, plan procedure, specifications, frequency of the inspection, testing, acceptance criteria, method of sampling, testing etc. to be followed for quality.
- iv. The approval of quality assurance does not absolve the contractor of the contractual obligations towards executing the work as laid down in the specification of the work.
- v. The contractor shall produce quality control records in the formats approved by Engineer-in-charge in the quality assurance plan.
- vi. The contractor shall ensure the enforcement of quality assurance plan by all his specialized agencies as approved. The Project Engineer cum Estate Officer reserves the right to inspect, witness, review any stages of the work at shop / site as deemed necessary for quality assurance and / or timely completion of work.
- vii. The contractor shall procure required materials in advance so that there is sufficient time for testing of the materials and clearance of the same before use in the work. The contractor shall provide at his own cost suitable measuring arrangements at site for checking the dimensions as may be necessary for execution of work.

12) TESTING OF MATERIALS

All the required tests as per Technical Specification should be conducted at the cost of the contractor, unless specifically mentioned otherwise. All materials which are to be tested at the manufacturer's works shall satisfactorily pass the tests in presence of the authorized representative of IISC before being used in the work. In case all requisite testing facilities are not available at the manufacturer's premises, such testing shall be conducted at approved laboratory. The charges for such testing shall be borne by the contractor.

6. GENERAL CONDITIONS

DEFINITIONS OF TERMS

In constituting these conditions and specifications, the following expressions shall have the meaning, therein assigned to them unless there is something repugnant in the subject of context in consisting with such meanings.

- 6.1 Institute shall mean the "Indian Institute of Science, Bangalore".
- 6.2 "Office" shall refer to the Office of the Project Engineer cum Estate officer.
- 6.3 "Contractors" shall mean the tenderer whether a firm, registered company, partnership or any individual whose tender has been accepted by Institute or by an Officer (duly authorized in this behalf) on behalf of the Institute and who has entered into agreement with Institute for due fulfillment of the contract and shall include the legal representatives, successors, heirs and assignees of the tenderer.
- 6.4 "Engineer" shall mean the "Project Engineer cum Estate officer", Indian Institute of Science, Bangalore or such other officer as may be appointed to call as the Project Engineer cum Estate officer for the purpose of the contract and shall also mean and include other officers of equivalent rank directly in charge of the work or any part thereof under administrative control of the Director, IISc, Bangalore-12.
- 6.5 When the Engineer is named as final authority, it includes all the above-mentioned officers and, in such matters, the contractors shall have the right of appeal against the orders up to the Director, IISc, Bangalore, whose decision shall be final and legally binding on all the parties concerned.
- 6.6 The Project Engineer cum Estate officer named as final authority for any decision taken, shall mean only the Director, IISc, Bangalore or his duly authorized assistant.
- 6.7 The Engineer in charge shall mean the Project Engineer cum Estate officer directly in charge of the work or his duly authorized assistants.
- 6.8 Plant shall mean and include any or all plants, machinery, tools and other implements of all description necessary for the execution of the work in a safe and workmen like manner.
- 6.9 The expression "Works" where used in these conditions shall unless thereby something in the subject or contract repayment to such construction, be construed to mean the work or the works constructed to be executed under or virtue of the contract whether temporary or permanent and whether original, altered, substituted or additional.
- 6.10 "Contract and contract document" shall mean and include the notice inviting tenders, proceedings of the pre bid meeting, the stamped agreement, conditions of contract, specifications and Schedules 'B', drawings and all other connected documents with tender schedule.
- 6.11 "Specifications" shall mean the specifications annexed and where these are not specifically mentioned shall be as may be detailed and necessary due to particular nature of work as approved by the Project Engineer cum Estate officer.
- 6.12 "Site" shall mean and include all the area in which operations in respect of the work are carried out. This shall also include materials stacking yards and the area where temporary structures are put up for installing any machinery etc.
- 6.13 "Tests" shall mean such tests as are required to be carried out either by the contractor or by the Project Engineer cum Estate officer from time to time on completion as detailed in the specifications before the work is certified as being satisfactory and is taken over by the Project

Engineer cum Estate officer.

6.14 "Month" shall mean a Calendar month.

6.15 "Prime contractor" means a firm that performs construction work itself and that the work is directly entrusted to the firm by the owner / Government / local body / Quasi Government / Government undertaking. Words used in singular shall also include the plural & vice-versa where the context so demands.

6.16 **CONTRACTOR TO INSPECT SITE:**

The contractor shall visit and examine the construction site and satisfy himself as to the nature of the existing roads or other means of communications, the character of the soil for the excavations, the extent and magnitude of the work and facilities for obtaining materials and shall obtain generally his own information on all matters affecting the execution of the work. No extra for charges made in consequence of any misunderstanding or incorrect information on any of these points or on the grounds of insufficient description will be allowed. All expenses incurred by the contractor in connection with obtaining information for submitting this tender including his visits to the site or efforts in compiling the tender shall be borne by the Tenderer and no claims for reimbursement thereof shall be entertained.

6.17 **ACCESS TO SITE:**

The Contractor is to include in his rates for forming access to the site, with all temporary roads and gangways required for the works.

6.18 **SETTING OUT:**

The Contractor shall set out the building in accordance with the plans. All grid/center lines shall be pegged out to the satisfaction of the Engineer. The Contractor shall be responsible for the correctness of the lining out and any inaccuracies are to be rectified at his own expense. He will be responsible for taking ground levels of the site before setting out and recording them without any extra charge.

The Contractor shall construct and maintain proper benchmark at the intersection of all main walls, columns, etc., in order that the lines and levels may be accurately checked at all times.

6.19 **TREASURE TROVE:**

Should any treasure, fossils, minerals, or works of art of antique interest be found during excavation or while carrying out the works, the Contractor shall give immediate notice to the Engineer of any such discovery and shall make over such finds to the Institute.

6.20 **ACCESS FOR INSPECTION:**

The Contractor is to provide at all times during the progress of the works and the maintenance period proper means of access, with ladders, gangways etc., and the necessary attendants to move and adapt as directed for the inspection of measurement of the works by the Engineer or their representatives.

6.21 **ATTENDANCE UPON ALL TRADERS:**

The Contractor shall be required to permit tradesmen/ Specialized agencies appointed by the employer to execute works like water supply, Sanitary, Electrical installation, lifts, air conditioning, hardware and other specialized works. The contractor shall also permit the above-mentioned agencies to use his scaffolding and retain the scaffolding till such works are completed. The rates quoted by the contractor shall be inclusive of the above facility.

6.22 **GATEKEEPER AND WATCHMAN:**

The Contractor from the time of being placed in possession of the site must make arrangements for watching, lighting and protecting the work, all materials, workmen and the public by round the

clock on all days including Sundays and holidays at his own risk and cost.

6.23 STORAGE OF MATERIALS:

The Contractor shall provide for necessary sheds of adequate dimension for storage and protection of materials like cement, steel, lime, timber and such other materials including tools and equipment which are likely to deteriorate by the action of sun, wind, rain or other natural causes due to exposure in the open. The cement storage site shall be leak proof and shall hold at least 4 months requirement. All such sheds shall be cleared away and the whole area left in good order on completion of the contract to the satisfaction of the Engineer.

All materials which are stored on the site such as bricks, aggregates etc., shall be stacked in such a manner as to facilitate rapid and easy checking of quantities of such materials.

6.24 COST OF TRANSPORTING:

The Contractor shall allow in his cost for all transporting, unloading, stacking and storing of supplies of goods and materials for this work on the site and in the places approved from time to time by the Engineer. The Contractor shall allow in his price for transport of all materials controlled or otherwise to the site.

6.25 W.C. AND SANITARY ACCOMMODATION AND OFFICE ACCESSORIES AND ACCOMMODATION:

The contractor shall provide at his own cost and expense adequate closet and sanitary accommodation complying in every respect to the rules and regulations in force of the local authorities and other public bodies, for his workmen, for the workmen of nominated sub-contractors and other contractors / specified agencies working in the building, the Project Engineer of works and other Institute agents connected with this building project and maintain the same in good working order.

The Contractor shall also provide at his own expense adequate office accommodation for the Project Engineer of works preferably contiguous to his office and shall maintain the same in a satisfactory condition and shall provide light, fan and attendant etc., for the same and shall remove them after completion of the works. He shall arrange to provide latest survey Instruments and at all times maintain the same in good working order at site, to enable the Project Engineer of works or other representative of Institute to check the lines and levels of the work.

6.26 MATERIALS:

Materials shall be of approved quality and the best of their kind available and shall conform to I.S. specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on site well ahead of requirement for use in the work. The work-involved calls for high standard of workmanship combined with speed and to the entire satisfaction of the Project Engineer.

6.27 TO ASCERTAIN FROM CONTRACTORS FOR THE OTHER TRADES.

The Contractor shall ascertain from all agencies / Sub-contractors all particulars relating to their work with regard to the order of its execution and the position in which chases, holes and similar items will be required; before the work is taken in hand as no patch works shall be allowed for cutting away work already executed in consequence of any neglect to ascertain these particulars beforehand.

6.28 SAMPLE APPROVAL:

Before ordering materials, the Contractor shall get the samples approved from the Project Engineer

cum estate officer well in time.

6.29 TESTING OF WORK AND MATERIAL:

The Contractor shall, if required by the Engineer arrange to test materials and/or portions of the works at his own cost in order to prove their soundness and efficiency. If after any such test the work or portion of works is found in the opinion of the Engineer to be defective or unsound, the Contractor shall pull down and redo the same at his own cost. Defective materials shall immediately be removed from the site at his own cost.

6.30 FOREMAN AND TRADESMEN:

All Tradesmen shall be experienced men properly equipped with suitable tools for carrying out the work of carpentry and joinery and other specialist trades in a first-class manner and where the Engineer deem necessary, the Contractor shall provide such tools which are considered necessary for carrying out of the work in a proper manner.

All such tradesmen shall work under an experienced and properly trained Foreman, who shall be capable of reading and understanding all drawings, pertaining to this work and the contractor shall also comply with other conditions set out in different clauses of the conditions of the contract.

6.31 PROJECTPROGRAMME OF WORKS AND WEEKLY PROGRESS REPORT:

a) Organization chart:

The contractor should submit the proposed organization chart for the project including the details of staff to be deployed full time on site to the approval of Project Engineer, where the PROJECT ENGINEER raises any objection to either the qualification or experience or required professionalism of any of the staff deployed by the contractor, the same shall be replaced by suitably competent person to the approval of PROJECT ENGINEER within 7 days.

b) Program chart:

The Contractor shall furnish the detailed programme of execution for timely completion of the project (inclusive of rainy season). Such a detailed program of works prepared using Industry Standard Scheduling Software like **MS Project 2000 or Primavera** shall be submitted by the Contractor within ten days after receiving communication of tender acceptance. As per the detailed drawings and schedule of quantities; the contractor shall work out concurrent activities with start and finish times, integrating of all tasks with interface and milestone event drawn and to evaluate for reduction in total project duration through improved over lapping of tasks and activities where feasible. The Contractor shall plan for improved planning and scheduling of activities and forecasting of resource requirements, ability to use the computer effectively to produce timely valid information for Project Management purpose. Accordingly, PERT; CPM Networking shall be drawn. GANNT charts shall also be furnished. The Contractor shall also furnish necessary particulars to the Project Engineer of works for compiling weekly progress reports in the form furnished by the Institute. A monthly financial programme shall also be submitted.

6.32 CLEARING OF SITE:

The contractor shall after completion of the work clear the site of all debris and left-over materials at his own expense to the entire satisfaction of the Institute. The same should be carted out of the Institute at his own cost.

The contractor shall also clear the labour camp/RMC plant of all types of permanent/temporary structures, soak pits, sump, septic tanks or any other such installations as identified by the PROJECT ENGINEER to the entire satisfaction of the Institute. The debris/excess stuff shall be carted out of

the Institute at his own risk and cost.

6.33 PHOTOGRAPHS:

The Contractor shall at his own expense supply to the Institute photographs in duplicate copies not less than 25 cm x 20 cm. (10" x 8") along with soft copy, of the works taken from all the portions of the building at intervals of not more than one week during the progress of the work, or at every important stage of construction, as directed by the Project Engineer of work.

6.34 PROVISION OF NOTICE BOARD:

The Contractor shall provide a notice board on proper supports 3m x 2m (10' x 6') in a position approved by the Engineer. He shall allow for painting and lettering stating name of work; name of Architects; Structural Consultants; General Contractor and Sub-Contractors. All letters except that of the name of the work shall be in letters not exceeding 5 cm. in height and all to the approval of the Engineer. Proper barricading shall be erected all-round the site before commencement of the work.

6.35 PROTECTION:

The contractor shall properly cover up and protect all work throughout the duration of work until completion, particularly masonry, moldings, steps, terrazzo or floor finishes, staircases and balustrades, doors and window frames, plaster angles corners lighting and sanitary fittings, glass, paint work and all finishing.

6.36 PREPARATION OF BUILDING FOR OCCUPATION AND USE ON COMPLETION:

The whole of the work shall be thoroughly inspected by the Contractors and all deficiencies and defects set right. On completion of such inspection, the Contractor shall inform the Engineer in writing that he has finished the work and it is ready for the Engineer's inspection.

On completion, the Contractor shall clean all windows and doors and all glass panes, including cleaning of all floors, staircases and every part of the building including oiling of all hardware. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Engineer.

6.37 The tenderer must understand clearly that the rates quoted are for complete items of works including charges due to materials, labour, all lead and lift, HOM of plant and machineries, scaffolding, supervision, service works, power, all types of royalties, GST, labor cess, all types of taxes payable to the Govt and local bodies, overhead charges, etc., and includes all extra to cover the cost of night work if and when required and no claim for additional payment beyond the prices or rates quoted will be entertained for payment subsequently towards any claims on the grounds of misrepresentation or on point that he was supplied with information given by promise or guarantee by the Institute, or by any person whether member of or employee in Institute will not be entertained. Failure on the contractor's part to obtain all necessary information for the purpose of submitting his tender and quoting rates therein shall not absolve him of any risk or liability consequent upon the submission for tender.

6.38 All the works shall be carried out as per specifications prescribed by BIS, National Building code, CPWD / KPWD specifications, relevant IS codes or as directed by the Project Engineer in the absence thereof.

6.39 In case there is any conflict in the specifications and drawings the decision of the Project Engineer cum Estate officer shall be final and binding on the contractor.

- 6.40 All the materials shall be got approved by the Project Engineer cum Estate officer before use.
- 6.41 The rates quoted for in individual items shall include labour, cost of materials conveyance and lift charges for all materials required for successful completion of work and all taxes payable to any authority as per rules in vogue from time to time.
- 6.42 Necessary pillars shall be constructed by the Contractor for benchmark at no extra cost as directed by the Project Engineer.
- 6.43 Site order book shall be maintained in the work spot and the contractor shall sign in the order book in token of having gone through the instructions issued by the inspecting officers and carryout the instructions promptly.
- 6.44 In the work spot the contractor shall provide suitable temporary office with a covered area of 1000 sq.ft matching that of the Contractor's office with necessary furniture for use of Institute as directed by the Project Engineer for which no extra payment or compensation shall be claimed. The furniture however will after completion of the work, be the property of the contractor and shall remove them at the close of the contract.
- 6.45 The contractor shall take all precautions against damage from accident. No compensation will be allowed to the contractors for their tools and plant materials lost or damaged from any cause. The contractor is liable to make good the structure or plants damaged by any other cause at his own cost. The Institute will not pay the contractor for corrections or repairing any damaged portion of work done during construction.
- 6.46 The contractor shall employ adequate no. of skilled & unskilled labours required for successful timely execution of work. He shall submit daily reports to the Engineer in charge regarding the strength of labour employed both skilled and unskilled.
- 6.47 The contractor shall furnish weekly medical report showing number of persons ill or incapacitated and nature of their illness, to the Project Engineer.
- 6.48 The contractor shall furnish a report of any accident which may occur, within 24 hours of its occurrence to the Project Engineer.
- 6.49 The contractor shall keep on site of work a qualified Engineer as required as per rules of registration as their authorized representative who will receive all instructions given from the Institute officers. The representative shall have permanent office at site of work where communications can be sent and notices can be served by the Project Engineer throughout the duration of work.
- 6.50 Prior approval should be obtained from the Project Engineer for the construction and location of the temporary site office, store sheds and labour quarters, within the premises of the site, similarly the contractor shall get approval of the Project Engineer regarding the areas to be utilized for stacking the materials etc., for the work.
- 6.51 Reference to detailed specifications are indicated against the items contained in the Schedule 'B', in case there is any item for which no detailed specifications is indicated, it shall be carried out as per specifications intimated by the Project Engineer. The contractor shall not be entitled for any extra claims or compensation on this account. In case of additional or extra items not covered by the Schedule 'B', the contractor shall carry out the work as per specifications intimated by the Project Engineer.
- 6.52 The Engineer shall have the right to direct the contractor to progress the various items of works in

the manner prescribed by him.

- 6.53 Failure to adhere to any of the above will be sufficient cause for taking action under clause (2) or clause (3) or both along with their sub clauses of conditions of contract.
- 6.54 Contractor shall make arrangements at his own cost to construct approach road for conveyance of materials etc., preferably on the alignment accepted by the Institute to procure land etc. for housing, staff and workmen near the site of the work.
- 6.55 It is not possible for the Institute to release any quarry (metal and sand etc.) for this work. The contractor has to make his own arrangements. No claim regarding leads and lift will be accepted.
- 6.56 The contractor has to make his own arrangements in regard to power supply and water required for construction and drinking water facilities.
- 6.57 Tool, Tax, Octroi, Royalty for collecting earth, gravel, sand, stone, excise duty, GST, labour cess or any other tax payable on account of this contract shall be met by Contractor.
- 6.58 The contractor shall be entirely responsible for sufficiency of the scaffolding, timbering, machinery, tools, implement and generally of all means used for fulfillment of the work. Whether such means may not be approved or recommended by the Project Engineer, the contractor must accept at his own cost all risks of accidents or damages.
- 6.59 After completion of the work, service drawings as per actual execution in Auto CAD should be submitted by the agency for services such as Electrical, Water supply and Sanitary before submission of final bill.
- 6.60 Extra care shall be taken regarding the laborers by providing waist belt, Helmets scaffolding etc. at your own cost and supervision and shall be carried out as per the directions of the Project Engineer.

6.61 WORKMANSHIP AND LABOUR:

The quality of all materials, tools, operators and labour used on the work shall be subject to the approval of the Project Engineer cum Estate officer or his authorized agent who shall have power to order immediate removal by the contractor any of the above that may not meet with his approval. In case of failure to carry out orders of removal within the time specified, the Project Engineer or his authorized agents shall get the same removed at the contractor's expense.

6.62 KEEPING DRY AND PUMPING:

Unless otherwise provided for in the contract, the contractor will at his own expense keep all portions of the work free from undue water, whether due to springs, soakage or inclement weather and will use his own implements and machinery for this purpose.

6.63 BAILING OUT OR DEWATERING:

Adequate arrangements shall be made by the contractor for dewatering the foundation trenches and excavation and keeping the same dry while the masonry or concrete work is in progress and till the Project Engineer considers that the mortar is sufficiently set.

The rates for the various items include the cost of shoring, strutting, coffer dam, channels or other incidental devices necessary for diverting the water met within foundation. The cofferdam and the diversion channel shall, however, be maintained in good and working condition till the completion of the structure or until such time, as in the opinion of the Project Engineer till the coffer dam or/and diversion channel is no longer necessary. Bailing out water necessitated by the failure to maintain the cofferdam and diversion channel will not be paid for separately under any conditions.

No extra rate shall be paid for removing any stuff outside, which might find excess due to rains or for reasons whatsoever from the sides or bottom of the foundation trenches and excavation or from also where when the dewatering operations are in progress.

The contractor must assure himself by making the necessary investigation regarding the depths to which foundations are likely to go. If any work is ordered to be done beyond dimensions or

deviations marked in the drawings, no extra rate other than the rate for the Undertaking of work quoted by the contractor be paid.

The contractor will make himself arrangements for necessary plant such as Pump, engines, and other materials required in this connection.

6.64 FACILITIES FOR INSPECTION:

The work at all times be open for inspection by the Project Engineer or his duly authorized Assistant and the contractor shall arrange easy access to every part of the work and shall provide such ladders, scaffolding and lifts for this purpose as necessary at his own cost.

6.65 DELIVERY OF WORKS:

The final bill will be prepared after the work is handed over to the Project Engineer or his duly authorized representative in a thoroughly complete, clean, sound and workman like state.

6.66 EXTRA ITEM:

Whenever the contractor is ordered by the Project Engineer or the person duly authorized by him to execute any item of work, which is not in his tender, it shall be the contractors duty to see that the order is duly entered in the order book on the work, unless a separate communication to this effect is received by him, it shall be his duty to get the rates sanctioned for the item by the appropriate authority. For any extra item of work not thus ordered either by any entry in the order book or separate communication, the contractor shall have no claim to payment.

6.67 COMPLIANCE WITH BYELAWS AND PROTECTIONS AGAINST ACCIDENTS, ETC:

Contractor is responsible for complying with all acts, bye-laws, Municipal and other regulations for the provision and maintenance of lights during nights, barricading, providing any other protection that may be necessary and will be liable for all claims that may arise from accidents of nuisance caused by works.

6.68 DISPUTES:

Disputes on the points between the Project Engineer and the contractors shall be referred to the Center for campus management and Development, whose decision shall be given in writing and shall be final and binding on the contractor.

6.69 DUTIES AND LEVIES :

The contractor shall unless otherwise specially stated in the contract, be responsible for the payment of all import duties, octroi duties, GST, quarry fees etc., on all materials and articles brought to site.

6.70 CLEARANCE OF SITE:

The site described and shown on the plan is to be cleared of all obstruction, loose stones and materials, rubbish of all kinds of shrubs and brushwood, the roots being entirely removed. The products of the cleaning to be stacked in such a place and manner as ordered by the Project Engineer.

In jungle clearing all trees not marked for preservation, jungle wood and brushwood shall be cut down and their roots entirely removed up. All wood and materials from the clearings will be property of the Institute and should be stacked as the Engineer in charge directs. Trees shall not be cut without prior permission of the Institute.

All holes or hollow, whether originally existing or produced by digging up roots, shall be carefully

filled up with earth well rammed to the required density and leveled off, as may be directed.

6.71 LINE OUT:

The contractor shall use necessary measuring instruments, theodolite, workstation and other materials like flags, strings, pegs, nails, pillars, paints, etc., and also Labour required for ascertaining of the initial ground levels at the different stages of excavation and construction of masonry or other structures at his own cost. Any dispute in regard to the accuracy of the measuring instruments and the device shall be subjected to the final decision of the Engineer-in charge of the work.

6.72 MACHINERY: All the machinery that will be employed on the work shall be approved, efficient and thoroughly, complying with the specifications of each machine or parts and shall have been manufactured by reputed and qualified firms. All the machinery employed on the work shall be open to inspection at all working hours, by the Project Engineer and any defect shall be rectified, repaired, replaced, renewed or remodeled so that its performance in the opinion of the Project Engineer is satisfactory. Any defective part of the machine, which requires replacement, shall be promptly replaced, failing which the Engineer-in-charge, shall be at liberty to cause the defective fittings removed from site of work at the cost of the contractor.

6.73 OPERATORS: The machines shall be in charge of efficient and trained operators, which terms shall include drivers, mechanics or other personnel who are actually operating the machines. The Engineer in-charge has the right to test operators, etc., as deemed necessary by him for the class of machinery, which he is to operate and shall drive out such of the operators who fail in the tests.

6.74 SAFETY PRECAUTION: All reasonable safety precautions for the safety of workers shall be taken. The contractors shall be responsible for the maintenance of all regulations under the Factory Act, workmen's compensation. Minimum wages act and other act for the safety and welfare of the workers employed by him. In addition, the contractors shall provide adequate protection to all workers employed by him against natural elements such as rain, sun, wind etc., during working hours and provide free, pure protected drinking water during working hours.

6.75 NON-STOP OPERATION:

In the continuous or non-stop operations suitable shifts or working hours for each shift shall be maintained. The contractor is liable for all reasonable extra payment for all extra hours of work done by the workers employed by him.

6.76 TESTS:

The Project Engineer cum Estate officer or his authorized representatives shall have full scope and right of entry at all times to examine and test, measure, count, weigh, take bores, or in any manner satisfy himself that the work executed is according to the specifications and required strength. Any portion of work got disturbed, during such tests, shall be made good by the contractors, without extra cost. The Engineer in charge has the right to change the design proportions, mixes within reasonable limits to ensure requisite strength of the structure. Laboratory for requisite tests shall be established by the Contractor at site only, at his own cost.

6.77 ADEQUATE ARRANGEMENTS TO ACHIEVE PROGRESS:

The Project Engineer shall have the right to advise the contractor on the strength, quality and nature of labour to be employed on work to maintain progress on the work, commensurate with the strength of structure. Similarly, he shall advise the contractor on the nature and adequacy of the machinery that are required on the work.

6.78 DETAILS TO BE FURNISHED FOR ENGAGING SUB-CONTRACTOR FOR SPECIALISED

WORKS:

The tenderer shall be required to engage agencies of standing and repute who have experience in executing works of similar nature and magnitude. Such specialized trades cover electrical installation (HT/LT), Lifts, A.C. sanitary and water supply works, firefighting installation and any such other trades as may be directed by the Institute. The successful tenderer shall be required to engage Sub-agencies for such specialized trades only with the prior written approval of the Project Engineer cum Estate officer after giving an opportunity to the Project Engineers Estate officer to evaluate the experience and competence of the sub-agency for each trade. In order to ensure implementation of this requirement, it is required that each tenderer shall submit along with his tender, names of three sub-agencies for each trade amongst whom tenderer proposes to engage if successful in the tender. Along with names of sub-agencies for each trade, the tenderer shall furnish in detail the following particulars in respect of each sub-agency in the format furnished in Technical Bid.

All such information concerning sub-agencies shall be furnished along with the tender. Any tender containing insufficient information in this regard is liable for rejection. In the event of non-compliance of this requirement, the Institute shall have the right to nominate any sub-agency who in their opinion meets the selection criteria. In such event it would be incumbent on the successful tenderer, to accept and appoint then nominated sub-agency without demur and on this account, if there is any additional cost, such cost shall be borne by the successful tenderer. The Institute shall have no liability on this account. The Institute has the right to evaluate the experience, reputation etc., of such sub-agencies and on their approval in writing to the successful tenderer, successful tenderer shall be required to engage only such approved agencies for execution.

If the Institute is not satisfied with the performance or capability of the names in the panel furnished by the tenderer, the successful tenderer shall be required to engage an agency nominated by Institute. In all these matters, there shall be no additional financial implication to the Institute. The successful tenderer shall be required to execute works within the accepted rates only and no claim will be accepted due to the Institute, insistence on engaging any sub-agency. The Institute further reserves the right to instruct the successful tenderer to terminate the work of sub-agency at any time during the contract, if the performance is found unsatisfactory. In such case, the successful tenderer shall be required to furnish a further panel of names from whom a similar selection can be made by the Institute. In this instance also, the Institute is not liable for any additional cost. Responsibility for the delay occurred in this process, if any shall rest with the successful tenderer.

It is the responsibility of the successful tenderer to ensure that the sub-agencies engaged in the work comply with all the clauses in the agreement between the Institute and the successful tender. It shall be responsibility of the successful tenderer to exercise first line supervision on the works executed by his subagencies including supervision on the quality of materials and workmanship and to ensure that the subagencies comply with the technical specifications, drawings and bill of quantities. The successful tenderer shall also establish competent site organization technically and administratively to ensure that the works of various sub-agencies are supervised and well co-ordinate to ensure proper sequencing of construction and finishing works and to ensure that the overall time schedule is fully complied with.

The detailed construction programme schedule to be furnished by successful tenderer shall include action plan for procurement of materials and execution of works at site for each of the sub-agency and the detailed construction programme schedule shall reflect proper integration of each component of the building to ensure well-coordinated execution so as to complete the project including services within the stipulated time schedule.

6.79 Existing service lines such as electrical, water supply, sewer lines, telephone lines etc., shall be

carefully protected and preserved before commencement and during excavation, dismantling /demolition operations. Details of Facilities shall be provided to the successful tenderer. Any damage caused to the aforesaid service lines, etc., during excavation, demolition/dismantling shall be made good at Contractor's own expense/cost. Restoration of any service lines, which needs to be shifted and found in the proposed site, is the responsibility of the contractor and the agency shall carry out the work as per the direction of Project Engineer the cost of such work will be borne by the Institute.

6.80 Dust nuisance to neighbour shall be minimized by providing and erecting screens to the required height as per direction of Project Engineer cum Estate officer with Aluminum sheets or canvas or other suitable material before commencement of the work. The site shall be cleared off such protection arrangement after virtual completion of work. All the operations shall be carried out strictly in accordance to regulations of municipal and other local authorities and shall be restricted to normal working hours.

6.81 No debris or materials got from dismantlement/demolition the building(s) shall be thrown in the public road causing inconvenience to the traffic and any fine or penalty imposed by local authority for non-compliance of this provision shall be borne by the contractor.

6.82 The Contractor shall be responsible for any injury to persons, animals, or things and for all structural damage to property which may arise from the operation or neglect of himself and or any nominated sub-contractors, contractor's Employees and or third party whether such injury or damage arising from carelessness, accident or any other cause whatsoever, in any way connected with the carrying out the construction/dismantling/demolition.

The contractor shall take required insurance cover with an approved insurance company as provided in the contract and deposit with the Institute well before commencement of construction/ demolition / dismantling.

6.83 **Preservation of trees:** The contractor shall preserve all existing trees in and adjacent to the site which does not interfere with the construction as determined by the Engineer-in charge.

6.84 **Drawings and working Details:** The work shall be carried out strictly in accordance with the approved plans and estimates and specifications and as per the instructions of the Engineer-in-charge, and no deviations or changes are permitted without the written order of the Engineer. The designs and drawings enclosed with the tender documents are only typical and tentative. The working drawings and the working details of the several components of works will be prepared and made available at the time of execution and the contractor shall carryout the work in accordance with such working drawings and working details.

6.85 **Omissions and discrepancies in drawings and instructions:**

In all cases of omissions, doubts or discrepancies in the dimensions or discrepancies in the drawings and item of work, a reference shall be made to the Project Engineer cum Estate officer, whose elucidation and elaboration shall be considered as authorized. The Contractor shall be held responsible for any error that may occur in the work through lack of such reference and precautions.

6.86 The contractor shall be responsible for accuracy for all shapes, dimensions, and Alignments both vertical and horizontal etc., of all the components of the work.

6.87 **Lands for the use of the Contractors Camp:**

The contractor shall have to make his own arrangements at his own cost for construction of living accommodation outside the IISc premises. The Employee shall not provide any space / building for labour camp.

6.88 **Undesirable Person to be removed from site:**

The contractor shall not employ on site any person who is undesirable, if in the opinion of the

Project Engineer the person or persons at site of work employed on behalf of the contractor is/are considered undesirable. The Project Engineer shall notify the contractor to this effect and the contractor will be bound by the decision of the Project Engineer to remove such person or persons from the site of work and from the labour camp. The contractor shall not be entitled to any damage or loss on this account. On the contrary, the contractor shall be liable to compensate the Institute for any loss or damage to the Institute property caused by the employment of such person.

6.89 Labour Statistics:

The contractor shall submit daily reports on the following:

- (a) Total No. of labour employed in the working area.

6.90 Execution of work during night time:

The work shall normally be carried out between 08.00 hours and 17.00 hours with a break of one hour and when permitted during night period, the second shift shall be between 17.00 hours and 00 hours with a break of half an hour during night. When ordered to work at night, adequate provision for lighting the working area should be made by the contractor at his cost and got approved by Engineer. The agency shall not be paid extra for the works executed during night.

6.91 Safety code:

- a) The Contractor at a prominent place at work spot should bring these safety provisions to the notice of all concerned by display on notice board. The persons responsible for compliance of the safety code shall be named therein by the contractor.
- b) To ensure effective enforcement of the rules relating to safety precautions, the arrangement made by the contractor shall be open to inspection by the Labour Officer, Engineer or his representatives.
- c) All necessary personal safety equipment's as considered adequate by the Engineer should be kept available for immediate use of persons employed at the site and maintained in the good condition and the contractor should take adequate steps to ensure proper use of equipment by those concerned.
- d) Workers employed on mixing concrete, cement grout, cement mortar shall be provided with protective footwear protective goggles and protective gloves. Those engaged in mixing or stacking cement or any materials injurious to the eye, nose and mouth shall be provided with a face mask and protective cover free of cost by the contractor.
- e) Those engaged in welding work shall be provided with welder's protective eye Shield and gloves. Stonebreakers shall be provided with protective goggle and protective clothing and seated at sufficiently safe intervals.
- f) Those engaged in binding and fabricating steel shall be provided with protective gloves.
- g) Those engaged in deep cuts, large rock excavation shall be provided with helmets.
- h) All labour / persons at work shall wear helmet compulsorily.
- i) When the work is near any place where there is risk of drowning all necessary equipment's shall be kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provisions should be made for prompt first aid treatment of all injuries likely to be sustained during the course of work.
- j) Adequate and suitable caution and danger signal boards shall be prominently exhibited at road/high tension overhead line/where heavy electrical machines are working where overhead cranes or hoist; derricks, winches are working where blasting zone is demarcated. The content of the board shall be in English and the local language for easy identification.
- k) All scaffolding, ladder, stairways, gangways, staging, centering, form work and temporary support and safety devices etc., shall be sound in strength and constructed and maintained as such throughout its use. The agency shall obtain approval from Project Engineer cum Estate

officer for scaffolding, formwork etc., before commencement of work.

- l) No materials on any site of work shall be so stacked as to cause danger or inconvenience to any persons or public.
- m) The Contractor shall provide all necessary fencing and lighting to protect the public/working men from accident and shall be bound to bear the expense of defense of every suit action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost, which may be awarded in any such suit action or proceedings to any such persons or which may with consent of the contractor be paid to compensate any claims by any such person.
- n) No electric cables or apparatus, which is liable to be a source of danger to persons, employed shall remain electrically charged unless a caution Board is put into that effect and close approach to the same is prohibited.
- o) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosives. No floor, roof or other portion of any building used for residence shall be so overloaded with debris or materials so as to render it unsafe.
- p) The final disposal of water used for work or removed from work spot as well as the supply used for domestic consumption shall be as directed by the Engineer. The contractor shall make his own arrangement for purification of domestic water supply used by his staff and labour colony and used on the site of work to the satisfaction of the Engineer.
- q) The source of drinking water supply/distribution system in workers colony shall be protected from chances of contamination by poisonous materials epidemic causing infections bacteria etc., by maintaining the source and system under adequate hygienic conditions.
- r) Notwithstanding the above clauses, there is nothing in this to exempt the contractor to exclude the operations of any other Act or Rules in force of the Central Govt., State Govt.

6.92 AWARENESS OF SITE CONDITIONS AND CARRYING OUT OF SITE INSPECTION PRIOR TO TENDER SUBMISSION:

Prior to the preparation and submission of his Tender, the Contractor shall make visits to the site and carry out all the necessary inspections and investigations in order to obtain all information and to make his own assessment of the conditions and constraints at site, including the means of access to it. The Contractor shall make himself aware of all the features of the site and the working conditions and space and shall, in general, be responsible for obtaining all the necessary and requisite information needed for him to prepare and submit his Tender.

Should the Contractor require any clarifications he shall seek these in writing from the Project Engineer before submitting his Tender. At no stage will any extra claims be entertained or allowed on any matter or for any reason arising from or as a consequence of the Contractor's failure to comply with all the requirements stipulated in this Clause.

6.93 WORK AND WORKMANSHIP

To determine the acceptable standard of workmanship, the Project Engineer may order the Contractor to execute certain portions of works and services under the close supervision of the Project Engineer. On approval, they shall label these items as guiding samples so that further works are executed to conform to these samples.

6.94 TEST CERTIFICATES

The contractor shall submit copy of test certificates for all the major electrical equipment such as circuit breakers, CTs, PTs, instruments, relays, busducts, rising mains, busbars, cables etc., and

panel as a whole, confirming to relevant IS/BIS standards issued by manufacturers.

6.95 SAMPLES AND CATALOGUES

Before ordering the material necessary for these installations, the contractor shall submit to the Engineer-in-Charge/Consultants for approval, a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, circuit breakers, lighting fixtures, boxes etc., along with the catalogues with their dimensional details.

For major items such as sub lighting panels distribution boards, the submission of drawings/catalogues along with technical details shall be enough. Prior to ordering any electrical equipment/material/system, the contractor shall submit to the Engineer-in-Charge/Consultants the catalogues, along with the samples, where applicable, from the approved manufacturer. The contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the Engineer-in-Charge/Consultant.

Also, the contractor shall ensure that the dimensional details of the equipment fit into the allotted space provided in the building.

6.96 COMPLETION CERTIFICATE

On completion of the electrical installation a certificate shall be furnished by the contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out.

6.97 PERFORMANCE GUARANTEE

The contractor shall indemnify the Institute against defective materials and workmanship for a period of Five years after completion of the work.

6.98 RATE ANALYSIS

At any time and at the request of the Project Engineer the contractor shall provide details or breakdown of costs and prices of any part or parts of the works.

6.99 The Project Engineer reserves the right to delete any item from the contractor's scope of work.

7. CONTRACTOR'S LABOUR REGULATIONS

7.1 DEFINITION:

In these regulations unless otherwise, expressed or indicated the following words and expressions shall have the meaning hereby assigned respectively that is to say:

Labour means workers employed by the contractor or the Institute directly or indirectly through sub-contractor or any other person, or any agent on his behalf on a payment as per prevailing Karnataka State labour regulations and will not include supervisory staff like overseers etc.

Fair wages means whether for item or place of work notified at the time of inviting tenders for the work and where such wages have not been so notified, the wages prescribed by the Karnataka Public Works Department for the district in which the work is done.

Contractors shall include every person whether a sub-contractor head or agent employing labour on the work taken contract.

The relevant orders of Government of Karnataka in regard to payment of wages as amended from time to time shall be followed by the contractor.

7.2 WORKING HOURS:

Normally working hours of a labour employed should not exceed 8 hours a day. The working day shall be so arranged that inclusive of interval for rest if any, it shall not spread over more than 12 hours on any day.

When a worker is made to work for more than 8 hours on a day or for more than 48 hours in any week, he is entitled to double the ordinary rate of wages. Children shall not be made to work.

Every worker shall be given a paid weekly holiday normally on Sunday.

7.3 DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall (a) before he commences his work on contract, display and correctly maintain in a clean legible condition in conspicuous places on the work, notices in English and in the local language spoken by the majority of the workers, giving the rate of wages which have been certified by the Regional Labour Commissioner, as fair wages and the hours of work which such wages are earned, and a copy of such notices shall be sent to the certifying officers.

7.4 PAYMENT OF WAGES:

Wages due to every worker shall be paid to him direct.

7.5 FIXATION OF WAGES PERIODS:

The contractor shall fix the wages period of which the wages shall be payable. Wages of every worker employed on the contract shall be paid.

In case of establishments in which the wage period is one week, within three days from the end of the wage period wages shall be paid. In the case of other establishment before the expiry of the 7th day or 10th day from the end of the wage period according to the numbers of the workers employed in such establishment does not exceed 100 or exceeds 1000.

When the employment of any workers is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the days succeeding the one which his employment is terminated.

All payment of wages shall be made on a working day except when the work is completed before the expiry of the wages period in which case final payment shall be made within 48 hours of the last working day at work site and during the time.

NOTE: The term working day means a day on which the labour is employed, and the work is in progress.

7.6 FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES:

The Wages of workers shall be paid to him without any deductions of any kind except the following deductions:

Deductions for absence for duty i.e., from the place or the places whereby the terms of his employment he is required to work. The amount of deductions shall be in proportion to the period for which he was absent.

Deductions for damage or loss of goods expressly entrusted to the employed person for custody or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to neglect or default.

Deduction for recovery of advance or for adjustment of over payment of wages, advance granted shall be entered in a register.

And other deductions which the Institute may from time to time allow.

7.7 Fines:

No fine shall be imposed on any worker save in respect of such acts and the Commissioner of Labour has approved omissions on his part as.

No fine shall be imposed on a worker and no deduction for damage or loss be made from his wages until the worker has been given an opportunity. Undertaking of showing cause against such fines or deductions.

The total amount of fines which may be imposed in any one wage period on a worker shall not exceed an amount equal to the wages payable to him in respect of that wage period.

No fine imposed on any worker shall be recovered from him by instalments or after the expiry of sixty days from the date which it was imposed.

Every fine shall be deemed to have imposed on a day of the act or omission in respect of which it was imposed.

The contractor shall issue an employment card in Form III to each worker on the day of the worker's entry into the employment. If the worker has already any such card with him for the previous employment of contractor, he shall merely endorse that employment card with relevant entries. On termination of employment, the employment card shall again be endorsed by the contractor and returned to the worker.

7.8 REGISTER OF UNPAID WAGES:

The contractor should maintain a register of unpaid wages in such a form as may be convenient at the place of work but same shall include the following particulars:

- Full particulars of the labourer's whose wages have not been paid.
- Reference number of the muster roll and wage register
- Rate of wages

- The period
- Total amount not paid
- Reasons for not making payment
- How the amount of unpaid wages was utilized
- Acquaintance with dates.

7.9 REGISTER OF ACCIDENTS:

The contractor shall maintain a register of accidents in such form as may be convenient at the workplace but the same shall include the following particulars.

- Full particulars of the laborers who met with accidents.
- Rate of wages
- Sex
- Age
- Nature of accidents and cause of accident
- Time and date of accidents
- Date and time when admitted in Hospital
- Date of discharge from the Hospital.

The agency shall alone be liable to pay compensation for any damage/death/injury sustained by the personnel or any other members of the agency in the course of their work/duty at the Institute during the contract period. Govt. of India issued guidelines on payment of compensation in cases of death / permanent incapacitation of person due to unintended/ unforeseen occurrences during maintenance, operation and provisioning of public services. Under these guidelines, the agency has to pay an amount of Rs. 10 Lakhs as compensation in the cases where a person is died and up to Rs. 7.5 Lakhs in the case of disabled based on loss of earning capacity. Institute has the right to recover further penalty in the cases where the incidents have happened with the negligence of the agency.

7.10 REGISTER OF FINES ETC.

The contractor shall maintain a register of fines and a register of deductions for damages or loss in form Nos. I and II respectively which shall be kept at the place of work.

The contractor shall maintain both in English and local language a list approved by Commissioner for labour clearly stating the acts and commissions for which penalty or fine may be imposed on a workman and display it in a good condition in conspicuous place on the work.

7.11 SUBMISSION OF RETURNS:

The contractor shall submit periodical returns as may be specified from time to time.

7.12 AMENDMENTS:

The Government of Karnataka may from time to time add to or amend the regulations and on may question as to the application interpretation on effect if these regulations the decision of the Commissioner of Labour or Deputy Commissioner for Labour to Govt. in that behalf shall be final.

7.13 Labour Clause

No labourers below the age of 15 years shall be employed on the work.

Payments of wages of labourers. The contractor shall pay not less than fair wage of labourers engaged by him on the work.

EXPLANATION:

(a) The contractor shall notwithstanding the provision of any contract to the contrary cause to be paid wages to labourers indirectly engaged for the work including any labour engaged by his sub-

contractors in connection with the same works if the labourers have been immediately employed by him.

(b) In respect of all labours directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with Govt. of India, Contractors Labour Regulations from time to time, in regard to payment of wages. Wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage book, wage slips, publication of scale of wage and other terms of employment, inspection and submission of periodical returns and all other matter of a like nature.

The Project Engineer cum Estate officer or In-charge Engineer concerned shall have the right to deduct from the money due to the contractors any sum required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or her wages which are not justified by their terms of the contractor non-observance of the regulations.

(c) For payment of minimum wages, the Contractor is bound to follow the relevant orders of Govt. of India from time to time.

(d) Vis-à-vis the Institute the contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractors. The regulations aforesaid shall be deemed to be part of this contract, and any breach thereof shall be deemed to be a breach of this.

7.14 In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this agreement the contractor shall at his own expense arrange for the safety provisions as per Karnataka P.W.D. safety code framed from time to time and shall at his own expense provide for all facilities in arrangements and provide necessary facilities as aforesaid he shall be liable to pay penalty of Rs.50/- for each default and in addition the Project Engineer cum Estate officer in charge shall be at liberty to make arrangements and provide facilities as aforesaid, and recover the cost incurred in that behalf from the contractor.

7.15 The contractor shall submit by the 4th and 19th of every month to the Project Engineer of true statement showing in respect of the second half of the preceding month and the first half of the current month respectively (1) the name of labourers employed by him on the work (2) their working hours, (3) the wages paid to them, (4) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused to them and (5) the number of female workers who have been allowed, maternity benefit according to clause 19F and the amount paid to them, failing which the contractor shall be liable to pay the Institute a sum of not exceeding Rs. 50/- for each default or materially incorrect statement by deduction from any bill due to the contractor and amount levied as fine.

7.16 In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all the rules framed by Institute from time to time for the protection of health and sanitary arrangements for workers employed by the Indian Institute of Science and its contractors.

7.17 Maternity benefit rules for female workers employed by contractor, leave and pay during leave shall be regulated as follows:

(i) in case of delivery: Leave during maternity leave not exceeding 8 weeks up to and including the day of delivery and 4 weeks following that day.

(ii) In case of miscarriage, up to 3 weeks from the date of miscarriage.

7.18 Pay:

- i) In case of delivery: Leave pay during maternity leave will be at the rate of women's average daily earning calculated on the total wages earned on the days when full time work was

done during the period of three months immediately preceding the date on which she gives notice that she expects to be confined.

- ii) In case of miscarriages: Leave pay at the rate of average daily earnings calculated on the total wages earned on the day's full-time works was due during a period of 3 months immediately preceding the date of miscarriage.
- iii) Conditions for the grant of maternity leave: No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than 6 months immediately preceding the date of delivery /miscarriage.

8. CONDITIONS OF CONTRACT

Clause 1. Security Deposit

Estimated cost of the work put to tender	E.M.D. Percentage	F.S.D. Percentage
(i)	(ii)	(iii)
Rs. 4,00,00,000	2%	5.5%
Note : EMD + FSD to be limited to 7.5% of the contract value		

- (a) The person/persons whose tender may be accepted (hereinafter called the contractor which expression shall unless the context otherwise requires, include his heirs, executors, administrators and assigns) shall pay Earnest Money Deposit indicated in Column (ii) of the table given below and shall permit Institute (a) to deduct FSD at the percentage mentioned in Column (iii) of the table given below of all moneys payable of work done under the Contract, at the time of making such payments to him/ them and (b) to hold such deductions as further Security Deposit. The EMD + FSD will be limited to 7.5% of the contract value.

E.M.D - Earnest Money Deposit

F.S.D- Further Security Deposit

No Interest will be paid on EMD / Further Security deposit.

(b) **Additional or Reduction in Security Deposit**

The EMD for the tendered work and additional amount of Security Deposit at the rates mentioned in **Sub-clause 1(a)** above should be, paid by the contractor. The Project Engineer cum Estate officer may allow if a portion of the work is withdrawn from the Contractor under the provisions of Clause 12(a) a proportionate reduction in the amount of security Deposit.

- EMD paid along with the tender shall be refunded only after the completion of the defect liability period without any interest.
- 1%labour cess towards workers Welfare Fund on the works expenditure will be recovered from RA bills for depositing the same to the welfare board as per Karnataka Govt. Order. Rates quoted should be inclusive of cess.

- (c) However, if the Contractor desires, agency may furnish a BG issued by a Scheduled Commercial Bank in favour of the Registrar, Indian Institute of Science, payable at Bangalore amounting to 3% of the total contract value valid upto completion of defect liability period in which case EMD deposited by them will be refunded and no recoveries towards security deposit will be effected in the running account bills.

(d) **Dues to Institute, to be set off against Security Deposit.**

All compensation or other sums of money payable by the Contractor to Institute under the terms of this contract may be realized or deducted from any Security Deposit payable to him or from any sums which may be due or may become due by Institute to the Contractor on any account whatsoever and in the event of his security deposit being reduced by reason of any such realization or deduction as aforesaid, the Contractor shall, within ten days thereafter, make good in cash any sum or sums which have been deducted from his security deposit or any part thereof. Otherwise, the amount will be treated as outstanding due from the agency.

(e) **Refund of Security Deposit (EMD &FSD):**

i) EMD paid by the contractor at the time of tendering and FSD deducted from the R.A bills at the prescribed rates shall be refunded to the contractor immediately after the virtual completion of the work against production of bank guarantee for an equal amount from any of a Scheduled commercial Bank valid for a period as mentioned in clause(ii)below.

ii) The bank guarantee received as stipulated in (i)above, will be treated as performance guarantee and shall be returned to the contractor after the final bill is paid or after **three years** including monsoon period from the date of virtual completion of the work during which period the work should be maintained by the contractor in good order, whichever is later. The validity of the bank guarantee shall be maintained for the above period.

iii) In case of BG's furnished towards security deposit same shall be returned after completion of the defect liability period.

Clause 2. PENALTY FOR DELAY

(a) Written Order to Commence Work

After acceptance of the tender, the Project Engineer cum Estate officer shall issue a written order to the successful tenderer to commence the work. The Contractor shall enter upon or commence any portion of work only with the written authority and instructions of the Project Engineer cum Estate officer. Without such instructions the Contractor shall have no claim to demand for measurements of or payment for, work done by him.

(b) Programme of work

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor. It shall be reckoned from the date of handing over the site to the Contractor not less than 75 percent of work site area comprising a continuous block. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be the essence of the contract on the part of the Contractor). To ensure good progress during the execution of the work, the contractor shall be bound (in all cases in which the time allowed for any work exceeds one month) to comply with the time schedule according to the programme of execution of the work as agreed upon and enclosed by the contractor during execution of agreement.

(c) Review of progress and responsibility for delay

The Project Engineer cum Estate officer shall review the progress of all works with the contractor at least once every month. Such a review shall take into account the programme fixed for the previous week, obligations on the part of the Institute for issue of drawings etc, and also the obligations on the part of the Contractor. The review shall also examine the accumulated delays by the contractor if any and mitigation measures proposed by the contractor to overcome the delay.

(d) Apportioning of responsibility for the delay between Contractor and Institute.

In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the contractor and the Institute. This record should be signed in full and dated both by the Project Engineer cum Estate officer and the Contractor. If the contractor refuses to sign the said record, approval of the reasons for delay may be submitted to CENTER FOR CAMPUS MANAGEMENT AND DEVELOPMENT (CCMD) for approval and such approval is binding on the contractor.

(e) Shortfall in progress made up subsequently.

To the extent the shortfall is assessed, as due to the delay on the part of the contractor, a notice

shall be issued to him by the Project Engineer cum Estate officer to make up the shortfall. If the shortfall is not made up before the progress of the work is reviewed during the second month succeeding the month in which the shortfall was observed, the Contractor shall be liable to pay penalty as indicated in **Clause (h)** below.

Grant of extension of time.

If the delay is attributable to reasons beyond the control of the Contractor, requisite extension of time shall be granted by the Project Engineer cum Estate officer in accordance with **Clause 5** after obtaining the approval of his higher authorities, wherever necessary.

(f) Review of progress by Centre for campus management and Development.

The Centre for campus management and Development shall review the progress periodically, preferably more number of times as required. These reviews are in addition to the monthly reviews required to be done by the Project Engineer cum Estate officer. The results of such review by the CENTER FOR CAMPUS MANAGEMENT AND DEVELOPMENT (CCMD) shall, wherever necessary, be incorporated in the next review of the Project Engineer cum Estate officer.

If the Contractor stops the work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer, then The Employer may terminate the Contract at the risk and cost of the contractor.

(g) Settlement of dispute regarding shortfall in progress.

In case of dispute between the Project Engineer cum Estate officer and Contractor regarding the responsibility for the shortfall in progress, the matter shall be referred to the Centre for campus management and Development who shall thereupon give a decision within fifteen days from the date of receipt of reference. The decision of the Centre for campus management and Development shall be final and binding on the contractor and the Project Engineer cum Estate officer.

(h) Penalty for delay

In respect of the shortfall in progress, assessed as due to the delay on the part of contractor as per **Clause 2(b)** and **2 (c)**, the contractor shall be liable to pay as penalty an amount equal to half percent of the contract value of the balance work assessed according to the programme, for every week that the due quantity of work remains incomplete; provided always that the total amount of penalty to be paid under the provisions of this clause subjected to a maximum of 10 percent of the contract value of the entire work as shown in the tender, provided further that in the event of the contractor making up the shortfall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the contractor.

Note: If the Project Engineer cum Estate officer considers it necessary, he shall be entitled to take action as indicated in **Clause 3 (d)** also.

(i) Liquidated damages

The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

(j) Adjustment of excess/over payments.

Excess/over payments as soon as they are discovered should be adjusted in the next running account bill of the contractor and in case the final bill has already been paid, the excess/over payment made shall be recovered from the Security Deposit of the contractor together with interest at such percentages as Institute may decide from time to time, from the date of such excess or over payment to the date of recovery.

ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

Clause 3. In any case in which under any clause or clauses of this contract the contractor shall have rendered himself liable to pay compensation and/or penalty amounting to the whole of his security deposit including the amount deducted in instalment from his bills as Further Security Deposit, the Project Engineer cum Estate officer on behalf of the Director, IISc shall have power to adopt any of the following courses as he may deem best suited in the interest of Institute.

(a) Forfeiture of Security Deposit

Without prejudice to Institute's right to recover any loss from the Contractor under sub-clauses (b) and (c) of Clause 3 of the Contract, to rescind the contract (of which rescission notice in writing to the contractor under the hand of the Project Engineer cum Estate officer shall be conclusive evidence). And in that case, the security deposit of the contractor including whole or part of the lump sum deposited by him and also the amount deducted from his bills as Further Security Deposit, shall stand forfeited and be absolutely at the disposal of the Institute.

b) Debiting cost of labour and materials supplied.

To employ labour paid by the Institute and to supply materials to carry out the work or any part of the work, debiting the contractor with the cost of the labour and the price of the materials (as to the correctness of which cost and price the certificate of the Project Engineer cum Estate officer shall be final and conclusive against the contractor) and crediting him with the value of the work done; in all respects in the same manner and at the same rates as if it had been carried out by the contractor under terms of this contract, and in that case the certificate of the Project Engineer cum Estate officer as to the value of the work done shall be final and conclusive against the contractor.

c) Recovery of extra cost on unexecuted work

To measure up the work of the contractor and to take such part thereof as is remaining unexecuted out of his hands and to give it to another contractor to complete it in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (as to the amount of which excess expenses the certificate in writing of the Project Engineer cum Estate officer shall be final and conclusive) shall be borne and paid by the original contractor and shall be deducted from any money due to him by Institute Otherwise the amount will be treated as outstanding due from the agency.

d) Action against unsatisfactory progress

If the contractor does not maintain the rate of progress as required under **Clause 2** and if the progress of any particular portion of work is unsatisfactory even after taking action under **Clause 2(c)** and **2(d)**, the Project Engineer cum Estate officer shall be entitled to take action under **Clause 3(b)** or **3(c)** at his discretion in order to maintain the rate of progress after giving the contractor 10 days' notice in writing whereupon the contractor will have no claim for any loss sustained by him owing to such actions.

e) No compensation for loss sustained on advance action

In the event of any of the above courses being adopted by the Project Engineer cum Estate officer, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased, or procured any materials, entered into any agreements, or made any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid the contractor shall not be entitled to recover or be paid any sum for any work thereof actually performed by him under his contract, unless and until the Project Engineer cum Estate officer shall have certified in writing the performance of such work and the amount payable in respect thereof, and he shall only be entitled to be paid the amount so certified.

- f)** Recovery of 1% of the contract value towards the labourer's welfare fund created by the Government of Karnataka will be effected in the running account bills of the contractor.

Clause 4. CONTRACTOR TO REMAIN LIABLE TO PAY COMPENSATION IF ACTION IS NOT TAKEN UNDER CLAUSE-3.

In any case in which any of the powers conferred upon the Project Engineer cum Estate officer by **Clause 3** thereof shall have become exercisable and the same shall not have been exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor for which under any clause hereof he is declared liable to pay compensation or penalty amounting to the whole of his security deposit and the liability of the contractor for past and future compensation or penalty shall remain unaffected.

Power to take possession of or require removal of or sell contractor's properties.

In the event of the Project Engineer cum Estate officer taking action under **sub-clause (a)** or **(c) of Clause 3**, he may, if he so desires, take possession of all or any tools, plant, materials and stores, in or upon works or the site thereof or belonging to the contractor, or procured by him and intended to be used for the execution of the work or any part thereof, paying or allowing for the same in account at the contract rates; or in the case of contract rates not being applicable, at current market rates, to be certified by the Project Engineer cum Estate officer whose certificate thereof shall be final. In the alternative, the Project Engineer cum Estate officer may after giving notice in writing to the contractor or his clerk of the works, foreman or other authorised agent, require him to remove such tools, plant, materials or stores from the premises within a time to be specified in such notice; and in the event of the contractor, failing to comply with any such requisition, the Project Engineer cum Estate officer may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respect, and the certificate of the Project Engineer cum Estate officer as to the expense of any such removal; and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

Clause 5. GRANT OF EXTENSION OF TIME

- (a) If the contractor shall desire an extension of the time for completion of the work, he shall apply in writing to the Project Engineer cum Estate officer before the expiry of the period stipulated in the tender or before the expiry of 30 days from the date on which he was hindered as aforesaid or on which the cause for asking for extension occurred, whichever is earlier and the Project Engineer cum Estate officer or other competent authority may if in his opinion, there are reasonable grounds for granting an extension, grant such extension as he thinks necessary or proper. The decision of such competent authority in this matter shall be final.
- (b) The time limit for completion of the work shall be extended commensurate with its increase in cost occasioned by alterations or additions and the certificate of the Project Engineer cum Estate officer or other competent authority as to such proportion shall be conclusive.

Clause 6. ISSUE OF FINAL CERTIFICATE - CONDITIONS REGARDING

On completion of the work the contractor shall report in writing to the Project Engineer cum Estate officer the completion of the work. Then he shall be furnished with a certificate by the Project Engineer cum Estate officer of such completion, but no such certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall have been executed, all scaffolding, surplus materials and rubbish, and shall have cleaned thoroughly all wood work, doors, windows, wall, floor or other parts of any building, in or upon which the work has been executed, or of which he may have had possession for the purpose of executing the work, nor until the works shall have been measured by the Project Engineer cum Estate officer or other competent authority, or where the measurements have been taken by his Project Engineer until they have received the approval of the Project Engineer cum Estate officer or other competent authority, the said measurements being binding and conclusive against the contractor. If the contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish, and cleaning on or before the date fixed for the completion of the work the Project Engineer cum Estate officer or other competent authority may, at the expense of the contractor, remove such scaffolding, surplus materials and rubbish, and dispose of the same as he think fit and clean off such dirt etc., as aforesaid and contractor shall be liable to pay the amount of all expenses incurred but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

Note: CLOSURE OF CONTRACT PENDING COMPLETION OF MINOR ITEMS.

In cases where it is not desirable to keep the building contract open for minor items, such as flooring in the bathrooms, etc., which can be carried out only after installation of sanitary work the main contract may be finalized after getting a supplementary agreement executed in the prescribed form by the same contractor for doing the residual work.

Clause 7. PAYMENT PROPORTIONATE TO WORK APPROVED AND PASSED.

No payment shall be made for any work estimated to cost rupees five thousand or less until after the whole of the work shall have been completed and certificates of completion given. But in the case of works estimated to cost more than Rs. 5,000 the contractor shall on submitting the bill and after due verification by the Project Engineer as per Clause 7(b) entitled to necessary Payment proportionate to the part of the work then approved and passed by the

Project Engineer cum Estate officer or other competent authority whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor i.e. part payment of submitted RA bills is admissible to contractor. Any such reduced payment amount is admissible for adjustment in the successive RA Bills or Final Bill.

Payment at reduced rates

The rates for several items of works agreed to within shall be valid only when the items concerned are accepted as having been completed fully in accordance with the stipulated specifications. In cases where the items of work are not accepted as so completed, The Project Engineer cum Estate officer or other competent authority may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.

Payment or intermediate certificates be regarded as advances:

All such intermediate payments shall be regarded as payments by way of advance against the final payments only and not as payments for work actually done and completed, and shall not preclude the Project Engineer cum Estate officer or other competent authority from requiring any bad, unsound imperfect or unskilful work to be removed or taken away and reconstructed or re-erected nor shall any such payment be considered as an admission for the due performance of the Contract or any part thereof in any respect or the accruing of any claim, nor shall it conclude determine or affect in any other way the powers of the Project Engineer cum Estate officer or other competent authority as to the final settlement and adjustment of the accounts, or otherwise or in any other way vary or affect the contract.

Submission of Final bill and its settlement

The contractor shall submit the final bill within one month from the date of actual completion of the work in all respects. His claims shall be settled within five months from the date of submission of the bill in complete acceptable form after duly checked and certified by concerned Engineer, under normal circumstances.

Disputed items

Note: The contractor shall submit a list of the disputed items within 30 days from the disallowance thereof and if he fails to do this, his claim shall be deemed to have been fully waived and absolutely extinguished.

Clause 9. DEFINITION OF WORK :

- (k) The expression 'Work' or 'Works' where used in these conditions, shall unless there be something in the subject or context repugnant to such construction, be construed to mean the work or works contracted to be executed under or in virtue of the contract, whether temporary or permanent and whether original, altered, substituted or additional.
- (l) **Work to be executed in accordance with specifications, drawings, orders etc.**

The contractor shall execute the whole and every part of the work in the most sound and substantial and workmanlike manner, and in strict accordance with the specifications both as regards materials and workmanship. The contractor shall also conform exactly, fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by

the Project Engineer cum Estate officer or other competent authority and lodged in his office and to which the contractor shall be entitled to have access at such office, or on the site of the work for the purpose of inspection during office hours. The contractor shall also be responsible for the delivery of structure in sound conditions and the execution of the work strictly in accordance with the specifications of the work.

The order of preference in case of any discrepancy as indicated to be read as following:

- a) Nomenclature of item as per Bill of Quantities.
- b) Additional specifications, particular specifications & special conditions.
- c) General Conditions.
- d) Tender drawings and specifications mentioned in drawings.
- e) Tender specifications.
- f) Indian Standard specifications of BIS.
- g) Sound engineering practice as per directions of Project Engineer cum Estate Officer
- h) Manufactures specifications.

A reference made to any Indian Standard specifications in these documents reference to the latest version of that standard, including such revisions / amendments as issued by Bureau of Indian standards upto last date of receipt of tender. The contractor shall keep at his own cost all such publications of relevant Indian Standards applicable to the work at site.

(m) Action where there is no specification

In the case of any class of work for which there is no such specification, then in such a case of the work shall be carried out in all respects in accordance with the instructions and requirements of the Project Engineer cum Estate officer or other competent authority.

(n) Work as per Specifications and IS Codes.

The detailed specification, which forms a part of contract, accompanies the tender document. In carrying out the various items of work as described in Schedule B of the tender documents and the additional, substituted, altered items of work, this detailed specification shall be strictly adhered to, supplemented by relevant provisions of Indian standard specifications, the code of practice; etc., The Indian standard specification, National Building Code and the code of practice to be followed shall be the latest versions of those listed in the detailed technical specifications. Any class of work, not covered by the detailed technical specifications, shall be executed in accordance with the instructions and requirements of the Project Engineer cum Estate officer and the relevant provisions of the Indian standard specifications.

Clause 10. ALTERATION IN QUANTITY OF WORK, SPECIFICATIONS AND DESIGNS, ADDITIONAL WORK, DELETION OF WORK

- (i)** The Project Engineer cum Estate officer shall have power to make any alternations in, omissions from additions to or substitutions for the original specification, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work. For that purpose or if for any other reason it shall in his opinion be desirable, he shall have power to order the Contractor to do and the contractor shall do any or all the following: -

- iii) Increase or decrease the quantity of any work included in the contract.
- iv) Omit any such work.
- v) Change the character or quality or kind of any such work,
- vi) Change the levels, lines, positions and dimensions of any part of the work,
- vii) Execute additional work of any kind necessary for the completion of the works and
- viii) Change in any specified sequence, methods or timing of construction of any part of the work.

Contractor bound by Project Engineer cum Estate officer's instructions

The Contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Project Engineer cum Estate officer or other competent authority and such alteration shall not in any way vitiate or invalidate the contract.

Standard Quantity Take-off (SQT)

Contractor within **14 days** of Issue of LOI to submit the Project Manager & seek approval for the Standard quantity Take-off sheets for all the items mentioned in the Tender BOQ, after due referencing the Tender/ GFC drawings and the Technical Specification. Upon approval, the SQT shall remain the base document for initiating any change orders/ variation in accordance to Clause 31, tracking the daily project progress, and for the measurement sheets.

Orders for variations to be in writing

- (ii) No such variations shall be made by the Contractor without an order in writing of the Project Engineer cum Estate officer; provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is the result of the quantities exceeding or being less than those stated in the 'Schedule B' provided also that if for any reason the Project Engineer cum Estate officer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order without any confirmation in writing of such verbal order given by the Project Engineer cum Estate officer, whether before or after the carrying out of the order, shall be deemed to be an order in writing within the meaning of the clause; provided further that if the Contractor shall within seven days confirm in writing to the Project Engineer cum Estate officer and if such confirmation is not contradicted in writing within fourteen days by the Project Engineer cum Estate officer, it shall be deemed to be an order in writing by the Project Engineer cum Estate officer.
- (iii) (a) Any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor on same conditions In all respects on which he agreed to do the main work and same rates as a respecified in the tender for the main work. However, change in the Undertaking rates tendered and accepted shall be considered in respect of items under which the quantity of work performed exceeds tendered quantity by more than 25 percent and this actual change in rate will be restricted only to such excess quantity (i.e. beyond 125 percent of the tendered quantity).

(b) Rate for excess quantity beyond 125 percent of tendered quantity

The Additional quantity which exceeds 125 percent of the tendered quantity shall be paid at the rates entered in or derived from Schedule of Rates prevalent at the time of executing additions and alterations plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates (KPWD) of the year in which the tender is accepted (as per the comparative Statement prepared at the time of acceptance of the tender).

(c) Rates for additional, substituted, altered items of work

If the additional, substituted or altered work includes any class of work for which no rate is specified in the contract, then such work shall be carried out at the rates specified for or derived from similar item of work in the agreement. In the absence of similar items in agreement, rate shall be as specified for or derived from similar items in the schedule of rates of KPWD prevalent at the time of execution of such additional substituted or altered items of works, plus or minus the overall percentage of original tendered rates over the current schedule of rates of (KPWD) the year in which tender is accepted as mentioned in sub clause (b) above. With regard to the question whether the additional, substituted or altered item/items of work/works is / are similar or not, to that/those in the agreement / in the Schedule of Rates of KPWD and the decision of the CCMD shall be final and binding on the contractor.

(D) Determination of rates for items not found in Estimate or Schedule of Rates

If the rates for additional, substituted or altered work cannot be determined in the manner specified in sub **clauses (b) and (c)** above, then the contractor shall within 7 days of the date of receipt by him of the order to carry out the work, inform the Project Engineer cum Estate officer of the rates which it is his intention to charge for such class or work, supported by analysis of the rate or rates claimed. Thereupon the Project Engineer cum Estate officer shall determine the rate or rates on the basis of observed data and failing this, on the basis of prevailing market rates. Under no circumstances the contractor shall suspend the work on the plea of non- settlement of rates for items falling under this clause. In the event of any dispute regarding the rates for such items the decision of Project Engineer cum Estate Officer, CCMD shall be final.

Working out the data rates for non-SR/ non tendered items shall be based on the procedures laid down in the standard rate analysis format of KPWD Bangalore circle Bangalore. The data rates shall be approved by the Project Engineer cum Estate Officer, CCMD and shall be binding on the contractor.

Clause 11. TIME LIMITS UNFORSEEN CLAIMS

Under no circumstances whatever shall the contractor be entitled to any compensation from Institute on any account unless the contractor shall have submitted claim in writing to the Project Engineer cum Estate officer or other competent authority within 30 days of the cause of such claim occurring.

Clause 12. NO CLAIM TO ANY PAYMENT OR COMPENSATION FOR DELETION OF WHOLE OR PART OF WORK

(a) If at any time after the execution of the contract documents, the Project Engineer cum Estate officer or other competent authority shall, for any reason whatsoever, require the whole or any part of the work as specified in the tender, to be stopped for any period or require the whole or part of the work (i) not to be carried out at all or (ii) not to be carried out by the tendered contractor, he shall give notice in writing of the fact to the contractor who will there upon suspend or stop the work totally or partially as the case may be. In any such case, except as provided here under, the contractor shall have no claim to any payment of compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not so derive in consequence of the full amount of the work not having been carried out, or on account of any loss that may be put on account of materials purchased or agreed to be purchased, or for unemployment of labour recruited by him. He shall not also have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions, which may involve any curtailment of the work, as originally contemplated.

(b) **Payment for materials already purchased or ordered by contractor.**

Where, however, materials have already been purchased or agreed to be purchased by the contractor before receipt by him the said notice the contractor shall be paid for such materials, at the rates determined by the Project Engineer cum Estate officer or other competent authority provided they are not in excess of requirements and are of approved quality, and/or shall be compensated for the loss, if any, that he may be put to, in respect of materials agreed to be purchased by him, the amount of such compensation to be determined by the Project Engineer cum Estate officer or other competent authority whose decision shall be final.

(c) **Labour charges during stoppage of work**

If the contractor suffers any loss on account of his having to pay labour charges during the period during which the stoppage of work has been ordered under this clause, the contractor shall on application, be entitled to such compensation on account of labour charges as the Project Engineer cum Estate officer or other competent authority, whose decision shall be final, may consider reasonable. Provided that the contractor shall not be entitled to any compensation on account of labour charges if in the opinion of the Project Engineer cum Estate officer or other competent authority, the labour could have been employed in the same locality by the contractor for the whole or part of the period during which the stoppage of the work has been ordered as aforesaid.

(d) **Time limit for stoppage of work**

The period of stoppage ordered by the Project Engineer cum Estate officer or other competent authority should not ordinarily exceed six months. Thereafter the portion of works stopped

may be treated as deleted from this agreement if a notice in writing to that effect is given to the Project Engineer cum Estate officer or other competent authority by the contractor within seven days after the expiry of the above period.

Execution of work deleted:

The portion of work thus deleted may be got executed from the same contractor on supplemental agreement on mutually agreed rates, which shall not exceed current Schedule of Rates plus or minus tender percentage.

Clause 13. ACTION AND PENALTY IN CASE OF BAD WORK

If at any time before the security deposit is refunded to the contractor, it shall appear to the Project Engineer cum Estate officer or other competent authority that any work has been executed with unsound, imperfect or unskilful workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or are otherwise not in accordance with the contract, it shall be lawful for the Project Engineer cum Estate officer or other competent authority to intimate this fact in writing to the contractor and then notwithstanding the fact that the work, materials or articles complained of may have been paid for, the contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified on whole or in part as the case may require, or if, so required shall remove the materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Project Engineer cum Estate officer or the competent authority in the written intimation aforesaid, the contractor shall be liable to pay a penalty not exceeding one percent on the amount of the estimate for every day not exceeding ten days during which the failure, so continues and in the case of any such failure the Project Engineer cum Estate officer or other competent authority may rectify or remove, and re-execute the work or remove and replace the materials or articles complained of, as the case may be at the risk and expense in all respects of the contractor should the Project Engineer cum Estate officer or other competent authority for any valid reasons consider that any such inferior work or materials as described above is to be accepted or made use of, it shall be within his discretion to accept the same at such reduced rates he may fix thereof.

Clause 14. WORK TO BE OPEN TO INSPECTION - CONTRACTOR OR RESPONSIBLE AGENT TO BE PRESENT

- (a) All works under or in course of execution or executed in pursuance of the contract shall at all time be open to the inspection and supervision of the Project Engineer cum Estate officer or other competent authority and his Engineer-in-charge, and the contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Project Engineer cum Estate officer or other competent authority Project Engineer to visit the work shall have been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for the purpose. Orders given to the contractor duly authorized agent shall be considered to have the same force and effect as if they had been given to the contractor himself.

(b) Employment of Minimum technical staff

The Contractor shall employ the following technical staff during execution of this work:

- (i) One qualified Graduate Engineer & One qualified Diploma Engineer, when the cost of the work to be executed up to 1 Crore,
- (ii) Two qualified Graduate Engineer & Three qualified Diploma Engineer, when the cost of the work to be executed from 1 Crore to 10 crores.
- (iii) Three qualified Graduate Engineer & Six qualified Diploma Engineer, when the cost of the work to be executed above 10 crores.
- (iv) In addition to (i) and (ii) above, the contractor shall employ different types of such technical personnel as may be required and sufficient for execution of work and directed by the Project Engineer cum Estate officer to ensure efficient execution of work.

The technical staff so employed, should be available at site whenever required by Engineer in-charge to take instructions.

- (c) If the contractor fails to employ the technical staff as aforesaid, he shall be liable to pay a sum of Rs. 25000 (Rupees Twenty thousand only) for each month of default in the case of Graduate Engineers and Rs.15000 (Rupees Ten thousand only) for each month of default in case of Diploma Holders.
- (d) If the Contractor himself possesses the required qualification and is available at the site for receiving instructions from the Project Engineer cum Estate officer and other competent authority vide **sub-clause (a)** above it will not be necessary for the technical staff to be available at site for receiving instructions.

Clause 15. NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP

The contractor shall give not less than five days' notice in writing to the Project Engineer cum Estate officer or his Project Engineer in charge of the work before covering up or otherwise placing beyond the reach of the measurement any work in order that the same may be measured; and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement, and shall not cover up or place beyond the reach of measurement, and work without the consent in writing of the Project Engineer cum Estate officer or other competent authority or his Project Engineer in charge of work; and if any work shall be covered up or placed beyond the reach of measurement, without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.

Clause 16. CONTRACTOR LIABLE FOR DAMAGE DONE, AND FOR IMPERFECTIONS FOR TWELVE MONTHS AFTER CERTIFICATE OF COMPLETION

If the Contractor or his workmen or servants shall break, deface, injure or destroy any part of a building in which they may be working, or any building, road fence, enclosure or grassland or cultivated ground contiguous to the premises on which the work or any part thereof is being executed, or if any damage shall be done to the work, while it is in progress from any cause whatever or if any imperfections become apparent in it within Twelve months of the grant of a certificate of completion, final or otherwise, by the Project Engineer cum Estate officer or other competent authority the contractor shall make good the same at his own expenses, or in default the Project Engineer cum Estate officer or other competent authority may cause the same to be made good by other workmen, and deduct the expenses (of which the certificate of the Project Engineer cum Estate officer or other competent authority shall be final) from any sums that may be due or may thereafter become due to the

contractor, or from his Security Deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

The Defects liability period shall be extended for as long as defects remain to be corrected. Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Institute.

Clause 17. CONTRACTOR TO SUPPLY PLANT, LADDERS, SCAFFOLDINGS, ETC., AND IS LIABLE FOR DAMAGES ARISING FROM NON-PROVISION OF LIGHT, FENCING ETC

The contractor shall supply at his own cost all materials, plant, tools, appliance, implements, ladders, scaffolding, and temporary works required for the proper execution of the work whether in the original, altered or substituted form and whether included in the specification, or other documents forming part of the contract or referred to in these conditions or not, and which may be necessary for the purpose of satisfying or complying with the requirements of the Project Engineer cum Estate officer or other competent authority as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore, to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or the materials. Failing this, the same may be provided by the Project Engineer cum Estate officer or other competent authority at the expense of the contractor and expense may be deducted from any money due to the contractor under the contract or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof. The contractor shall provide necessary fencing and lights required to protect the public from accident, and shall also be bound to bear the expense of defense of every suit, action or other legal proceedings, that maybe brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any suit, action or proceedings to any person, or which may with the consent of the contractor be paid for compromising any claim by any such person.

Clause 18. MEASURES FOR PREVENTION OF FIRE

The contractor shall not set fire to any standing jungle, trees, brushwood or grass without a written permit from the Project Engineer cum Estate officer. When such permission is given, and also in all cases when destroying cut or dug up trees, brushwood grass, etc., by fire the contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property.

Clause 19. LIABILITY OF CONTRACTOR FOR ANY DAMAGES DONE IN OR OUTSIDE WORK AREA.

Compensation for all damages done by contractor or his men whether in or beyond the limits of Institute property including any damage caused by spreading of fire mentioned in Clause 18 shall be estimated by the Project Engineer cum Estate officer and the estimate of the Project Engineer cum Estate officer, subject to the decision of the Centre for Campus Management and Development on appeal shall be final and the contractor shall be bound to pay the amount of the assessed compensation on demand failing which the same will be recovered from the contractor as the damages in the manner prescribed in clause 1(c) or deducted by the Project Engineer cum Estate officer or other competent authority from any sums that may

be due or become due from Institute to the contractor under this contract or otherwise.

The contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of fire and shall pay any damages and cost that may be awarded by the court in consequence.

Clause 20. WORK ON NOTIFIED HOLIDAY

No work shall be done on any notified holiday without the sanction in writing of the Project Engineer cum Estate officer or other competent authority.

Clause 21. WORK NOT TO BE SUBLET

- (a) The contract shall not be assigned or sublet by the contractor. However, any specific portion of the work which is of a specialized nature and normally not executable by a general contractor could be got done by the specialized agencies which are executing such works, after obtaining the specific approval of the Project Engineer cum Estate officer in writing in each case. Such consent to sublet the work, if given, shall not relieve the contractor from any liability or obligation under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor or his agents, servants or workmate as fully as if they were the acts, defaults or neglects of the contractor, his agents, servants or workmen.

Consequences of subletting work without approval, becoming insolvent, bribing etc., by contractor and action against the contractor.

If the contractor shall assign or sublet his contract or any portion thereof without the specific approval of the Project Engineer cum Estate officer or attempts to do so or become insolvent or commence any proceedings to get himself adjudicated as insolvent or make any composition with his creditors or attempts so to do or if any bribe, gratuity, or indirectly be given, promised or offered by the contractor or any of his servants or agents to any officer or person in the employ of Institute in any way relating to his office or employment or if any such officer or person in the employment or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Project Engineer cum Estate officer or other competent authority may thereupon by notice in writing rescind the contract and the security deposit of the contractor shall thereupon stand forfeited and be absolutely at the disposal of Institute and the same consequences shall ensure as if the contract had been rescinded under Clause 3 here of and in addition, the contractor shall not be entitled to recover or be paid for any work actually performed under contract.

- (b) **Recovery of excess payments based on excess measurements and action against contractor.**

Whenever it is noticed that excess payments have been made to the contractor based on excess measurements recorded by the Project Engineer in the measurement book and countersigned by the contractor or his duly authorized agent, action shall be taken to recover the excess payments together with interest immediately. Action may also be taken to remove the name of the contractor from the approved list of contractors and also to black list him.

Change in classification of excavations accepted not permitted.

Once the measurements mentioning the classification of the excavations are recorded in the measurement book and the same is signed by the contractor or his authorized agent in token

of acceptance, no request for reclassification by the contractors shall be entrained.

(c) Criminal proceedings against IISc Officer and Contractor for the lapses.

Institute also reserve the right to initiate criminal proceedings against the concerned Institute Officers who are directly responsible for the lapse and the contractors who have colluded with the officers of the Institute in the lapse and fraudulently received amounts not due to them legitimately.

Clause 22. SUM PAYABLE BY WAY OF COMPENSATION TO BE CONSIDERED AS REASONABLE COMPENSATION WITHOUT REFERENCE TO ACTUAL LOSS.

All sums payable by a contractor by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied for the use of Institute without reference to the actual loss or damage sustained and whether any damage has or has not been sustained.

Clause 23. SETTLEMENT OF DISPUTES - TIME LIMIT FOR DECISION

(a) If any dispute or difference of any kind whatsoever were to arise between the Project Engineer cum Estate officer and the contractor regarding the following matters namely,

- (i)** The meaning of the specification's designs, drawing and instructions herein before mentioned,
- (ii)** The quality of workmanship or materials used in the work and
- (iii)** Any other question, claim right, matter, thing whatsoever, in any way arising out of or relating to the contract, designs, drawings, specification, estimates, instructions, or orders, or those conditions, failure to execute the same whether arising during the progress of the work, or after the completion, termination or abandonment thereof, the dispute shall, in the first place, be referred to the Centre for campus management and Development who have jurisdiction over the work specified in the contract. The Centre for campus management and Development shall within a period of fifteen days from the date of being requested by the Contractor to do so give written notice of its decision to the Contractor.

If the decision of the Centre for campus management and Development is not acceptable to the contractor, he may approach the **Director, IISc within** a period of 15 days for settlement.

(b) Director's decision final.

Subject to other form of settlement hereafter provided, the Director's decision in respect of every dispute or difference so referred shall be final binding upon the contractor. The said decision shall forthwith be given effect to and contractor shall proceed with the execution of the work with all due diligence.

(c) Remedy when Director's decision is not acceptable to contractor.

In case the decision of the Director is not acceptable to the contractor, he may approach the Law Court at Bangalore for settlement of dispute after giving due written notice in this regard to the Director within a period of ninety days from the date of receipt of the written notice of the decision of the Director. Further, the Bangalore courts alone shall have the exclusive jurisdiction.

(d) Time limit for notice to approach Court of law by contractor

If the Director has given written notice of his decision to the contractor and no written notice to approach the law court has been communicated to him by the contractor within a period of ninety days from receipt of such notice, the said decision of Director shall be final and binding upon the contractor.

(e) Time limit for notice to approach court by contractor when decision is not given by Director, IISc as at(b).

If the Director fails to give notice of his decision within a period of ninety days from the receipt of the contractor's request in writing for settlement of any dispute or difference as aforesaid, the Contractor may within ninety days after the expiry of the first named period of ninety days approach the Law Courts at Bangalore giving due notice to the Director.

(f) Contractor to execute and complete work pending settlement of dispute.

Whether the claim is referred to the Director or to the Law Courts, as the case may be, the contractor shall proceed to execute and complete the works with all due diligence pending settlement of the said dispute or differences.

(g) Obligations of the Project Engineer cum Estate officer and contractor shall remain unsettled during considerations of dispute.

The reference of any dispute or difference to the Director or the Law Court may proceed notwithstanding that the works shall then be or be alleged to be complete, provided always that the obligations of the Project Engineer cum Estate officer and the contractor shall not be altered by reason of the said dispute or difference being referred to the Director or the Law Court during the progress of the works.

Clause 24. CONTRACTOR TO PAY COMPENSATION UNDER WORKMEN'S COMPENSATION ACT.

(a) The contractor shall be responsible for and shall pay any compensation to his own workmen payable under the relevant Workmen's Compensation Act for injuries caused to the workmen. If Institute pays such compensation on behalf of the contractor it shall be recoverable by Institute from the contractor under as per relevant clauses.

(b) Contractor to pay expenses of providing medical aid to workmen.

The contractor shall be responsible for and shall pay the expenses of providing medical aid to any workman who may suffer a bodily injury as a result of an accident. If Institute incurs such expenses, the same shall be recoverable from the contractor forthwith and be deducted without prejudice to any other remedy of Institute, from any amount due or that may become

due to the contractor.

Clause 25. CONTRACTOR TO PROVIDE PERSONAL SAFETY EQUIPMENT FIRST AID APPARATUS, TREATMENT etc.

The contractor shall provide all necessary personal safety equipment and first aid apparatus for the use of the persons employed on the site and shall maintain the same in good condition suitable for immediate use, at any time and shall comply with the following regulations in connection therewith: -

- (i) The worker will be required to use the equipment so provided by the contractor and the contractor shall take adequate steps to ensure proper use of the equipment by those concerned.
- (ii) When work is carried on in proximity to any place where there is a risk of drowning; all necessary steps shall be taken for the prompt rescue of any person in danger.
- (iii) Adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work.

Clause 26. Minimum age of persons employed by contractor (a): No contractor shall employ

- (i) Any person who is under age of 18 years.
- (ii) Who does not produce a valid certificate of vaccination against epidemic diseases in respect of himself /herself as well as all the members of his/her family.
- (b) The contractor shall provide potable water facilities to the workers. Similar amenities shall be provided to the workers engaged on large works in urban area.
- (c) Removal of persons not satisfying conditions (a)(i) & (ii)

The Project Engineer cum Estate Officer or other authority is authorized to direct the removal or to remove through - his own agency, from the work any person referred to in sub-clauses (a) above not satisfying these conditions and no responsibility shall be accepted by the Institute for any delay caused in the completion of the work by such directions for removal.

- (d) Payment of fair and reasonable wages by contractor.

The contractor shall pay fair and reasonable wages, which shall not be less than the minimum wages fixed by Govt. of India from time to time to the workmen employed by him in the contract undertaken by him. In the event of any dispute arising between the contractor, and his workmen on the ground that the wages paid are not fair and reasonable the dispute shall be referred without delay to the Project Engineer cum Estate officer or other competent authority, who shall decide the same. The decision shall not in any way affect the conditions in the contract regarding the payment to be made by Institute at the agreed tender rates.

Clause 27. CONTRACTOR NOT ENTITLED TO ANY CLAIM OR COMPENSATION FOR DELAY IN EXECUTION OF WORK IN BORROW PITS.

The contractor shall not be entitled to claim compensation if there is any delay in the execution of the work on account of water standing in borrow pits and Compartments. The rates are inclusive for hard or cracked soil, excavation in mud, sub-soil water or water standing in borrow pits and no claim for extra rate shall be entertained, unless otherwise specified.

Clause 28. METHOD OF PAYMENT OF BILLS

Payment to contractors shall be made by RTGS by the Institute.

Clause 29. SET OFF AGAINST ANY CLAIM OF INSTITUTE

Any sum of money due and payable to the contractor (including the security deposit refundable to him) under this contract may be appropriated by the Institute and set off against any claim of Institute in respect of a payment of a sum of money arising out of or under any other contract made by the contract with the Institute.

Clause 30. RATES INCLUSIVE OF GST AND LABOUR CESS AND ROYALTY

- (a) The rates to be quoted by the contractor shall be inclusive of all taxes like GST, Labour cess, Royalty etc., No extra payment on this account will be made to the contractor.
- (b) When there is a change in existing taxes from time to time i.e. upward or downward is admissible accordingly.
- (c) All quarry fees, or duties levied by the state or any local body or authority and ground rent, if any, charged by the Project Engineer cum Estate officer for stacking materials should be paid by the contractor.

Clause 31. IMPORTANCE OF SAFETY

In addition to Contractor's Contractual Obligations on Safety as per the relevant clauses stated, The Contractor shall comply with all safety standards to the satisfaction of the Employer's Representative.

In respect of all labour, directly or indirectly employed on the project for the performance and execution of the Contractor's Work under the Contract, the Contractor shall at its own expense arrange for all the safety provisions as listed in (i) Safety codes of C.P.W.D. and Bureau of Indian Standards, (ii) The Electricity Act, (iii) The Mines Act, and Regulations, Rules and Orders made there under and such other acts as applicable. Precautions as stated in the safety clause are the minimum necessary and shall not preclude the Contractor taking additional safety precautions as may be warranted for the particular type of work or situations. Also, mere observance of these precautions shall not absolve the Contractor of his liability in case of loss or damage to property or injury to any person including but not limited to the Contractor's labour, the Employer's, Architect's, Employer's Representative's and Project Manager's representatives or any member of the public or resulting in the death of any of these.

The Contractor shall institute and implement to the satisfaction of the Project Manager a construction safety programme, including:

- Preparing Site-specific written safety programme consistent with the EHS Plan, Indian law and best practices. As a minimum, the programme shall require applicable safety equipment for all workers, use of barriers and barricades around potentially dangerous areas, protection of workers working under elevated conditions, accident reporting, first aid provisions etc.
- Weekly safety reviews and 'risk assessments' shall be carried out in conjunction with the Project Manager and the Employer in order to identify potential safety hazards and to mitigate against them.
- Attending weekly or as scheduled safety meetings at site conducted by the site safety representative of project manager
- The Contractor will be required to provide all personnel entering the Site an Identity and safety rules card and verbal explanation of the safety programme.

- Requiring all Sub-Contractors and other workers under the responsibility of the Contractor (including the Vendors or later phases of the construction of the Project) to adhere to the written safety programme as per approved format.

Experienced safety officers with adequate number of supporting personnel shall be appointed by the Contractor for full time on the site during the Contract period.

NON-COMPLIANCE OF REGULATIONS

If the Project Manager or the Employer's Representative notifies the Contractor of non-compliance with the foregoing regulations, the Contractor shall immediately, if so directed, or in any event not more than eighteen (18) hours after receipt of such notice, make all reasonable efforts to correct such non-compliance. If the Contractor fails to do so, the Employer may suspend all or any part of the Work. When the Contractor has undertaken satisfactory corrective action, Employer shall lift the suspension of the Work. The Contractor shall not claim any extension of time to complete the Work or additional fees due to any such work suspension.

The Client reserves the right to levy penalty if the safety norms such as not wearing helmets, safety gloves/belts/shoes/jackets. etc., even after a written notice by the enforcing authority, a penalty of Rs.10,000/- per day per event or till the safety norms are adhered to in addition to stopping of work till the safety norms are adhered.

Clause 32. Refund of Security Deposit (EMD & FSD):

The Security Deposit lodged/paid by a Contractor shall be refunded to him after the final bill is paid or after the successful completion of defect liability period, during which period the work should be maintained by the Contractor in good order, whichever is later.

Clause 33. PENALTY FOR DELAY

(a) Written Order to Commence Work

After acceptance of the tender, The Project Engineer/Registrar shall issue a written order to the successful tenderer to commence the work. The Contractor shall enter upon or commence any portion of work only with the written authority and instructions of The Project Engineer/Registrar. Without such instructions the Contractor shall have no claim to demand for measurements of or payment for, work done by him.

(b) Programme of work

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor. It shall be reckoned from the date of handing over the site to the Contractor not less than 75 percent of work site area comprising a continuous block. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be the essence of the contract on the part of the Contractor). To ensure good progress during the execution of the work, the contractor shall be bound (in all cases in which the time allowed for any work exceeds one month) to comply with the time schedule according to the programme of execution of the work as agreed upon and enclosed to the agreement.

(c) Review of progress and responsibility for delay etc.,

The Project Engineer cum Estate Officer, CCMD shall review the progress of all works with the contractor during the first fortnight of every month. Such a review shall take into account the programme fixed for the previous month, obligations on the part of the Contractor.

(d) Apportioning of responsibility for delay between Contractor and Institute.

In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the contractor and the Institute. This record should be signed in full and dated both by The Project Engineer cum Estate Officer, CCMD and the Contractor.

Clause 34. BAR CHART / CPM CHART:

BAR chart / CPM chart shall be produced during agreement by the contractor. According to the bar chart work is to be executed otherwise penalty will be levied for the delay of work

9. THE ARTICLES OF AGREEMENT

This Agreement is made at Bangalore, on this ----- day of ----- in the year -----

BY AND BETWEEN

INDIAN INSTITUTE OF SCIENCE herein referred as IISc, a Trust registered under the Charitable Endowments Act, 1890, a deemed University and an autonomous Institution funded by the Ministry of Education, Government of India having its office at **Sir C.V Raman Road, Malleswaram, BANGALORE 560 012**, (hereinafter referred to as the IISC which expression shall unless repugnant to the context or meaning thereof, mean and include its successors in interest, trustees and permitted assigns) of the ONE PART

AND

M/s-----, hereinafter referred to as the "CONTRACTOR", (which expression shall unless repugnant to the context or meaning thereof, mean and include their partners, their respective heirs, executors, administrators and assigns) on the OTHER PART.

RECITALS

A. WHEREAS the IISc is desirous of getting the work of **Supply and Installation of Office Furniture at IDR Building in IISc, Bangalore** (hereinafter called the work) executed by the Contractor at the rates quoted by him amounting to **Rs. -----** (Rupees ----- only) inclusive of all Taxes which is -----% the estimated amount put to tender.

B. WHEREAS the Contractor has agreed to execute the aforesaid work on terms and conditions mentioned herein and subject to Tender Conditions of Contract and in accordance with the particular specifications, general notes and the schedule of quantities, schedule of rates, payment, and penalty condition, to the satisfaction of the IISc

NOW THIS AGREEMENT WITNESSETH AND THE PARTIES HERETO AGREE AND SOLEMNLY AFFIRM AS FOLLOWS:

1. In consideration of the payment to be made to them as hereinafter provided, the contractor shall, subject to the terms, conditions, specifications, schedule of quantities, drawings, etc., more particularly stated in the Schedules aforesaid, execute and complete the work within **5 Months** for the work after 10 days of issuance of work order or from the date of handing over of site, whichever is later.
2. IISc shall pay to the contractor such sums as shall become payable hereunder at the time and in the manner specified in the conditions contained in the schedule aforesaid.
3. The time allowed for carrying out the work as entered in the tender Agreement shall be strictly observed by the contractor and shall be deemed to be the essence of the contract on the part of the contractor and shall be reckoned from 10 days after the date on which the work order to commence the work is issued to the Contractor or the date of handing over of site, whichever is later. The work shall throughout the stipulated period of the contract be proceeded with all due diligence and the Contractor shall pay compensation an amount equal to one percent, or such smaller amount, as the Director, Indian Institute of Science (whose decision shall be final) may

decide on the amount of estimated cost of the whole work as shown in the tender for every day that the work remains un-commenced or unfinished, after proper dates.

4. The contractor shall ensure good progress during the execution of the work be bound in all cases in which the time allowed for any work exceeds one month (save for special jobs) to complete one-eighth of the whole work before, one-fourth of the whole time allowed under the contract has elapsed, three-eighths, of the work before one-half of such time has elapsed, and three-fourths of the work before three-fourths of such time has elapsed.

However, for special jobs if a time schedule has been submitted by the contractor and the same has been accepted by the Purchase Committee the contractor shall comply with the said schedule. In the event of the Contractor failing to comply with the conditions he shall be liable to pay as compensation an amount equal to one percent or such smallest amount, as the Director, Indian Institute of Science (Whose decision in shall be final), may decide on the said estimated cost of the whole work for every day that the due quantity of work remains incomplete; provided always that the entire amount of compensation to be paid under the provisions of this clause shall not exceed seven and a half (7.5) percent of the estimated value of the contract as shown in the tender, provided further that in the event of contractor making up the short fall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the Contractor.

5. The Purchase Committee or its authorized representative shall review the progress of all works with the contractor once every week. Such a review shall take into account the programme fixed for the previous week, obligations on the part of the Institute for issue of drawings etc., and also the obligations on the part of the Contractor. The review shall also examine the accumulated delays by the contractor if any and mitigation measures proposed by the contractor to overcome the delay. In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the IISc and the contractor. This record should be signed in full and dated both by the Purchase Committee and the Contractor.

6. Indian Institute of Science, without prejudice to its rights under the contract in any respect of any delay or inferior workmanship or otherwise, or to any claim for damages in respect of any breaches of the Contract and without prejudice to any rights of remedies under any of the provisions of this contract or otherwise and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases: -

- (i) If the contractor having been given by the Purchase Committee, a notice in writing to rectify reconstruct or replace any defective work or that the work is being performed in any inefficient or otherwise improper or unworkmanlike manner, shall omit to comply with the requirements of such notice for a period of seven days of such notice thereafter or if the contractor shall delay or suspend the execution of the work so that in the judgment of the Purchase Committee (which shall be final and binding) either they will be unable to secure completion of the work by the date for completion of the work or they had already failed to complete the work by that date.
- (ii) If the Contractor being a company passes a resolution or if the Court passes an order to wind up the company or if a receiver or a manager is appointed on behalf of the creditors of the company or under circumstances which entitles the Court or the creditors to appoint a receiver or manager which would entitle the Court to make a winding-up order.
- (iii) If the Contractor commits breach of any of the terms or conditions of this contract.

- (iv) If the contractor assigns or sublets without written approval of the Purchase Committee or becomes insolvent.

The Purchase Committee, on behalf of the Director of the Institute shall have powers: -

- a) To determine or rescind the Contract as aforesaid (in which termination or recession notice in writing to the Contractor underhand of the Purchase Committee shall be conclusive evidence). Upon such determination or recession, the security deposit of the Contractor shall be liable to be forfeited and shall absolutely be at the disposal of Institute.
- (a) To employ labour paid by the Institute and supply materials to carry out the work or any part by debiting the Contractor with the cost of the labour and the price of the materials (of the amount of which cost and price certified by the Purchase Committee, shall be final and conclusive against the Contractor) and crediting him with the value of the work done in all respect on the same manner and at the same rates as if it has been carried out by the contractor under the term of his contract. The certificate of the Purchase Committee as to the value of the work done shall be final and conclusive against the contractor, provided always that action under the sub-section shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the Institute are less than the amount payable to the contractor at his agreement rates, the difference shall not be paid to the Contractor.
- (b) After giving notice to the contractor to measure up the work of the contractor and to take such part thereof as shall be un-executed out of their hands and to give it to another contractor to complete in which case any expenses which may be incurred in excess a sum of which would have been paid to the original contractor if the whole work had been executed by him (of the amount of which excess the certificate in writing of the Purchase Committee shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any monies due to him from the Institute under this contract or any other account whatsoever, of from his security deposit or the proceeds of sales thereof, or a sufficient part thereof as the case may be.

In the event of any one or more of the above courses being adopted by the Purchase Committee, the contractor shall have no claim to compensation for any loss sustained by them by reason of having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case of action is taken under any of the provisions, aforesaid, the contractor shall not be entitled to recover or be paid any sum for work thereto/for actually performed under this contract unless the Purchase Committee has certified in writing the performance of such work and the value payable in respect thereof and they shall only be entitled to be paid the value so certified.

7. The schedules above mentioned include the General Rules and Directions to Contractors and the following documents, viz.,
- i) Letter of Intent
 - ii) Letter of Acceptance
 - iii) Purchase Order
 - iv) Conditions of Contract
 - v) Contractor's Bid - Bill of Quantities
 - vi) Technical Specifications
 - vii) Drawings

- viii) The pre-Bid meeting proceedings and corrigendum
 - ix) Any other document listed in the Contract Data as forming part of the contract shall form an integral part of the agreement and the decision of the Purchase Committee in reference to all matters of a dispute as to material and workmanship shall be final and binding on both the parties.
8. The IISc reserves the right of altering the drawings of the works and of adding to or omitting any item of work from or of having portions of the same carried out departmentally or otherwise and such alterations or variations shall not violate this agreement.
 9. This agreement comprises the work aforesaid, and all subsidiary works connected therewith even though such works may not be shown on the schedule appended hereto.
 10. In the event the contractor or their employees, agents, sub-contractors deface or destroy the property or the establishment belonging to IISc, the same shall be made good by the contractor at their own expenses.
 11. The Contractor shall ensure cleanliness at the premises of IISc ensure cleaning of site and removal of debris every week. In any event the contractor ceases to comply the foregoing the IISc shall ensure the site cleaned at the expense of the contractor.
 12. The Contractor shall at all-time be responsible for the safety of their employees, agents, sub-contractors, and in any event during the commission of work or in their due course of work the IISc shall not be held responsible. The contractor shall defend, indemnify and hold the Institute harmless from any liability or damage, lawsuits, penalties imposed by any State or Central Government or statutory body or by a third party for reasons of violation of any of statutory provisions or requirements by the contractor.
 13. The Contractor shall adhere to the working conditions and its scope strictly and any act not in confirmation with the scope of work which is mutually accepted by both the parties shall only be done after prior approval and acceptance in writing by the Director.
 14. The Contractor shall at any time be responsible for the completion of work in time, also the contractor shall be responsible to submit the final bill within one month after completion of the work.
 15. Notwithstanding anything contained in the tender submitted by the contractor, all the clauses of this agreement shall be binding on both parties.
 16. Where counter-terms and conditions, printed or copied, are offered by the contractor, the same shall not be deemed to have been accepted by the IISc, unless specific written acceptance thereof is furnished by the IISc. Notwithstanding the foregoing, no verbal agreement or inference from a conversation with any office members/representatives/employees of the IISc before, during, or after the execution of the agreement, shall in any way affect or modify any of the terms/obligations contained herein.
 17. In the event the contract is terminated by the IISc due to any aforementioned act/omission on the part of the contractor, or for any reason whatsoever, the IISc shall be entitled to engage the services of any other person, agency or Contractor to meet its requirement, without prejudice to its rights including claim for damages against the Contractor.

18. This agreement can be terminated by IISc with the prior written notice of Seven (7) days in the event of a breach of any of its terms of this agreement and even otherwise this Agreement may be terminated by IISc by giving a minimum of 7 days prior written notice to the Contractor.
19. The IISc shall be indemnified for all losses due to commissions and omissions of persons deployed by the contractor. If any loss or damage is caused to the IISc on account of any negligence, carelessness, acts of omissions, commissions of contractors, its employees or staff, the same shall be made good by the contractor. The contractor shall defend, indemnify and hold the Institute harmless from any liability or damage, lawsuits, penalties imposed by any State or Central Government or statutory body or by a third party for reasons of violation of any of statutory provisions or requirements by the contractor. The IISc shall not be liable for any damage or compensation payable to any workmen or to any person as a consequence of this work and the IISc shall be completely indemnified accordingly.
20. The contractor shall pay wages directly to its personnel. The contractor shall also ensure that no amount by way of commission or otherwise is deducted from the wages of the workmen. The contract labourers deployed by the agency shall not involve in any theft/pilferage/damage to Institute property. After necessary investigations, if proved that the contractor or their personnel are responsible for the incident, the contractor is liable and will be penalized to the extent of the value of the loss and additionally Rs. 50,000/- for each such incident.
21. All terms and conditions, the scope of work, and other conditions as mentioned in the tender document will be diligently complied with by the contractor. The terms and conditions, the scope of work, and other conditions mentioned in the tender documents shall form a part and parcel of this agreement.
22. The Contractor hereby agrees and affirms that during or subsequent to the performance of the duties under this Agreement, the Contractor shall maintain confidentiality and shall not divulge, communicate, use or appropriate any of the IISc Information, except to the extent necessary for the Contractor to fulfil his obligations or duties to the IISc under this Agreement. The Contractor shall not cause transmission, removal or transfer of tangible embodiments of, or files from the IISc place of business, without the prior written consent of the IISc and shall not disclose any information of the IISc to any third party.
23. In case of disputes including all questions relating to the performance of the obligations under this agreement and all the dispute and differences which shall arise either during or after the agreement period or other matters arising out of or relating to this agreement or payments to be made in pursuance thereof shall be decided by the Director of IISc whose decision shall be binding on the contractor. The Contractor hereby agrees to be bound by the decision of the Director.
24. **COURTS:**

Courts of appropriate jurisdiction situated in Bangalore City shall have exclusive jurisdiction
25. **GOVERNING LAW**
This Contract shall be governed by the Law of India for the time being in force.

IN WITNESS WHEREOF the parties hereto have set their respective hands the day and the year here in above written.

In the presence of:
Witness 1:

Signed by for and on behalf of the said Contractor.

(Company Name)

In the presence of:

Signed by for and on behalf of the IISc.

Witness 2:

REGISTRAR
INDIAN INSTITUTE OF SCIENCE BANGALORE-12

INDIAN INSTITUTE OF SCIENCE, BANGALORE-12

ITEM RATE TENDER FOR WORK

I/We, hereby tender for the execution for the Indian Institute of Science, Bangalore-12 of the works specified in the under mentioned memorandum within the time specified in such memorandum at the rates specified therein and in accordance, in all respects, with the specifications, designs, drawings and instructions in writing which have been read by me/read and explained to me and with such materials as provided for by and in all other respects in accordance with such conditions as for as possible.

MEMORANDUM OF WORK

1	General Description	Supply, Installation, Testing and Commissioning of laboratory furniture in the lower ground floor at the IDR Building in IISc, Bangalore
2	Estimated Cost	Rs. 4,00,00,000
3	Earnest Money	Rs. 8,00,000
4	Date of Commencement of work	Within ten days from the date of issue of work order or the date of handing over the site whichever is later
5	Frequency of interim Certificate and Payment	N/A
6	Further Security Deposit	5.5 % on the running account bills and final bill in addition to Earnest Money Deposit. When the F.S.D. deducted from the RA bills of the Contractor @ 2 % of the bill amount exceeds Rs.1.00 lakhs, the amount in excess of Rs.1.00 lakh may, at the request of the Contractor, be released to him against the production of a bank guarantee issued by a Scheduled Commercial Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.
5	Time allowed for the completion of work in all respects from the date of commencement of work	150 days
6	Bills Of Quantities.	As per enclosure.

7	Defects liability period /release of security deposit.	The security deposit lodged/paid by a contractor shall be refunded to him after the final bill is paid or after twelve months from the date of completion of the work, during which period the work so executed should be maintained by the contractor in good order, whichever is later.
8	Period for payment of Bill.	Four weeks from the date of submission of each bill by the Contractor.
9	Period for submitting the final Bill.	One month from the date of virtual completion of the work by the Contractor.
10	Specifications.	The work shall be carried out strictly in accordance with the enclosed specifications and wherever items are not covered by those specifications in accordance with specifications/drawings /designs/requirements and directions.

I/We hereby agree to abide by and fulfil all the terms and provisions of the conditions contained in the articles of agreement, which have been read by me/us or in default thereof to forfeit and pay to the Registrar, Indian Institute of Science or his successors the sums of monies mentioned in the said conditions.

The sum of **Rs. 8,00,000 (Rupees Eight lakhs only)** has been deposited by demand draft as Earnest Money the full value which is to be absolutely forfeited to the Registrar or his successors in Office should I/We fail to commence the work specified in the above memorandum and complete the same.

Dated this **xxrd** day of **xxxxxx 2024**.

Signature of the Contractor

Witness to Contractor/s Signature:

NAME ADDRESS OCCUPATION

The above tender is hereby accepted by me on behalf of the Indian Institute of Science, Bangalore-12.

**REGISTRAR
INDIAN INSTITUTE OF SCIENCE
BANGALORE.**

10. References

I.S. STANDARDS OF ELECTRICAL WORKS

Sl .No	STANDARDS	TITLE
	Code of Practice / Guide	
1	IS : 732 - 1989	Code of Practice for Electrical wiring installations.
2	IS : 4648 - 1968	Guide for Electrical layout in residential buildings
3	IS : 80614 - 1976	Code of Practice for Design, installation and maintenance of service lines up to and including 650V.
4	IS : 7752 (Part-1) - 1976	Code of Practice for interior illumination : General requirements and recommendations for welding interiors.
5	IS : 4347 - 1967	Code of Practice for hospital lighting
6	IS : 6665 - 1972	Code of Practice for industrial lighting
7	IS : 2672 - 1966	Code of Practice for Library lighting
8	IS : 10118 (Part-1) - 1982	Code of Practice for selection, installation and maintenance of switcher and Controlgear : Installation.
9	IS : 4146 - 1983	Application guide for voltage transformers.
10	IS : 3043 - 1987	Code of practice for earthing.
11	IS : 5216 (Part-2) - 1982	Guide for safety procedures and practices in electrical work :General.
12	IS : 4237 - 1982	General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC.
13	IS : 6875 - (Part-1) - 1973	Control switches (Switching devices for control and auxiliary circuits including 1000 V AC and 1200 V DC : General requirements and tests.
14	IS : 10027 - 2000	Composite units of Air-Break switches and rewirable type fuses for voltages not exceeding 650 V AC.

15	IS : 4064 (Part-1) - 1978	Composite units of Air-Break disconnecter, Air-Break switch disconnecter and fuse-combination units for voltages not exceeding 1000 V AC or 120 V DC : General requirements.
16	IS : 8828 - 1996	Electrical accessories - circuit breakers for over current protection for household and similar installation.
17	IS : 2516 (Part-1/Sec01)-1985	Circuit-Breaks : Requirements and tests : Voltages not exceeding 100 V AC or 1200V DC.
18	IS : 5039 - 1983	Distribution pillars for Voltages not exceeding 1000 V AC or 1200 V DC.
19	IS : 8544 (Part-4) - 1979	Motor starters for voltages not exceeding 1000 V : Reduced voltage AC starters, two- step auto transformer starters.
20	IS : 9537 (Part-1) - 1988	Conduits for electrical installations General requirements
21	IS : 9537 (Part-4) - 1983	Conduits for electrical installations : Pliable self recovering conduits of insulating materials.
22	IS : 3854 - 1997	Switches for domestic and similar purposes.
23	IS : 1293 - 1988	Plugs and sockets outlets of rated voltage upto and including 250 Volts and current upto and including 16 Amperes.
24	IS : 2418 (Part-1) - 1977	Tubular Fluorescent lamps for general lighting services : Requirements and tests.
25	IS : 9900 (Part-1) - 1981	High pressure mercury vapor lamps : Requirements and tests.
26	IS : 1913 (Part-1) - 1978	General and safety requirements for luminaries : Tubular fluorescent lamps.
27	IS : 10322 (Part-1) - 1982	Luminaries : General requirements
28	IS : 302 (Part-1) - 1979	General and safety requirements for house hold and similar electrical appliances.
29	IS : 6236 - 1971	Direct recording electrical measuring instruments.
30	IS : 2705 (Part-1) - 1982	Current transformers : General requirements.

31	IS : 2448 (Part-1) - 1963	Adhesive insulating tapes for electrical purposes : Tapes with cotton textile substrates.
32	IS: 8130-1984	Code for Conductor Construction
33	IS: 5831-1984	Code for Insulation & sheath material
34	IS:694-1990	PVC insulated Flexible Single Core Wire/ Unarmoured Multicore/ Flat Cables. For working voltage upto & including 1100V.
35	IS:1554(Part-1)-1988	Copper or Aluminium Conductor, PVC insulated, extruded inner sheathed PVC, galvanised steel wire/strip armoured, extruded PVC sheathed LT Control/Power Cable. For working voltage upto & including 1.1KV.
36	IS:3975-1990	Code for Number of Strips in armouring construction.
37	IS: 7098/II/85	XLPE insulated HT & AB Cables. For working voltage 6.35/11KV.
38	IS:14255-1995	Code for Aerial Bunched Cables. For working voltage upto 1.1KV.
39	IS:13573/VDE 0278/IEC 60502/HD 629.1.S2 CENELEC	Code of Type tests for HT termination jointing kit.
40	IS 7569:1987	Cast Acrylic Sheets for use in Luminaires
41	IS 8030:1976	Specifications for Luminaires for Hospitals
42	IS 10242: Part 3: Sec 6: 1986	Electrical installations in ships: Part 3 Equipment, Section 6 Luminaires & accessories
43	IS 10322: Part 2 1982	Specification for Luminaires - Part 2: Constructional Requirements
44	IS 10322: Part 3 1984	Specification for Luminaires - Part 3: Screw & Screw Less Terminals
45	IS 10322: Part 4 1984	Specification for Luminaires - Part 4: Method of Tests
46	IS 10322: Part 5: Sec 1: 2012	Luminaires: Part 5 Particulars requirements, Sec 1 General Purpose Luminaires
47	IS 10322: Part 5: Sec2: 2012	Specifications for Luminaires - Part 5 : Particular Requirements - Section 2: Recessed Luminaires

48	IS 10322: Part 5: Sec4: 1987	Luminaires: Part 5 Particulars requirements, Section 4 Portable general-purpose luminaires
49	IS 13383: Part 1 : 1992	Photometry of Luminaires - Method of Measurement - Part 1: Luminaires for use in interior Lighting
50	IS 13383: Part 2 : 1992	Methods of Photometry of luminaires: Part 2 Luminaires for road & street lighting
51	IS 13383: Part 3 : 1992	Photometry of Luminaires - Method of Measurement - Part 3: Luminaires for Floodlighting
52	BSEN 10025 Grade 5, 355JO (or) ASTM A 572 F50	Steel sheet thickness
53	IS 875 Part 3	Wind Velocity
54	IS 2062 (or) ASTM A	Base Plate
55	BSEN ISO 1461 (or) ASTM A123 (or) IS	Galvanized in single hot dip / With Average 70 Microns
56	BS 5135	Welded Single L-Seam Joint
57	AISI 304 Grade	Stainless Steel Wire Rope (Factor of Safety: TR No. 7)
58	IS 1239	Maximum Load Carrying Capacity (Lantern)
59	IS 9595 (or) IS 10178 AWS	Single Section & Single Joint welded
60	ASTM - A 123 and 153	Hot dip Galvanized in Single dipping with not less than 65 Microns

ANNEXURE-IV

11. TECHNICAL SPECIFICATIONS, DRAWINGS AND COMPLIANCE

The work shall be carried out as per CPWD / KPWD specifications and relevant IS codes. In case of discrepancy between technical specification and BOQ, the BOQ shall prevail.

The contractor needs to ensure that the existing system functionality is understood, and the new system implementation needs to be done accordingly. The functionality needs to be ensured and provided within the system installation. Any product/accessory/software missing to achieve this functionality in the BOQ needs to be considered in the commercial price bid. There should be no compromise while choosing the components. The integrator needs to ensure all required components are added in and provided without any issues within the system to ensure the functionality is met. The contractor has to submit the design schematic for Audio, Video and Control, stage lighting and stage curtains to demonstrate a clear understanding of the system.

11.0 SCOPE OF WORK

The specification covers the general requirement for the Supply, Installation, Testing and Commissioning of laboratory furniture in the lower ground floor at the IDR Building in IISc, Bangalore

11.1 TECHNICAL SPECIFICATIONS FOR LAB FURNITURE:

I. DESIGN CRITERIA

a. TYPE

❖ C-Frame Assembly:-

All "C-Frame" components and assemblies shall be manufactured of heavy duty furniture grade cold rolled steel, free of surface blemishes and must be stretcher leveled flat. Alternatively, standard hollow metal sections, conforming to I.S. Code IS 4923 : 1997 can be used.

C- Frame" - Standard support assembly shall comprise of the following.

1. All standard leg assemblies are approximately 750mm high for sitting height & 900mm high for standing height.
2. The legs shall be structurally manufactured of 11 gauges, 75mm x 50mm x 3mm thick steel tubing, bead welded for maximum structural strength. Alternately, standard hollow metal sections- 80mm x 40mm x 3,2mm thick can be used.
3. Each leg assembly shall include minimum two (2) non-conductive floor levelers that provide for a minimum of vertical adjustment.
4. Horizontal support shall be manufactured of 12 gauge 75mm x 50mm x 3mm thick steel tubing to provide maximum structural strength.
5. All support assemblies shall be powder coated with high chemical resistant epoxy powder.

It is the Intent of the work to provide high quality CRCA Epoxy Powder Coated Cabinets 30mm Granite work top type of Lab Furniture.

The Work tops shall be of 30 mm Jet black Granite of an even surface and the level tolerance less

than 1 mm. The front edge of the granite shall be chamfered at an angle of 40 deg and smoothed and provided with a 2-3mm drip groove at the bottom. The back splash Skirting for the wall bench shall be granite 20 mm thick material for an height of 100mm from the finished table top level Snorkel / spot extractor shall be provided as per the layout.

It is the Intent of the work to provide exhaust system specifically designed for Laboratory Environment. Exhaust from Snorkels, Solvent / Acid Storage cabinets shall be connected through PP Pipe / PPRP duct which is connected to exhaust blowers.

b. FUME HOOD DESIGN BRIEF

- Constant Air Volume type Fume Hood of different sizes described in the Tender BOQ.
- Fume Hood with 30 mm Granite Work top.
- Factory Mutual (FM) Approved Solvent Base Cabinets.
- Utility Points - Line Vacuum, Potable Water, Nitrogen and Effluent drain.

II. GENERAL SCOPE OF WORK:

Furnish all cabinets and casework, including tops, ledges, "C-FRAME" supporting structures complete with knee space panels, filler panels etc., as per the Tender Bill of Quantities & drawings including delivery to the building, set in place, properly levelled and handing over with documentation after commissioning.

The supplier shall furnish and deliver all utility service outlet accessory fittings as mounted on the laboratory furniture like electrical sockets, switches, Gas & Water valves identified on drawings & as listed in the Tender Bill of quantities.

The supplier shall furnish and deliver all laboratory sinks, cup sinks, drains, drain troughs, overflows and sink outlets with integral tailpieces, which occur above the floor, and where these items are part of the equipment. All tailpieces shall be furnished with the couplings required to connect them to the drain piping system.

The supplier shall furnish service strip supports where specified, setting in place service tunnels, service turrets, supporting structures and reagent racks of the type shown on the drawings.

All various equipment fittings, assemblies, accessories, hardware, foundation bolts, supports, terminal lugs for electrical connections, cable glands, junction boxes and other sundry items for proper assembly and installation of various equipment and components of the work shall be deemed to be included in the tender, irrespective of the fact whether such items are specifically mentioned in the tender or not.

The supplier shall remove all debris, dirt and rubbish accumulated as a result of the installation of the laboratory furniture to an onsite container, leaving the premises broom clean and orderly.

After award of work, bidder has to integrate all the components of the work in consultation with the IISc, appointed Lab consultant i.e. (Lab furniture, fume hoods, exhaust system, integration with Electrical and all other services included in the BOQ with the help of respective specialized agencies), prepare shop drawings and get it approved from Engineer in charge before taking up the production/placing order for supply, checking/ensure the efficiency of the overall design and get it vetted from the IISc, appointed consultant.

Submit 6 sets of hard copies along with the soft copy of Lab wise and complete master plan of as built drawings of all the components.

Quoted rates shall include the cost of all the components specified in the specifications, all necessary tests in the factory and the tests conducted after receipt of materials at site in approved testing labs, performance tests, all taxes as per bid document, all minor accessories not specified in the BOQ item but necessary/ required to make the component operational /functional. Clarification if any can be asked during the pre-bid meeting.

III. GENERAL DESIGN REQUIREMENT

The furniture shall be of modern design and shall be constructed in accordance with the best practices of the Scientific Laboratory Equipment Industry. First class quality casework shall be insured by the use of proper machinery, tools, dyes, fixtures and skilled Workmanship to meet the intended quality and quantity for the project.

All cabinet bodies shall be of over closing design with fully knock down and having a main and add on construction to avoid any gaps in between two units. All units to be with interlocking type of construction to form a rigid integral structure.

All cabinets shall have a cleanable smooth interior. And shall be positioned on Pedestal Frame legs same shall be covered with PVC Coving to ensure no dust & moisture enters below the cabinets.

Thickness of Steel used in the construction of cases shall be as per specification enclosed.

Solvent storage cabinets shall be EN Certified 90 minutes fire rated and specifically designed for the storage for the storage of flammable and combustible liquids.

Acid storage cabinets shall be steel, and construction features as other cabinets except them shall be completely lined with 6 mm thick phenolic resin liner and 16 mm phenolic resin shelves.

IV. FUME HOOD

a. PURPOSE

The Laboratory Fume Hood will function as an enclosed workspace which will prevent employee exposures by containing emissions from within the Hoods & Exhausting them effectively.

b. TYPE

Fume Hoods shall be bench top Fume Hood

Constant Air Volume type benchtop Fume Hood shall be provided.

Fume Hood shall have utility valve like Line vacuum, N2, Potable Water, 4+4nos Tiny Trip power sockets (6 Raw power & 2 UPS).

All the Fume Hoods shall be of CRCA Powder Coated Hood with internal contact parts liner shall be of 6mm thick Reinforced Phenolic Resin Liner.

Base cabinets with vent provision shall be provided below the fume hoods & FM approved Solvent storage cabinets wherever specified in the Tender BOQ.

V. STANDARDS:

Conformity with Statutory Acts, Rules, Standards and Codes.

All components shall conform to relevant up to date Indian Standard Specifications, wherever existing irrespective of whether explicitly mentioned or not.

All electrical work shall be carried out in accordance with the provision of Indian Electricity Act

2003 and Indian Electricity Rules 1956, amended to date.

All lab fixtures shall conform to relevant international standards or guidelines and should provide documentary evidence to this effect. These include the following:

SEFA 3 – Scientific Equipment and Furniture Association for Work surface.

SEFA 8M - Scientific Equipment and Furniture Association for Steel Caseworks.

SEFA 8 - Scientific Equipment and Furniture Association.

SEFA 10 - Scientific Equipment and Furniture Association for C Frame.

NFPA 30 - National Fire Protection Association

NFPA-45 - National Fire Protection Association

UL - Underwriters Laboratories

ASTM D522 - Bending Test

ASHRAE 110-2016

(OR)

BGI/GUV-I 850-0 Laboratories

TRGS 526 Laboratories

DIN 12898 Laboratory fittings; hose nozzles

DIN 12918 Laboratories - laboratory fittings – part 1: Water taps

DIN 12918 Laboratories – laboratory fittings – part 2: Taps for combustion gases

DIN 12918 Laboratories-laboratories fittings – part 3: Taps for industrial gases

DIN/EN 13792 Labels for laboratory fittings

DIN/EN 15154-1 Safety emergency showers – part 1: Body showers with water connection for laboratories

DIN/EN 15154-2 Safety emergency showers – part 1: Eye showers with water connection

DIN/EN 14470-1 Fire resistance storage cabinets – part1: Safety cabinets for flammable liquids

DIN/EN 14470-2 Fire resistance storage cabinets – part 2: Safety cabinets for pressurized gas cylinders

DIN/EN 14175-2 Fume cupboards– part 2: requirements for safety and performance capacity

DIN/EN 14175-2 Fume cupboards – part 3: design test procedures

DIN 12924-2 Laboratories – fume cupboards – part 2: high performance fume cupboards

DIN 12924-4 Laboratories – fume cupboards – part: fume cupboard for pharmacies.

VI. QUALITY ASSURANCE AND TESTING.

The supplier shall have a history of successful projects of similar size and complexity.

Single Source Responsibility: For furnishing all cabinets and casework, including tops, ledges, “C-FRAME” supporting assemblies work top, modesty panel, shelves, storage, service fixtures and accessories, fume hoods, exhaust ducting, exhaust blowers and scrubbers, as a single responsibility.

The supplier shall submit test results for SEFA-3 & 8, 8M compliance as indicated in performance criteria of the respective codes for a minimum of any 2nos Cabinets of different sizes as listed in the BOQ. The supplier shall at his own expense and at no cost to the purchaser carry out all such tests and inspections of goods and related services as specified in Tender. Fume hoods shall be type tested at manufacturers own test facility by reputed third party testing agency & relevant certificates to be submitted.

Whenever the supplier is ready to carry out such tests, reasonable advance notice shall be given to the purchaser including obtaining necessary permission or consent from third party agency to enable the purchaser or its designated representative to attend the test and/or inspection.

VII. GENERAL SPECIFICATON

The steel frames, panels & shutters should be made from Prime Quality CRCA (Cold Rolled Cold Annealed) Steel. All cabinet shall be complete welded construction complying SEFA 8M standards.

Floor cabinets made of hollow tubular square cross sections would not be acceptable.

Single units should be complete welded construction complying with SEFA 8M Standards & units should be placed side by side to form the entire table.

Under Bench C-frame structure mounted Cabinets & Sink Base Unit.

All cabinets shall be overlay construction. Exterior corners shall be spot welded with heavy back up reinforcement at exterior corners. All face joints shall be welded and ground smooth to provide a continuous flat plane.

Thickness of CRCA / GI powder coated with minimum 60 to 80 microns high chemical resistant epoxy powder / 80 to 100 microns Polyurethane powder coating steel used in construction of cases shall be 1.2mm thick.

Base molding to be provided for the free-standing base units. Base molding shall be sealed at the bottom to prevent dust accumulation beneath the cabinet.

Support struts shall consist of two 1.6mm thk channel uprights fastened top and bottom by two adjustable "U" shaped spreaders, each 2.6mm thk, 1- 37.5mm x length required formed from galvanized steel. Struts shall be furnished to support drain troughs, and to support worktop at plumbing space under fume hood superstructures or other heavy loads.

The sinks should be with self-draining base and should be suitable for mounting on top or underside of the work benches. Sinks shall have bottle trap.

Internal size of PP Single Molded Sinks -shall be defined in the Technical BOQ.

Polyethylene cup drains shall be molded in one-piece of acid-resistant polyethylene. They shall have an integral mounting flange and an integral tailpiece with 38mm I.P.S. male straight thread outlet with Bottle Trap.

a. Under Bench Cabinets

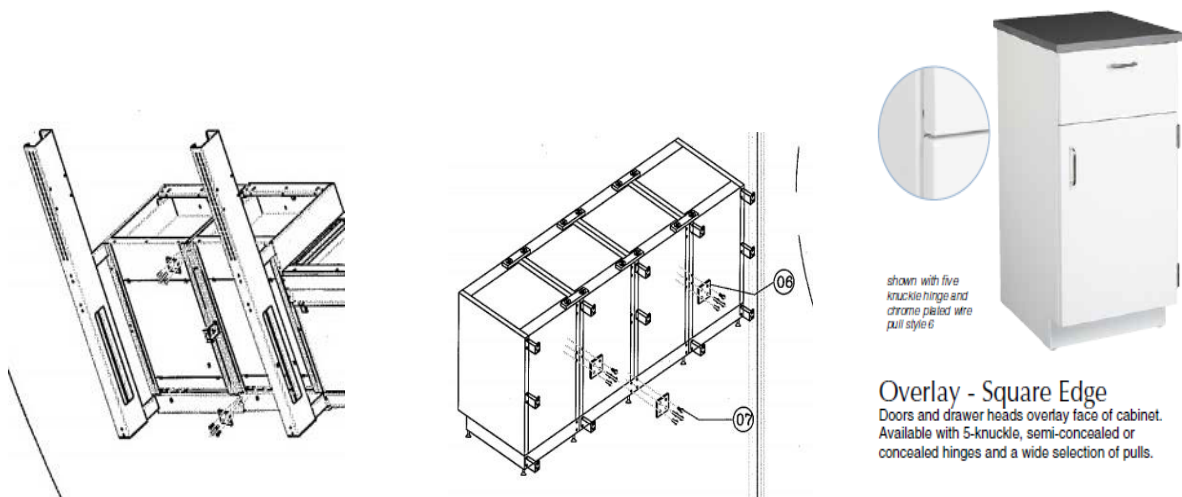


FIG: 01 TYPICAL UNDERBENCH SUPPORTING DETAILS

Under bench cabinets should be overlay construction. Thickness of CRCA with high chemical steel used in construction of cases shall be 1.2 mm thick except as follows:

Case and drawer suspension channels, 1.6mm thk.

Top and intermediate front horizontal rails, table aprons, hinge reinforcements, and reinforcement gussets, 1.6mm thk.

Drawer assemblies, door assemblies, bottom, bottom back rail, toe space rail, and adjustable shelves, 1mm thk.

The overall load carrying capacity of under bench cabinet should be 80 kg of UDL (40kg on the shelf and 40kg on the bottom)

Door shutters and drawers facias shall be bent to 19mm thick square edges, recessed aluminium pull, offering a comfortable handgrip, shall be securely fastened to doors and drawers with screws. All pulls shall be satin finish aluminium, with a clear, lacquer finish.

Drawer cabinets shall be made in one-piece construction including the bottom, two sides, back and front. They shall be fully covered at interior bottom on all four sides for easy cleaning. The top front of the inner drawer body shall be offset to interlock with the channel formation in drawer head providing a 19mm thick drawer head.

Drawer slides shall consist of high precision, fully extendable, double extension slides with minimum 40 kg load carrying capacity. Drawer slides shall be equipped with soft closure mechanism by air suspension, self-closing when the drawer reaches 80% closure. Drawer channels shall maintain alignment of drawer and provide an integral stop, but the drawer shall be removable without the use of tools. Drawers shall provide minimum 340mm front to back clearance when fully extended. Drawers shall rise when opened thus avoiding friction with lower drawers and/or doors.

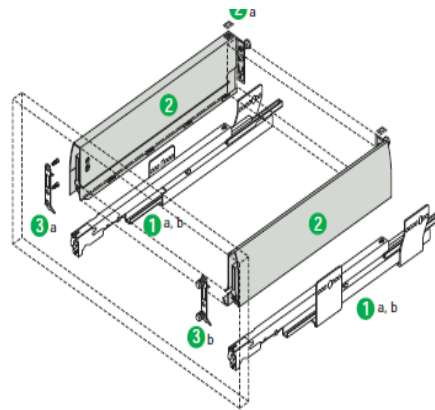


FIG: 02 TYPICAL DRAWER SLIDES DETAILS

Hinges shall be made of Type 304 stainless steel 2.2mm thick, 62.5mm high, with brushed satin finish with a five-knuckle bullet-type barrel. Hinges shall be attached to both door and case with two screws through each leaf. Welding of hinges to the door or case shall not be accepted. Doors under 900mm height shall be hung on one pair of hinges, and doors over 900mm high shall be hung on 3 hinges.

Handles shall be anodized aluminium, recessed type- 100mm x 44mm size.

All storage units except sink units shall be provided with locks. Locks shall be a 5-disc tumbler with heavy duty interchangeable cylinder and 2 sets of keys

A two-piece heavy-duty cam action positive catch shall be provided on all base cupboard doors and shall be positioned near the pivoting edge of door to provide a clean unobstructed opening. Main body of the catch shall be confined within an integral cabinet divider rail, while latching post shall be mounted on the hinge side of door. Nylon roller type catches are not acceptable.

Adjustable shelves shall be formed down 19mm, returned back 22.5mm and up 6.5mm into a channel formation front and rear; formed down 19mm at each end, shelves over 1050mm long shall be further reinforced with a channel formation welded to underside of shelf. Shelf adjustment clips shall be nickel-plated steel.

Shelves and Drawers: CRCA / GI powder coated with minimum of 60 to 80 microns high chemical resistant epoxy powder / 80 to 100 microns Polyurethane powder coating steel shelves and drawers shall have a load bearing capacity of 40kg of UDL.

Configuration of Storage Units: The storage units should be available in three configurations:

Storage unit with one/two shutters and one adjustable shelf

Storage unit with one drawer, one/ two shutters and one adjustable shelf
Storage unit with 4 drawers
All storages are fitted with 10 levers, 180-degree cam locks when not specified.
Hinged back panel (as shown in diagram) for easy access to services behind.

b. Anti-Vibration Table

Anti-Vibration Table (AVT) should be designed for use in analytical laboratory to provide suitable working conditions for high accuracy (0.0001 g) analytical balances that are sensitive to vibrations and shocks. The vibrations from the floor due to electricity fittings and other structural vibrations are responsible for producing errors in the measurement. Therefore, the AVT should be provided with suitable elastomeric mounts to isolate the vibrations and provide an error free vibration less surface for the analytical balance. The AVT should be made up of 80mm x 80mm tubular frame with 80mm thick granite on top & vibration pads. Fabrication of all structure should be in accordance with IS: 800 (latest). Welding of the structure should be as per IS: 800 and IS: 816

Geometric Profile of Anti-Vibration Table: Anti- Vibration Table should be an overall Rectangular Working Surface of min. 600 X600 mm and with a height of 750/ 900 mm.

Granite Geometric Profile: Granite geometry should be as per IS Standards IS 7327: 1991. Of 80mm Thickness.

Dimensions: 600 (W) x 600 (D) x 900 (H) mm/ 600 (W) x 600 (D) x 750 (H) mm (As mentioned in the tender BOQ).

Some of the Anti- vibration tables to be provided with Enclosure cabinets without exhaust as shown in the below drawing. Sliding laminated glass door at Front, Toughened glass at sides, CRCA Powder coated sheet at Rear side



FIG: 03 TYPICAL AVT WITH ENCLOSURE

c. Over Head Cabinets

Wall storage units shall be constructed of 1.2mm thick CRCA / GI, powder coated with minimum 60 to 80 microns high chemical resistant epoxy powder /80 to 100 microns Polyurethane powder coating, double wall construction for side walls with sound dampening technology or side and back wrap around body with corner posts with holes to support shelf supports, shelves shall be provided, constructed from 1.0mm thick CRCA / GI steel 60 to 80 microns high chemical resistant

epoxy powder /80 to 100 microns Polyurethane powder coating with all around 27mm strengthening edge, load capacity of 40 kg/ shelf , height should be adjustable to optimize the storage space inside the cabinet. Framed glass sliding / hinged door leaf shall be constructed from 1.2mm thick CRCA/GI powder coated with minimum 60 to 80 microns high chemical resistant epoxy powder /80 to 100 microns Polyurethane powder coating, steel panels, bent to 20mm thickness all around, dampened with contact cushions with 6mm thick float glass with polished edges fixed to shutter frame with PVC gasket. A guide runner shall be provided at the bottom with plastic coated ball bearings or the shutter should be top hung, supported on a ball bearing nylon roller running in a track attached to the top of the cabinet with a guide rail at the bottom. All cabinets should have load carrying capacity of 90 kg per cabinet. All cabinets should have a magnetic label to show details about its content. All storage cabinets should be provided with interchangeable cylinder locks.



FIG: 04 OVER HEAD CABINETS

d. Storage Cabinets

- **Full Height solid swing door Cabinets**

Swinging door full height storage cabinets shall have a completely finished interior same as exterior.

End uprights shall be formed at the front in a 25mm channel formation with the inside flange formed to provide a 775/800mm x 12.5mm door recess. The back of the upright shall be formed to a 62mm formation. A 1.6mm thk hinge reinforcement, same as specified for BASE CABINETS, shall be welded to inner side of front uprights.

Cabinet tops shall be formed into a 25mm x 1.5mm channel shape at front, with a 775/800mm x 12.5mm offset for door recess, and with flange at rear and sides for electro- welding cabinet top to cabinet back and ends.

Cabinet bottoms for storage cabinets shall be formed down on sides and back to create a square edge transition welded to cabinet end panels, and front edge shall be offset to create a seamless drawer and door recess rabbet for dust stop. Cabinet bottoms shall be formed to provide a flush 25mm face rail with a return flange to give a 14mm deep x 125mm high toe space.

Cabinet backs shall be welded to the top, bottom and ends. Backs shall be perforated for shelf adjustment holes on not more than 25mm centers. Holes shall be set in a channel formation in cabinet back and enclosed by end uprights.

Adjustable shelves shall be formed down 19mm, returned back 22mm and up 6mm into a channel formation front and rear, formed down 19mm at each end, shelves over 1050mm long shall be further reinforced with a channel formation welded to underside of shelf.

Toe space rails shall interlock in back of bottom rail and with end panel to provide a welding plate and shall extend to the floor with a flange turned back 13mm and turned up 9mm for support.

Glazed swinging doors shall be 19mm thick and consist of an inner and outer door pan welded to form a single unit. Outer door pan shall be 1.2mm thk steel, formed into a channel or flanged shape at all four sides. It shall be pierced and formed to create a 75mm wide frame with a beveled edge around the glass opening in the center of the door. Inner door pan shall be 1.2mm thk steel, flanged at all four sides, pierced for a glass opening in center of the door, with a 1.6mm thk hinge reinforcements welded in place. Doors shall be glazed with 6mm thick toughened glass, held in place by a rubber or vinyl gasket around the entire edge of the glass. Outer door pan shall be pierced for a recessed flush pull, as described under HARDWARE.

Solid panel swinging doors (two-piece) shall consist of an inner and outer pan formation, mechanically assembled after painting. All exterior surfaces shall be welded and ground smooth. Inner door pan shall be flanged for mechanical assembly. Door shall have a 2mm thick hinge reinforcement welded at hinge slot; as well as a full-height channel formation welded to inner pan. Doors shall be 19mm thick with sound deadening material.



FIG: 05 TALL CABINETS

- **ACID STORAGE CABINETS:**

The cabinet is to be flush face Construction, with doors and drawers in the same plane as the cabinet face frame, without overlap. The doors are to be 3/4" thick with square edges, and a stainless-steel pull handle. The height of the tall unit will be of 84" & Depth 22" & length varies 24", 30" & 36". It will have 2" dia hole in the top of cabinet at center & a powder coated extension piece until false ceiling for venting and will be connected to exhaust ducting. Door front panel will have Louvers at Equal distance for air circulation. Each unit will have 5 nos adjustable 16 mm Phenolic shelves with a 25mm lip at the bottom front to contain spills & 6 mm Phenolic liners for doors and cabinet inside surface.

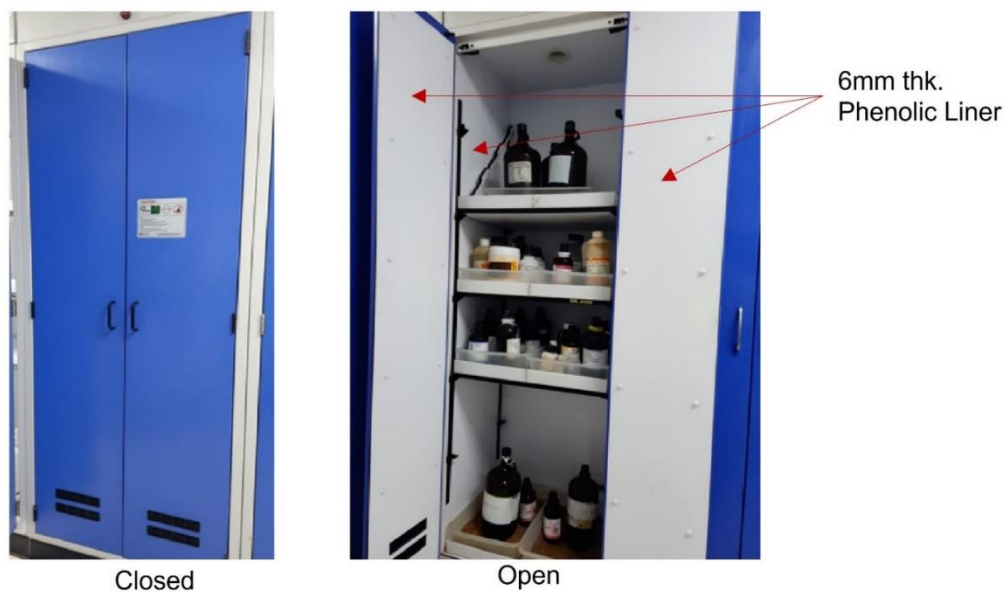


FIG: 06 ACID CABINETS

- a) **FM STORAGE CABINETS:**

- **Solvent Storage Cabinets:**

90minutes Fire rating approved as per (EN 14470-1) Solvent storage cabinets. The bottoms, top, sides and doors shall be fabricated of 1.2mm thk steel and shall be all double panel construction with a 40mm air space between panels. All joints shall be welded, or screwed, to provide a rigid enclosure. The doors shall swing on full-length stainless-steel piano hinges and shall be fully insulated. Loading capacity of Tray shelves shall be 75 kgs, 4nos of PP Trays shelves & 1 number Pan Collection. The right-hand door shall be equipped with a three-point latching device and the left-hand door shall have a full height astragal. The doors are self-closing and synchronized so that both doors will always fully close. The right-hand door is equipped with a three-point latching system that automatically engages when the doors close. Each door is equipped with a fusible-link hold-open feature that will ensure the door closes should the temperature outside the cabinet exceed 165 degrees Fahrenheit. Units 600mm long have only one door, self-closing, and equipped with a three-point latching system and hold-open feature. A 50mm deep liquid tight pan that covers the entire bottom of the cabinet shall be furnished to contain liquid leaks and spills. A full-depth adjustable shelf is also provided. The shelf is perforated to allow air circulation within the

cabinet. Two diametrically opposed vents with spark screens are provided in the back of the cabinet as well as a grounding screw. The cabinet shall have interior finish same as exterior. The cabinet shall be labelled: "FLAMMABLE - KEEP FIRE AWAY".



FIG: 07 FM APPROVED SOLVENT CABINETS

- **Above Bench 3 stage reagent shelves**

Reagent shelves shall be complete modular design consisting of 3 stage horizontal storage shelves. The ends and intermediate vertical supports should be 1.2mm and horizontal shelves of 10mm thickness of Toughened Glass supported on 2mm thick aluminium extrusion with MS brackets of 2mm thick. Each shelf should have a load bearing capacity of 50 kg of UDL for a length of 1000mm



FIG: 08 Reagent Shelves

- **Water Tap:**



FIG: 09 Three Way Wall Mounted Fittings with Swiveling GOOSENECK Spout

Wall mounted Water Tap shall be made up of Metal Handle & Brass with surface protected by Epoxy/Polyester Powder Coating RAL 7035 having male connection thread G3/8" & G1/2". Water flow capacity of around 30 l/min at 3 bar pressure & working temperature range of 0 70°C with test pressure 9 bars & max working pressure of 10 bar. . The fittings must be supplied with a 2x360° open/close function rubber headwork for fine regulation. The sealing must be made of EPDM and the lubrication must be silicone-based. The fittings should be capable of operating at maximum operating pressure of 10 bar (145 psi). The water fittings should be delivered with a flange and anti-rotational safety pins in order to keep the fitting fully locked in its position and to prevent unintentional turning that would result in leaks. The handles of the vale must be mounted with "zero gap" on the spindle of the headwork. The handle should be made of polypropylene and the handle must have a clear closing/opening indication. The fittings must be equipped with a hose nozzle according to DIN 12898. Depending on user requirement and preferences, the hose nozzle be made of polypropylene or powder coated brass and can be either fixed or removable type.

- **Twin Cup Eye Wash:**



FIG: 10 TYPICAL TWIN CUP EYE WASH

Twin cup eye wash shall comprise of the following:

All water-bearing parts made of brass: PA, POM, TPE, Metals: SS, AISI 316 and Rubber: EPDM handle with integrated, adjusting activation made of plastics, valve not self-closing high-performance spray heads made of brass, for large-scale dispersion of water, chemical resistant powder coated, largely scale-free, with rubber sleeves and sealed dust caps integrated flow regulation 14 litre / minute integrated backflow preventer stainless steel covered hose, length 1.5-meter, water inlet 12.5mm dia. female, DIN-DVGW tested and certificated table mounting accessories M28x1,5x80mm made of brass, incl. fastening-parts kit with nut M28x1,5mm and 2 screws M5 for mounting difficult to access, chrome-plated rosette, sealing to table surface with O-Ring sign for eye shower according to DIN 4844-2-D and BGV A8, self-adhesive PVC-film, 100 x 100 mm

Twin cup eye wash shall conform to the following codes; DIN 1988 und DIN EN 1717, DIN EN 15154-2:2006 and ANSI Z358.1-2004 Manufacturer: Broen or Water saver.

- **Safety Shower:**

Emergency Shower ; total height 2300 mm, projection 655 mm, should be capable of delivering water at a min 75 litres /min & Eye wash at a minimum of 11 litres /min with min working pressure of 1.5 bar, conforming to the following specifications:

Flange plate with 4 mounting holes made of Powder coated cast Aluminum (Radioactive labs to have stainless steel), chemical resistant orange powder coated, dimensions 230 x 230 mm Vertical stand pipe 2300mm height, 150mm dia made up of Galvanized steel, chemical resistant orange powder coated, with 25mm chrome plated brass stay-open ball valve. Valve is made with chrome plated brass ball and Teflon® seals. Furnished with stainless steel actuating arm and 29" stainless steel pull rod. DIN-DVGW tested and certificated pull rod made of steel, chemical resistant green powder coated, length 700 mm high-performance shower head made of chemical resistant plastic, with improved spray pattern, corrosion resistant, largely scale and maintenance-free, very robust, self-draining integrated automatic flow regulation 50 l/min. for a spray pattern according to the norms at a specified operating range of 1.5 to 3 bar dynamic water pressure eye / face wash unit with bowl body and bowl made of UV and impact resistant ABS plastic activation by pressing the big push plate made of stainless steel. High-performance spray heads made of brass, for large-scale dispersion of water, chemical resistant powder coated, largely scale-free, with rubber sleeves and sealed dust caps integrated flow. Regulation valve water inlet 1 1/4" male, water outlet 1 1/4" Female height 203 mm, width 445 mm, depth 300 mm according to DIN EN 15154-1:2006 , DIN EN 15154-2:2006, ANSI Z358.1-2004 and DIN 12899-3:2009



FIG: 11A TYPICAL FLOOR MOUNTED SAFETY SHOWER

2.7.1 Spot Extractor:

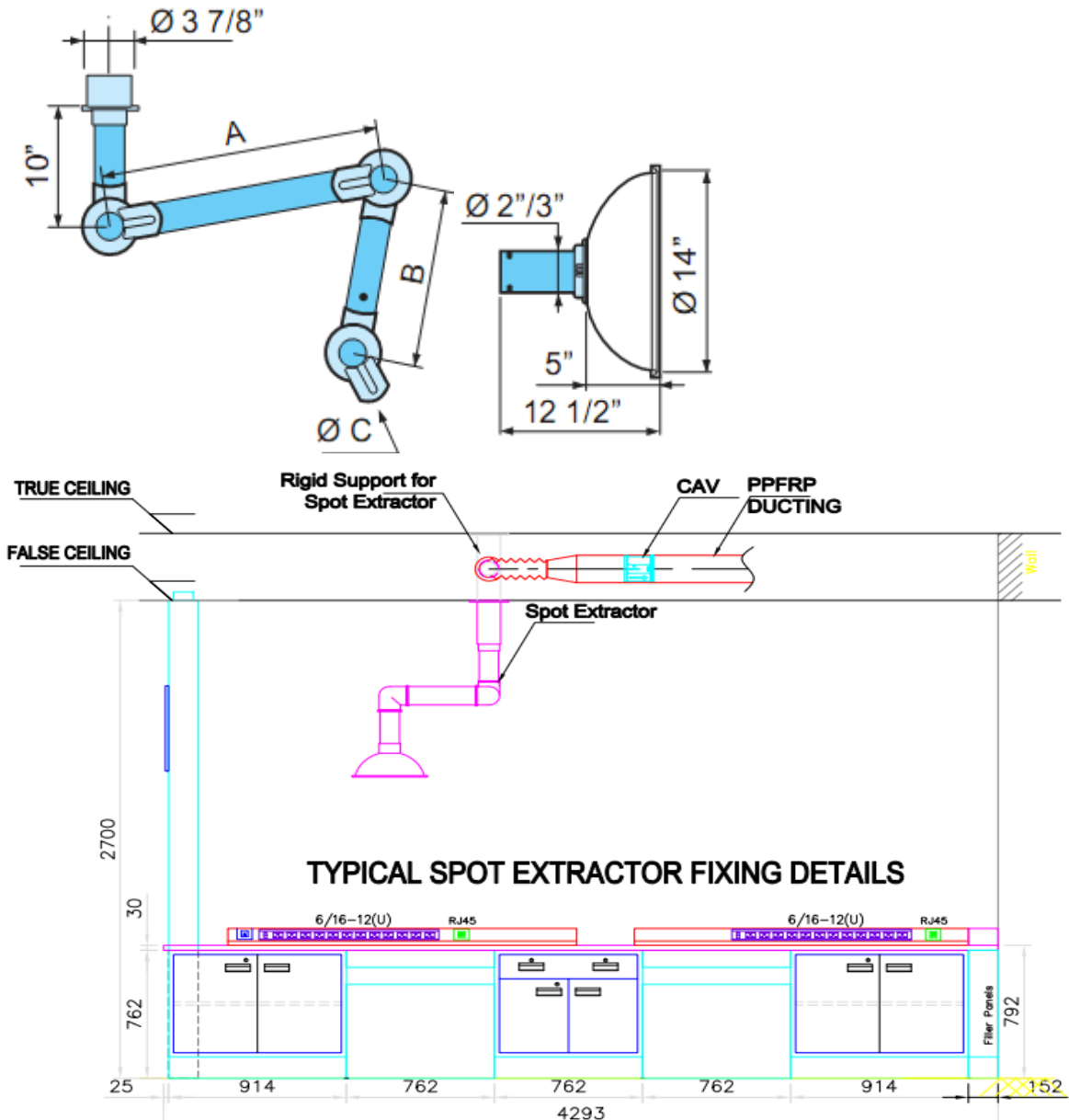


FIG: 12 TYPICAL SPOT EXTRACTOR FIXING DETAILS

Spot extractor shall be made of Poly Propylene with joints and tube in recyclable PP. All vertical drops from slab shall be made up of epoxy powder coated CRCA bracket. Extraction arm shall be $\text{Ø}75$, Lengths A=750 & B=450 with 360° rotation. Spot Extractor length up to 1500mm, which shall be mounted from ceiling with MS brackets with chemical resistance epoxy powder coating. Arms are provided with dampers, tight down to under pressure of 3500pa & air temperature of -10° to 70°C.

- **CAV Constant Air Volume**

Air flow controllers for constant air volume shall be of Plastic material (Polystyrene) classified M1 & galvanized steel for sleeves. Operating temperature shall be 5 to 60 deg C.

The air is forced to pass through predetermined space in which a flap can change the position according to the specified air flow. The requested airflow is fixed by a screwdriver. CAV is fixed in a Vertical / Horizontal ducts using a lip seal which ensure tightness.

- **Sinks:**

Should be made up of injection molded from pure polyolefin/ co-polymer material with inside corners coved, rectangular without border, having good resistance to organic solvents. Overall size (L x W x D) vary as per the BOQ.

- **Pegboard:**

Single faced stainless-steel pegboard having a tray hole for water drainage and detachable pegs. The essence is made up of 1 mm thick stainless steel (SS 304) whereas the pegs are made up of polypropylene and are adjustable with a minimum 10mm distance between each peg (L x W x H is 750 x 750 - 33 Pegs). SS 316L tray with 90 deg bend tube up to sink.

- **Bench Mounted/Suspended Laboratory Fittings**

The laboratory fitting manufacturer shall be certified to ISO 9001 / EN 29001 / BS 5750 Part 1, or equivalent.

The manufacturer should guarantee the availability of spare parts and replacement products for a period of minimum 10 years.

All external surfaces of the fittings shall be surface treated with a chemical resistant polyester powder coating that shall be highly resistant to most chemicals and provides excellent light fastness. Minimum thickness of coating shall be 50µm.

The fittings should be delivered with an "easy-to-mount" inlet connection, where it is possible to connect hoses, Cu-, SS-, or PEX pipes directly into the inlet of the valve, depending on the applications. Handle of the fittings to be metal.

The fittings should be delivered with color and media indication in accordance with EN 13792:2002.

Every fitting should be leak-tested before leaving the factory. Certificate of leak testing of each fitting to be provided.

Laboratory fittings must be supplied with an integrated service ball valve to provide the features Pre-setting of media flow, Local shut-off for maintenance purpose & Safety lock

- **Laboratory Fittings for Water**

The fittings must be supplied with a 2x360° open/close function rubber headwork for fine regulation. The sealing must be made of EPDM and the lubrication must be silicone-based. The fittings should be capable of operating at maximum operating pressure of 10 bar (145 psi).

The water fittings should be delivered with a flange and anti-rotational safety pins in order to keep the fitting fully locked in its position and to prevent unintentional turning that would result in leaks.

The handles of the valve must be mounted with "zero gap" on the spindle of the headwork. The handle should be made of metal and the handle must have a clear closing/opening indication.

The fittings must be equipped with a hose nozzle according to DIN 12898. Depending on user requirement and preferences, the hose nozzle be made of polypropylene or powder coated brass and to be removable type.

- **Laboratory Fittings for Non-burning 2.0 Gases**

The fittings must be supplied with a fine regulating needle headwork having 3x360 degrees open/close operation for fine regulation of media flow. The sealing must be made of FKM/FPM

and the lubrication must be Perfluoropolyether based. The fittings should be capable of operating at maximum operating pressure of 16 bar (232 psi).

The 2.0 non-burning fittings should be delivered with a flange and anti-rotational safety pins in order to keep the fitting fully locked in its position and to prevent unintentional turning that would result in leaks.

The handles of the valve must be mounted with "zero gap" on the spindle of the headwork. The handle should be made of metal and the handle must have a clear closing/opening indication.

The fittings must be equipped with a hose nozzle according to DIN 12898. Depending on user requirement and preferences, the hose nozzle be made of polypropylene or powder coated brass and to be removable type.

- **Laboratory Fittings for Vacuum**

The fittings must be supplied with a high-flow headwork having 1.5x360 degrees open/close operation for high-flow regulation of media flow. The sealing must be made of FKM/FPM and the lubrication must be Perfluoropolyether based. The valves should be capable of handling an operating pressure of -1 to 16 bar (-14.5 to 232 psi).

The vacuum fittings should be delivered with a flange and anti-rotational safety pins in order to keep the fitting fully locked in its position and to prevent unintentional turning that would result in leaks.

The handles of the valve must be mounted with "zero gap" on the spindle of the headwork. The handle should be made of metal and the handle must have a clear closing/opening indication. The fittings must be equipped with a hose nozzle according to DIN 12898. Depending on user requirement and preferences, the hose nozzle be made of polypropylene or powder coated brass and to be removable type.

- **Laboratory Fittings for Burning Gases**

Fittings must be delivered with a ceramic press/turn safety headwork with 90° open/close function, which prevents from unintentional opening of the valve. The sealing of the fittings for burning gases must be made of Nitrile and the lubrication must be mineral oil based. Fittings for burning gases should be capable of operating at maximum working pressure of 7 bar (100 psi).

The burning gas fittings should be delivered with a flange and anti-rotational safety pins in order to keep the fitting fully locked in its position and to prevent unintentional turning that would result in leaks.

Fittings for burning gases must be delivered with a metal handle with "POP-UP" indication buttons that make it possible visually to observe if the valve is open. Handles must be painted with the same quality polyester powder coating as the valve bodies.

Outlet must be equipped with a fixed metal serrated hose nozzle according to DIN 12898.

b) ELECTRICAL ACCESSORIES:

- **Industrial type sockets:**

16Amps 3 pin 1 phase plug and sockets controlled by tiny trip MCB shall be provided wherever specifically called for. Sockets shall be totally metal clad with porcelain base incorporating the pins. Sockets shall have 3 pins for single phase applications and 4 pins and scraping earth of 3 phase applications. The sockets shall be provided with suitable metal clad plug top with suitable cable entry. Sockets shall have metal covers with chain. It shall have a suitable interlocked switch. Industrial type sockets shall be provided with a suitable sheet steel housing made of 16 gauge with the socket mounted in flush with cover of the housing.

- **Installation of switches, sockets & accessories:**

All the switches shall be wired on phases. Connections shall be made only after testing the wires for continuity, cross phase etc., with the help of a megger. Switches, sockets fan regulators etc., shall be housed in proper GI factory boxes. The arrangement of switches and sockets shall be neat and systematic. Covers for enclosure shall be moulded accommodating switches, sockets etc., Outlets shall be terminated into a ceiling rose for fan points. For wall plug sockets, the conductor may be terminated directly into the switches and sockets. The outlets point control boxes etc. shall be set out as shown on the drawings. Before fixing these, the contractor shall obtain clearance from the Architect / consultant / project manager with regard to their proper locations. The enclosure of sockets and 3rd pin of the sockets shall be connected to the ground through a proper size earth continuity wires.

c) FUMEHOOD & ACCESSORIES

- **TYPES**

- **Constant Air Volume type Fume Hood with General storage cabinet**

Constant Air Volume type Fume Hood of different sizes described in the Tender BOQ.

Fume Hood with 30 mm Jet black Granite of a even surface and the level tolerance less than 1 mm. General storage Base Cabinets with vent provision.

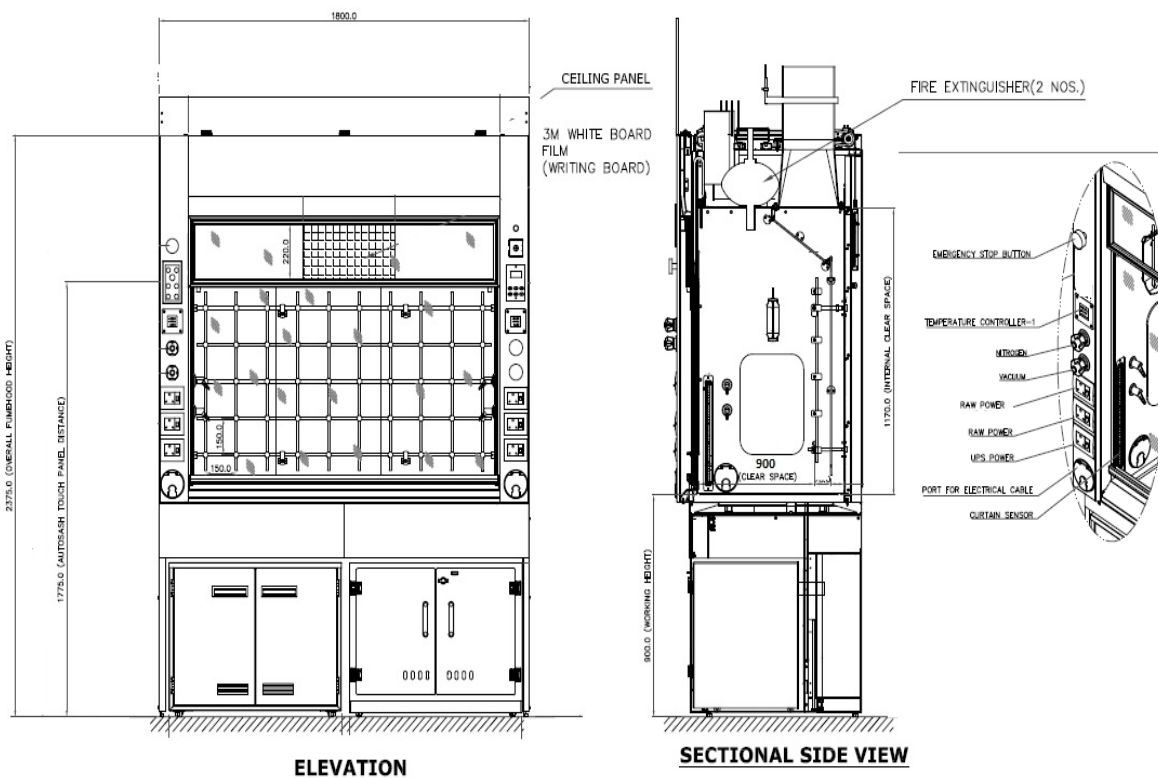


FIG: 14 Fume Hood with regular cabinet

➤ **Constant Air Volume type Fume Hood with FM approved Solvent storage cabinet**

Constant Air Volume type Fume Hood of different sizes described in the Tender BOQ.

Fume Hood with 30 mm Jet black Granite worktop in the center with 12mm lipping at the edges and the level tolerance less than 1 mm.

90 Min Fire rated Solvent Base Cabinets & SEFA 8M tested Acid storage Cabinets.



FIG: 15 Fume Hood with FM approved Solvent storage cabinet

- **Accessories:**

Furnishing and delivering all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings. Fittings attached to the fume hood superstructure shall be mounted on the front fascia of the hood as per the drawings. Furnishing and delivering all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings. Plumbing fixtures mounted on the fume hood superstructures shall be pre-plumbed up to 150mm above the Fume hood with SS-304 TUBING / Hoses. Electrical fixtures shall be prewired up to the Junction box provided on top of every Fume hood. Final plumbing and electrical connections are the responsibility of Plumbing & Electrical contractor.

- **PART I- MATERIAL OF CONSTRUCTION**

- **Fume Hood Superstructure Frame:**

A structure of steel angle shall be provided to support exterior panels and interior liner and baffle panels. To allow for maintenance and replacements, the interior liner panels shall be removable without disassembly of the frame structure and outer steel panels. Likewise, the exterior steel panels shall be removable without disassembly of the frame structure and inner liner panels. Fume hoods that require disassembly of the superstructure for liner replacement are not acceptable.

- **Fume Hood Interior Walls:**

Double wall ends, not more than 140mm wide, shall be provided to maximize interior working area. The area between the double wall ends shall be closed to house the remote-control valves. The front vertical fascia section shall have a full 135-degree 25mm radius at the front leading edge to provide a streamlined section and insure smooth even flow of air into the hood. The vertical facial shall contain the required service controls, electrical switches and receptacles. The hood interior end panels and sash track shall be flush with the fascia to prevent eddy currents and back flow of air.

- **Fume Hood Airfoil:**

A streamlined airfoil shall be integral at the bottom of the hood opening on bench and distillation hoods. This foil shall provide a nominal 25mm open space between the foil and the top front edge of the work surface to direct an air stream across the work surface to prevent back flow of air. The airfoil shall extend back under the sash, so that the sash does not close the 25mm opening. The foil shall be removable to allow large equipment into the hood. The foil shall be of 12-gauge 2.6mm thk steel to resist denting and flexing. Walk-in hoods shall have a stop located at the bottom of the sash track that will ensure a nominal 25mm opening between the bottom of the sash and the floor.

- **Fume Hood Liners:**

Interior liner panels shall be 6mm thick made from a compression molded cellulose fiber reinforced phenolic resin core with integrally cured white melamine surfaces. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.

SEFA 8.0 Certified from authorized SEFA approved agency with 10 years written Product Guarantee for all properties mentioned in material property data sheet. 10 years of proven testimonials in Global and Indian reputed Government & Private Research Laboratories. Fire Rating certified by 3rd party for Fume hood application with minimum 60 minutes of Fire rating.

- **Fume Hood Work top:**

The work tops shall be of 30 mm Jet black Granite of an even surface and the level tolerance less than 1 mm & not less than .375mm deep to contain spillage with a 75mm wide safety ledge across the front edge. A cup sink flush with the recessed work surface shall be provided.

- **Fume Hood Baffles:**

A stable, non-adjustable baffle with three fixed horizontal slots shall be provided to aid in distributing the flow of air into and through the hood. The baffle shall be spaced out 60mm from the back liner. The baffle shall be removable for cleaning. Baffle to be manufactured with same material specification of interior liner.

- **Fume Hood Lighting:**

A one-tube, energy-efficient, LED light fixture of the size given below shall be provided in the hood roof. Illumination at work surface shall be at least 500 Lux.

Hood Size, MM.	Nominal Fixture Length, MM.
1200	900
1500	1200
1800	1200
2100 / 2400	900 (2 Fixtures)

The light fixtures shall be isolated from the hood interior by a 6mm thick tempered glass panel sealed from the hood cavity. Fixture shall be UL labelled.

- **Fume Hood Sash:**

- **Sash:**

The sash shall have vertical rising steel frame. The bottom of the sash frame shall have a full-length metal handle. The sash track shall be a neutral colored polyvinyl chloride set flush with the interior liner panels to minimize turbulence. The sash shall be counterbalanced with a single weight to prevent tilting and binding during operation. The glass panels shall be 6mm laminated safety float glass mounted on metal rollers in an aluminium track.

- **Fume Hood Plumbing Services:**

All Utility services shall consist of remote-control valves as selected located within the end panels, controlled by extension rods projecting through the control panels of the hood, and with color coded plastic handles. All plumbing fittings shall be installed and piped upto 150mm above the Fume hood top. All the Plumbing shall be SS 304 hard / flexible tubes as per media specification
Fume hood Valves/Outlet manufacturer shall be certified to ISO 9001 / EN 29001 / BS 5750 Part 1, or equivalent.

The manufacturer should guarantee the availability of spare parts and replacement products for a period of minimum 10 years.

All external surfaces of the valve shall be surface treated with a chemical resistant polyester powder coating that shall be highly resistant to most chemicals and provides excellent light fastness. Minimum thickness of coating shall be 50µm.

The handles of the valves must be mounted with "zero gap" on the spindle of the headwork. The handle should be made of metal and the handle must have a clear closing/opening indication. The valve and outlets should be delivered with an "easy-to-mount" inlet connection, where ever possible to connect hoses, Cu-, SS-, or PEX pipes directly into the inlet of the valve, depending on the applications.

Both valve and outlets should be delivered with color and media indication in accordance with EN 13792:2002.

Every fitting should be leak-tested before leaving the factory.

- **Fume Hood Valves for water**

The valves must be supplied with a 2x360° open/close function rubber headwork for fine regulation. The sealing must be made of EPDM and the lubrication must be silicone-based. The valves should be capable of operating at maximum operating pressure of 10 bar (145 psi). Handle of the fittings to be metal.

- **Fume hood Outlets for water**

The water outlets shall be connected to the drain line of Cup sink & transferred to Main drain line.

- **Fume hood valves for Potable Water**

The valves must be supplied with a 2x360° open/close function rubber headwork for fine regulation. The sealing must be made of EPDM and the lubrication must be silicone-based. The valves should be capable of operating at maximum operating pressure of 10 bar (145 psi).

The outlets must be supplied with 1LPM flow fix for flow restriction. The handle of the fittings to be metal.

- **Non-burning 2.0 Gases**

The valves must be supplied with a fine regulating needle headwork having 3x360 degrees open/close operation for fine regulation of media flow. The sealing must be made of FKM/FPM and the lubrication must be Perfluoropolyether based. The valves should be capable of operating at maximum operating pressure of 16 bar (232 psi). Handle of the fittings to be metal.

- **Non-Burning 2.0 Gases/Vacuum Outlets**

The sealing of the outlets for non-burning 2.0 gases / vacuum must be made of FKM/FPM and the lubrication must be Perfluoropolyether based. The non-burning 2.0 gas / vacuum outlets should be delivered with rear wall connection (RWC) for compact installation. It should be possible for the outlet to be removed from outside without demounting the Fume hood panel. Handle of the fittings to be metal.

The outlets must be equipped with a hose nozzle according to DIN 12898. Depending on user requirement and preferences, the hose nozzle be made of polypropylene or powder coated brass and to be removable type.

- **Fume Hood Electrical Services**

The hood superstructure shall be pre-wired and contain a UL label certifying acceptable wire gauge, connections, fixtures and wire color coding. Wiring electrical services shall consist of 3 Nos of 20Amps 1 Phase 3 pin Industrial Plug and socket controlled by Tiny trip MCB at both sides each, emergency stop push buttons and a light switch. Distribution Board with 20/25Amps DP RCBO as incomer and outgoings will be 20Amps x 3. Internal wiring from DB to each circuit, emergency push button and lighting shall terminate in one 150mm x 150mm x 100mm service junction box located on the fume hood roof. Final wiring and circuit dedication shall be by others. The control panel should be located in the front face panel of the fume hood for easy accessibility for maintenance.

- **Electric Hatch**

There shall be two hatches, one in each vertical front side of the fume hood near worktop level which will allow passage of the electric wires of the equipment being used in the chamber to be guided through and connected to the electric power points

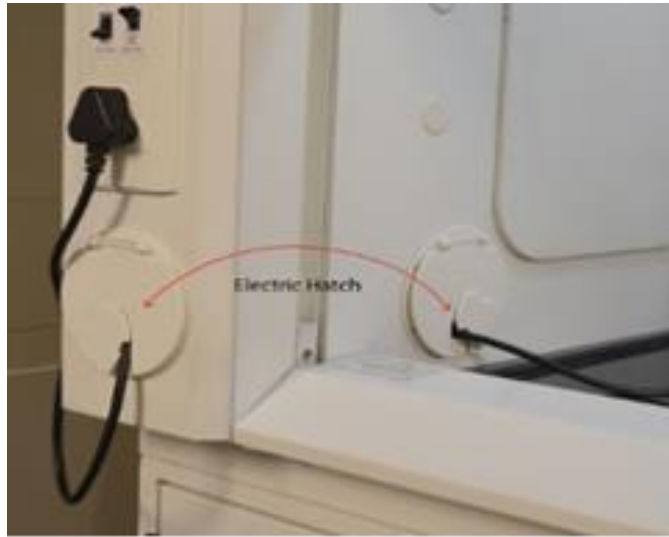


FIG: 16 TYPICAL ELECTRICAL HATCH DETAILS

- **Access Opening:**

The interior end liner panels shall be furnished with an opening that provides access to the service piping and valves to facilitate installation and maintenance. The openings shall be covered with a removable panel with rounded corners. Panels that require tools to remove are not acceptable. The panel shall provide an overlapping seal on all edges.

- **Fume Hood Finish:**

After the component parts have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine-grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.

After the phosphate treatment, the steel shall be dried, and all steel surfaces shall be coated with a chemical and corrosion resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.

The completed finish system in standard colours shall meet the performance test requirements specified under Performance Requirements.

PART 1: PERFORMANCE REQUIREMENTS

- **Steel Casework Construction Performance (SEFA 8 & 8M)**

Each adjustable and fixed shelf upto 1200 mm length shall support an evenly distributed load of per 25 kg per square ft. up to a maximum of 80 kg per sq.ft., with nominal temporary deflection, but without permanent bend.

Drawer construction and performance shall allow 340mm clear when in an extended position and suspension system shall prevent friction contact with any other drawer or door during opening or closing. All drawers shall operate smoothly, a minimum of 10,000 cycles with an evenly distributed load of 70 kg.

Swinging doors on floor mounted casework shall support 90 kg. Suspended at a point 300mm from

hinged side, with door swung through an arc of 160 degrees. Weight load test shall allow only a temporary deflection, without permanent distortion or twist. Door shall operate freely after test and assume a flat plane in a closed position.

- **Steel Paint System Finish (SEFA 8 & 8M)**

➤ **Steel Paint System Finish:**

After Cold Rolled Steel component parts have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine-grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.

After the phosphate treatment, the steel shall be dried and all steel surfaces shall be coated with a chemical and corrosion-resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.

- **Steel Paint System Finish: All steel coated surfaces to follow the following testing standards:**

Sl. No	Characteristic	Specification	Method Used	Standards References
1	DFT (DRY FILM THICKNESS)	35 micron	ELCOMETER OR DFT METER	ASTM-D: 1186 (93), IS - 13871(1993), IS - 101
2	GLOSS AT 600	70 ±5 units	GLOSS METER	ASTM-D 523-89 Reapproved (1994)
				ISO - 2813
				DIN - 67530, IS - 13871(1993), IS - 101
3	SCRATCH HARDNESS	3 kgs	SCRATCH HARDNESS TESTER	BS - 3900 Part E2 1970
				IS - 101 (Part- /Sec-2) 1988, IS - 13871:1993
4	IMPACT RESISTANCE	275 Kg.cm	IMPACT TESTER	ASTM-D: 2794-93
				BS - 3900 Part E3 1979, IS - 101
				JISK - 5400 (1979), IS - 13871(1993)

Sl. No	Characteristic	Specification	Method Used	Standards References
5	CROSS CUT ADHESION	1x1 mm or GT=0		DIN - 53151
				ISO - 2409
				ASTM - 3002
				ASTM - 3359
				JISK - 5400 (1979), IS - 13871(1993)
6	FLEXIBILITY	3.25 mm	CYLINDERICAL MANDREL BENDING TESTERS	DIN - 53152, ISO - 1519
				ASTM - D: 522
				BS - 3900 PART E1, IS - 101 (Part-5/ Sec-2) 1988
7	ERICHSEN CUPPING	8 mm	ERICHSEN CUPPING TESTER	JISK - 5400 (1990)
				IS - 101 (Part 5/Sec 2) 1988, IS - 13871(1993)
8	SALT SPRAY	1000 hours	SALT SPRAY CHAMBER	IS - 101 (Part 6/Sec 1)1988

The completed finish system in standard colors shall meet the performance test requirements specified under Performance Test Results.

- **Performance Test Results (Chemical Spot Tests):**

- **Testing Procedure:**

Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4" dia. watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2-ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

- **Test Evaluation:**

Evaluation shall be based on the following rating system.

- Level 0- No detectable change.
- Level 1- Slight change in color or gloss.
- Level 2- Slight surface etching or severe staining.
- Level 3- Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

After testing, panel shall show no more than three (3) Level 3 conditions.

- **Test Reagents**

Test No	Chemical Reagent	Test Method
1	Acetate, Amyl	Cotton ball & bottle
2	Acetate, Ethyl	Cotton ball & bottle
3	Acetic Acid, 98%	Watch glass
4	Acetone	Cotton ball & bottle
5	Acid Dichromate, 5%	Watch glass
6	Alcohol, Butyl	Cotton ball & bottle
7	Alcohol, Ethyl	Cotton ball & bottle
8	Alcohol, Methyl	Cotton ball & bottle
9	Ammonium Hydroxide, 28%	Watch glass
10	Benzene	Cotton ball & bottle
11	Carbon Tetrachloride	Cotton ball & bottle
12	Chloroform	Cotton ball & bottle
13	Chromic Acid, 60%	Watch glass
14	Cresol	Cotton ball & bottle
15	Dichlor Acetic Acid	Cotton ball & bottle
16	Dimethylformamide	Cotton ball & bottle
17	Dioxane	Cotton ball & bottle
18	Ethyl Ether	Cotton ball & bottle
19	Formaldehyde, 37%	Cotton ball & bottle
20	Formic Acid, 90%	Watch glass
21	Furfural	Cotton ball & bottle
22	Gasoline	Watch glass
23	Hydrochloric Acid, 37%	Cotton ball & bottle
24	Hydrofluoric Acid, 48%	Watch glass
25	Hydrogen Peroxide, 3%	Watch glass
26	Iodine, Tincture of	Watch glass
27	Methyl Ethyl Ketone	Cotton ball & bottle
28	Methylene Chloride	Cotton ball & bottle

Test No	Chemical Reagent	Test Method
29	Mono Chlorobenzene	Cotton ball & bottle
30	Naphthalene	Cotton ball & bottle
31	Nitric Acid, 20%	Watch glass
32	Nitric Acid, 30%	Watch glass
33	Nitric Acid, 70%	Watch glass
34	Phenol, 90%	Cotton ball & bottle
35	Phosphoric Acid, 85%	Watch glass
36	Silver Nitrate, Saturated	Watch glass
37	Sodium Hydroxide, 10%	Watch glass
38	Sodium Hydroxide, 20%	Watch glass
39	Sodium Hydroxide, 40%	Watch glass
40	Sodium Hydroxide, Flake	Watch glass
41	Sodium Sulfide, Saturated	Watch glass
42	Sulfuric Acid, 33%	Watch glass
43	Sulfuric Acid, 77%	Watch glass
44	Sulfuric Acid, 96%	Watch glass
45	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46	Toluene	Cotton ball & bottle
47	Trichloroethylene	Cotton ball & bottle
48	Xylene	Cotton ball & bottle
49	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

➤ **Performance Test Results (Heat Resistance):**

Hot water (190° F - 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

➤ **Performance Test Results (Impact Resistance):**

A one-pound ball (approximately 2" diameter) shall be dropped from a distance of 12 inches onto the finished surface of steel panel supported underneath by a solid surface. There shall be no

evidence of cracks or checks in the finish due to impact upon close eye-ball examination.

➤ **Performance Test Results (Bending Test):**

An 18-gauge steel strip, finished as specified, when bent 180o over a 1/2" diameter mandrel, shall show no peeling or flaking off of the finish.

➤ **Performance Test Results (Adhesion):**

Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1/16" apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination. Note: This test is based on ASTM D2197-68, "Standard Method of Test for Adhesion of Organic Coatings".

➤ **Performance Test Results (Hardness):**

The test sample shall have a hardness of 4-H using the pencil hardness test. Pencils, regardless of their brand are valued in this way: 8-H is the hardest, and next in order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which is the softest).

The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one-that is, the hardest pencil that will not rupture the film-is then used to express or designate the hardness.

• **FITTINGS**

➤ **Laboratory Service Fittings:**

Service fittings shall be laboratory grade, and water faucets and valve bodies shall be cast red brass alloy or bronze forgings, with a minimum content of 85%.

Plastic Coated Finish (Sepia Bronze):

When specified, laboratory service fittings shall have an acid resistant plastic coating applied over a fine sand-blasted surface. Surfaces shall be sprayed and baked three times with a minimum thickness of .0005 to .0010 mils.

Service Indexes:

Fittings shall be identified with service indexes with color coding:

• **PERFORMANCE:**

Maximum Line Pressures:

Laboratory Ball Valves (Gas and Air)	75 PSI
Needle Point Cocks (Gas and Air)	65 PSI
Vacuum 28.5" Mercury	
Hot and Cold Water	80 PSI
Steam	30 PSI

PART 2 – EXECUTION

- **SITE EXAMINATION**

Agency shall visit site before bidding for the tender and get himself acquainted with site conditions, type of buildings, lifts and leads and scope of work and no claim shall be entertained on this ground at later date. The work shall be executed as per direction of Engineer in charge.

- **INSTALLATION**

- **Preparation:**

Prior to beginning installation of casework, check and verify that no irregularities exist that would affect quality of execution of work specified.

- **Coordination:**

Coordinate the work of the Section with the schedule and other requirements of other work being prepared in the area at the same time both with regard to mechanical and electrical connections to and in the caseworks and the general construction work.

- **Performance:**

- **Casework:**

Set casework components plumb, square, and straight with no distortion and securely anchor to building structure. Shim as required using concealed shims.

Bolt continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1.5mm tolerance.

Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board.

Abut top edge surfaces in one true plane. Provide flush joints not to exceed 3mm.

- **Work surfaces:**

Where required due to field conditions, scribe to abutting surfaces.

Only factory prepared field joints, located per approved shop drawings, shall be permitted.

Secure the joints in the field, where practical, in the same manner as in the factory.

Secure work surfaces to casework and equipment components with materials and procedures recommended by the manufacturer.

- **Adjust and Clean:**

Repair or remove and replace defective work, as directed by CLIENT representative upon completion of installation.

Adjust doors, drawers and other moving or operating parts to function smoothly.

Clean shop finished casework; touch up as required.

Clean work surfaces and leave them free of all grease and streaks.

Casework to be left broom clean and orderly.

- **Protection:**

Provide reasonable protective measures to prevent casework and equipment from being exposed to other construction activity.

Advise CLIENT representative of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

- **PART 3: PERFORMANCE REQUIREMENTS**

- **Testing Procedure:**

Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 30mm dia. watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 60ml wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

- **Test Evaluation:**

Evaluation shall be based on the following rating system.

Level 0- No detectable change.

Level 1- Slight change in colour or gloss.

Level 2- Slight surface etching or severe staining.

Level 3- Pitting, catering, swelling, or erosion of coating. Obvious and significant deterioration.

After testing, panel shall show no more than three (3) Level 3 conditions.

Test Reagents

Test No	Chemical Reagent	Test Method
1	Acetate, Amyl	Cotton ball & bottle
2	Acetate, Ethyl	Cotton ball & bottle
3	Acetic Acid, 98%	Watch glass
4	Acetone	Cotton ball & bottle
5	Acid Dichromate, 5%	Watch glass
6	Alcohol, Butyl	Cotton ball & bottle
7	Alcohol, Ethyl	Cotton ball & bottle
8	Alcohol, Methyl	Cotton ball & bottle

Test No	Chemical Reagent	Test Method
9	Ammonium Hydroxide, 28%	Watch glass
10	Benzene	Cotton ball & bottle
11	Carbon Tetrachloride	Cotton ball & bottle
12	Chloroform	Cotton ball & bottle
13	Chromic Acid, 60%	Watch glass
14	Cresol	Cotton ball & bottle
15	Dichlor Acetic Acid	Cotton ball & bottle
16	Dimethylformamide	Cotton ball & bottle
17	Dioxane	Cotton ball & bottle
18	Ethyl Ether	Cotton ball & bottle
19	Formaldehyde, 37%	Cotton ball & bottle
20	Formic Acid, 90%	Watch glass
21	Furfural	Cotton ball & bottle
22	Gasoline	Watch glass
23	Hydrochloric Acid, 37%	Cotton ball & bottle
24	Hydrofluoric Acid, 48%	Watch glass
25	Hydrogen Peroxide, 3%	Watch glass
26	Iodine, Tincture of	Watch glass
27	Methyl Ethyl Ketone	Cotton ball & bottle
28	Methylene Chloride	Cotton ball & bottle
29	Mono Chlorobenzene	Cotton ball & bottle
30	Naphthalene	Cotton ball & bottle
31	Nitric Acid, 20%	Watch glass
32	Nitric Acid, 30%	Watch glass
33	Nitric Acid, 70%	Watch glass
34	Phenol, 90%	Cotton ball & bottle
35	Phosphoric Acid, 85%	Watch glass
36	Silver Nitrate, Saturated	Watch glass
37	Sodium Hydroxide, 10%	Watch glass
38	Sodium Hydroxide, 20%	Watch glass
39	Sodium Hydroxide, 40%	Watch glass
40	Sodium Hydroxide, Flake	Watch glass

Test No	Chemical Reagent	Test Method
41	Sodium Sulfide, Saturated	Watch glass
42	Sulfuric Acid, 33%	Watch glass
43	Sulfuric Acid, 77%	Watch glass
44	Sulfuric Acid, 96%	Watch glass
45	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46	Toluene	Cotton ball & bottle
47	Trichloroethylene	Cotton ball & bottle
48	Xylene	Cotton ball & bottle
49	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

- **Performance Test Results (Heat Resistance):**

Hot water (190° F - 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 180 per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

- **Performance Test Results (Impact Resistance):**

A one-pound ball (approximately 50mm diameter) shall be dropped from a distance of 300mm onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye-ball examination.

- **Performance Test Results (Bending Test):**

A 1.2mm thk steel strip, finished as specified, when bent 180o over a 12.5mm diameter mandrel, shall show no peeling or flaking off of the finish.

- **Performance Test Results (Adhesion):**

Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1.5mm apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination. Note: This test is based on ASTM D2197 68, "Standard Method of Test for Adhesion of Organic Coatings".

- **Performance Test Results (Hardness):**

The test sample shall have a hardness of 4 H using the pencil hardness test. Pencils, regardless of their brand are valued in this way: 8 H is the hardest, and next in order of diminishing hardness are 7 H, 6 H, 5 H, 4 H, 3 H, 2 H, F, HB, B (soft), 2 B, 3 B, 4 B, 5 B (which is the softest).

The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel like manner until one is found that will cut or scratch the film. The pencil used before that one that is, the hardest pencil that will not rupture the film is then used to express or designate the hardness.

• **Liner Tests – Chemical Spot Tests – 24 Hours:**

Chemical spot test shall be made by applying 10 drops (approximately 1/2 cc) of each reagent to the surface to be tested. Each reagent (except those marked **) shall be covered with a 38mm diameter watch glass, convex side down to confine the reagent. Spot tests of volatile solvents marked ** shall be tested as follows: A 1" or larger ball of cotton shall be saturated with the solvent and placed on the surfaces to be tested. The cotton ball shall then be covered by an inverted 60ml, wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire 24-hour test period and at a temperature of 77 degrees F. + 3 degrees F.

At the end of the test period, the reagents shall be flushed from the surfaces with water and the surface scrubbed with a soft bristle brush under running water, rinsed, and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Spots where dyes have dried shall be cleaned with a cotton swab soaked in alcohol to remove the surface dye. The test panel shall then be evaluated immediately after drying.

➤ **Ratings/Legend:**

- | | |
|--------------------------------|--|
| 1 -Epoxy Resin | A = No effect or slight change in gloss |
| 2 - Glass Reinforced Polyester | B = Slight change in gloss or colour |
| 3 - Stainless Steel 304 | C = Slight etching or severe staining |
| 4 - Stainless Steel 316 | D = Swelling, pitting, or severe etching |
| 5 - Reinforced Phenolic Resin | |

RESULTS:

		1	2	3	4	5
1. Acetic Acid 98%		A	B	B	B	A
2. Acetone **	A	D	A	A	A	
3. Acid Dichromate		A	A	A	A	A
4. Ammonium Hydroxide ** 28%		A	A	B	B	A
5. Amyl Acetate **		A	A	A	A	A
6. Benzene **	A	A	A	A	A	
7. Butyl Alcohol **		A	A	A	A	A
8. Carbon Tetrachloride **		A	A	A	A	A
9. Chloroform **		A	D	A	A	A
10. Chromic Acid 60%		B	B	C	C	A
11. Cresol		A	A	A	A	A
12. Dichloroacetic Acid		A	D	B	A	A
13. Dimethylformamide		A	A	A	A	A
14. Dioxane **	A	A	A	A	A	
15. Ethyl Acetate **		A	A	A	A	A
16. Ethyl Ether **		A	A	A	A	A
17. Ethyl Alcohol **		A	A	A	A	A
18. Formaldehyde		A	A	A	A	A
19. Formic Acid 90%		A	A	A	A	A
20. Furfural **	B	B	A	A	C	
21. Gasoline **		A	A	A	A	A
22. Hydrochloric Acid 37%		A	A	B	B	A
23. Hydrofluoric Acid 48%		B	D	D	D	A

24. Hydrogen Peroxide 30%		A	A	A	A	A	
25. Methyl Ethyl Ketone **		A	A	A	A	A	
26. Methyl Alcohol **	A	A	A	A	A		
27. Methylene Chloride **		A	D	A	A	A	
28. Monochlorobenzene **		A	A	A	A	A	
29. Naphthalene **		A	A	A	A	A	
30. Nitric Acid 20%		B	A	B	A	A	
31. Nitric Acid 30%		B	A	B	A	A	
32. Nitric Acid 70%		B	D	B	A	A	
33. Phenol ** 85%		A	C	A	A	A	
34. Phosphoric Acid 85%		A	A	B	A	A	
35. Silver Nitrate		B	C	A	A	C	
36. Sodium Hydroxide 40%		A	D	A	A	A	
37. Sodium Hydroxide 20%		A	D	A	A	A	
38. Sodium Hydroxide 10%			A	D	A	A	A
39. Sodium Hydroxide Flake		A	B	A	A	A	
40. Sodium Sulphide		A	B	A	A	A	
41. Sulfuric Acid 77%		A	A	C	A	A	
42. Sulfuric Acid 96%		C	D	C	A	C	
43. Sulfuric Acid 33%		A	A	C	A	A	
44. Tincture of Iodine		A	C	B	B	A	
45. Toluene **	A	A	A	A	A		
46. Trichloroethylene **		A	A	A	A	A	
47. Xylene **		A	A	A	A	A	
48. Zinc Chloride		A	A	B	A	A	
49. Nitric 70%/Sulfuric Acid 77%*		B	B	B	A	A	

* Equal parts of Nitric Acid 70% and Sulfuric Acid 90%.

** 37 Level 0, 9 Level 1, 3 Level 2, 0 Level 3 rating which is well acceptable range as per the SEFA3 rating scale

** Indicates these solvents tested with cotton and jar method

• CLASS II, TYPE-A2 BIO SAFETY CABINET:

1. Cabinet shall provide airflows & biological safety performance as specified.
 - Cabinet shall provide biological containment protection for both operator and product proven by an actual test, (e.g. test conducted by TUV NORD and NSF) and routinely validated.
 - Cabinet shall be constructed from 16GA, Type 304 stainless steel forming a monolithic, sealed structure.
 - Cabinet shall be easily fumigated employing an established procedure such as that recommended by EN 12469, Annex J in conjunction with cabinet automated process.
 - Supply HEPA filter shall be of full cabinet work zone width and depth.
 - Air Velocity from the supply filter shall average 55 to 65 FPM (.28 to .32 m/s). With no single point outside the 20% of average range measured in a horizontal plane defined by 4 inches (102mm) above the bottom edge of window.
 - Work access opening shall be 10 inches (254mm) high. Average inflow velocity shall nominally be 105 LFPM (.53 m/s).

2. The cabinet shall be ergonomically designed for maximum user comfort and adjustability.
 - Standard non-metallic armrest/ airfoil incorporating large 2 inch (51mm) forearm support area
 - 1/2 inch (12mm) recessed front grill designed for armrest comfort while maintaining containment performance.
 - Maximum visibility into cabinet work zone shall be at least 23 ¾ inches (603mm) from front access airfoil to exterior light housing.
 - Cabinet shall have a centrally located instrument panel within the control center that is easily serviced with quick disconnects.
 - Cabinet shall have the capability of incorporating a user adjustable base stand or base storage cabinet as an option.
 - The cabinet shall have a smooth operating sliding window from full closure to full opening at 18 inches (457mm).
 - Cabinet shall have a large work tray (20 ¾ inch (527mm) depth) removable with coved corners for easy cleaning.
 - Cabinet shall have a 10 degree slope.
3. The cabinet shall have all positive pressure plenums surrounded by a vacuum relative to the room.
4. Electrical power shall be supplied with a 12-foot (2.5m), 3-wire cord with molded plug. Electrical supply should be 230 VAC, 50/60 Hz (current rating varies per cabinet size. Reference Electrical Requirements Page 4) protected with thermal circuit breaker from distribution panel.
5. The cabinet shall use a DC ECM Motor with an optimally determined forward-curved fan for each model size/width to maximize both energy efficiency and filter loading capacity.
6. The cabinet shall have separate internal electrical circuits for blower, light, each outlet, accessory connection and optional UV light. Each circuit shall be protected with a fuse located in the Control Center on the electronic module.
7. The cabinet shall be CE compliant to meet the requirements for electrical/mechanical integrity.
8. Cabinet shall utilize a dual microprocessor control system that will perform the following functions:
 - Easy use interface via Touch Link color LCD.
 - Control blower DC ECM Motor via solid-state DC Motor Controller that provides compensation (constant volume control) for both filter loading and line voltage variances.
 - Fast, accurate, reliable dual thermistor, airflow sensors powered by TSI to control and monitor Cabinet airflows to set points.
 - Control lights via solid state switch.
 - Control outlets via solid state switch.
 - Display date/time.
 - Security password protection.
 - Display blower and optional UV light run timers.
 - Display alarm set points high/low for error conditions (down flow/inflow).
 - Display complete calibration, option menu and diagnostic functions.
9. Cabinet shall contain a control system that provides the following optional functional features.

- Night Care setback mode.
 - Upon sliding window closure, the blower will continue to operate at a lower rate to save energy and maintain interior clean air conditions ready for use upon sliding window opening.
 - Auto run timer allows the cabinet to automatically turn on and off on a daily basis.
 - Timer/Interlock functions for light, outlet and ultraviolet light.
10. Balancing of cabinet work zone down flow (recycling flow) to exhaust flow shall be accomplished with an internal exhaust flow damper, externally adjustable.
 11. Damper access plug shall be under a vacuum relative to the room.
 12. The cabinet shall be easily transportable through a standard 36 inch (914mm) wide door without disassembly.
 13. Sound level shall be no more than 60 dbA measured 19-11/16 inches (.5mm) in front center of the cabinet and 59 inches (1.5mm) above the floor
 14. LED lighting shall be externally mounted and provide 90 (968) to 120 (1291) foot-candles (LUX) on work surface.
 15. Cabinet shall come standard with two outlets with drip proof covers on back wall, one gas valve/service coupling on right side wall and one service coupling on right side wall.
 16. Cabinet shall be easily converted to a free-standing console model with the addition of the optional Base Support Stand.
 17. Cabinet work zone shall be all 16 GA. stainless steel.
 18. A 3/8 (10 mm) inch security ball valve with welded fitting shall be provided in the drain trough beneath the work tray.
 19. Cabinet shall have a permanent positive pressure plenum with quick release supply filter removal.
 20. Motor/blower shall be positioned so as to create an even filter loading, thereby prolonging the life of the HEPA filters, automatically handling a 250% minimum increase in filter loading without reducing total air delivery by more than 10%.
 21. Cabinet shall be capable of front filter removal without disassembly of the control panel and sliding window tracks/hardware.
 22. The following optional equipment shall be available to support installation and user requirements:
 - Adjustable Auto Window
 - Ultraviolet Light
 - Additional Service Valves for Air, Vacuum or other gases
 - Natural gas service valve interlocked w/blower
 - Additional Outlet
 - IV Bar with 6 Stainless Steel Hooks

- Exhaust Transitions - Canopy
- Base Support Stand (available in standard working surface heights of 30 inch (762mm) or 36 inch (914mm) with or without Storage Shelves
- Adjustable Control for Support Stand or Storage Cabinet
- Sinks with Hot/Cold or DI Water Faucets
- Storage Pull-Out Trays
- Lay in Sorbent Exhaust Filter
- Decorative Side Panels (hides plumbing fixture connections)

INDIVIDUALLY VENTILLATED ANIMAL CAGING SYSTEM :

- I. Individually Ventilated Animal Caging system (IVC System) consist of
- a) Standalone type Ventilator (Air Handling Unit)
 - b) Cage Rack with air distribution system (ducting system) for Rat
 - c) Animal Cage assembly with water bottle suitable for Rat

A brief description / specifications for above equipment are provided below.

a) Standalone type Ventilator (Air Handling Unit)

Standalone type IVC Ventilator unit shall be in 304-grade stainless steel construction. Unit shall consist of two separate modules for supply of clean air to animal cages and to evacuate contaminated air from the cages. Both the modules will individually consist of following;

- Suitable design silent operation blower to handle supply air / exhaust air.
- Pre filter & Hepa filter, grade H4 & H14 of suitable size
- Supply / Exhaust air fan with speed regulator
- Necessary electrical & controls to monitor various parameters such as Air Changes per hour, average cage temperature and humidity, working pressure mode.
- Programmable Logical Controller with TFT LCD, Touch screen type color Display to set and monitoring of above referred parameters as required. The controller should be capable for necessary logging of basic parameter data up to the period of 1 year.
- Run our counter with change filter notifications.
- Necessary audio visual alarm system (Local) to indicate the failure of maintenance of any of the parameters mentioned above.
- Housing & structure in SS 304 construction
- Castor wheels in special grade nylon construction with SS housing, 2 Nos. free moving & 2 Nos. with pad lock
- Supply & Exhaust air manifolds suitable to connect up to two double-sided racks or four single sided racks to each Ventilator.
- Ventilator shall be suitable for connecting 2 Nos. single sided racks on each side.
- Arrangement to adjust fan speed automatically as per the set value.
- Ventilator shall operate on 220 V, 50 Hz, single phase AC power supply.

b) Single Sided Cage Rack with air distribution system

Single sided Cage Rack suitable to mount cages from one side shall be in SS 304 construction and shall be suitable to house at least 30 Nos. of rat cages selected for the system:

The cage rack shall comprise of following;

- Frame structure with air distribution ducts, supply & exhaust air headers in SS 304 construction.
- Duct couplers, endcaps, supply air nozzles & exhaust air nozzles in special grade rubber construction suitable for autoclaving.

- Cage runners in special grade nylon construction suitable to withstand autoclave conditions.
- Suitable design castor wheels with SS 304 casing and special grade nylon wheels (2 nos. free moving & 2 Nos. with padlock arrangement).
- Wire reinforced hosepipes suitable to connect supply and exhaust air headers with ventilator.

c) Animal Cage assembly with water bottle suitable for Rat IVC system

IVC cage assembly shall consist of following;

- Cage bottom in polysulphone construction having floor area not less than 800 sq.cm. and cage effective height not less than 18 cm. The cage bottom will have suitable arrangement to properly house in cage rack at required position.
- Cage lid in polysulphone construction with supply air and exhaust airport & water bottle port with self-closing isolators, hepa grade breather filter with filter retainer ring & cage lid clamps
- Water bottle in Polysulphone construction with special grade rubber gasket and bottle cap with nozzle in SS 316 construction.
- Cage grill in SS 304 construction with nylon / silicon gasket.
- Cage card holder with hanger clip.

The system shall be supplied with necessary accessories such as flexible ducts to connect cage rack with the ventilator.



Height Adjustable Stainless steel revolving chair :

Please consider the following reference image for the height adjustable stainless steel revolving chair with backrest as mentioned in the tender:



EXECUTION METHODOLOGY

- **SITE EXAMINATION**

Bidder is requested to examine the site and installation work shall be taken up as per site availability and as per installation schedule approved by the Engineer in charge.

- **INSTALLATION**

- **Preparation:**

Prior to beginning installation of fume hood, check and verify that no irregularities exist that would affect quality of execution of work specified.

- **Coordination:**

Coordinate the work of the Section with the schedule and other requirements of other work being performed in the area at the same time both with regard to mechanical and electrical connections to and in the fume hoods and the general construction work.

- **Performance:**

Install fume hoods, plumb, level, rigid, securely anchored to building and adjacent furniture in proper location, in accordance with manufacturer's instructions and the approved shop drawings. Provide filler panels between top of hood and ceiling. Securely attach access panels but provide for easy removal and secure reattachment. Do not install any damaged units.

- **Adjust and Clean:**

After installations are complete, adjust all moving parts for smooth operation.

Remove all packing materials and debris resulting from this work and turn over the fume hoods to the Owner clean and polished both inside and out.

Repair or remove and replace defective work, as directed by owner and/or his representative upon completion of installation.

- **Protection:**

Provide reasonable protective measures to prevent casework and equipment from being exposed to other construction activity.

Advise owner and/or his representative of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

- **Certification:**

Fume Hood Manufacturer shall field test a random sample of 10% of the installed units using ANSI/ASHRAE 110-1995 to a control level of AI 0.01 ppm or better and witnessed by the consultant & CLIENT representative.

Project substantial completion shall be withheld until all required fume hood certification letters, tests, and reports have been submitted to and approved by the Consultant.

Integration: Fume hood exhaust need to be integrated with the supply of conditioned/fresh air required, balancing of air and testing, demonstration and commissioning complete as per site conditions and as per direction of Engineer in charge. The quoted rates as per BOQ items shall include the integration and nothing extra shall be payable for the same.

QUALITY ASSURANCE PLAN (QAP)

Below are the basic QAP points listed, Vendor has to submit detailed QAP plan along with the offer for review & approval.

Vendor has to study all the GFC drawings & prepare the Shop drawing.

Vendor has to integrate all the services part of Lab furniture in the Shop drawing.

Vendor has to provide the Technical data sheet for all the critical items. After receiving approval from Client & Consultant, should go ahead for procurement.

Vendor has to check the sample & cross-check the Shop drawing.

Site supervisor has to cross check all the items received as per approved Shop drawing.

Site supervisor has to check all the site installation as per the approved shop drawing & performance as per the Technical specification & standards.

LIST OF APPROVED MAKES FOR LAB FURNITURE & FUMEHOOD

List of Makes are listed below (Refer materials whichever are applicable for the scope of work). Approved equivalent materials of any other specialized firms not acceptable, in case it is established that the brands specified below are not available in the market subject to approval of the alternate brand by Client.			
SL NO	MATERIALS	MANUFACTURER / SUPPLIER / MAKE	VENDOR CONFIRMATION
1	Steel	Tata Steel, Jindal Steel, Equivalent For Imported Products	
2	Powder Coating	Kansai Nerolac, Berger Paints, Asian Paints, Equivalent For Imported Products	
3	Emergency Devices, Water Faucets And Gas Valves, Fume Hood Utility Fittings	Broen-Lab / Water Saver.	
4	Switches And Sockets	Northwest / Legrand / Mk / Schneider	
5	Locks	As Per The Manufacturer Recommendation, It Should Pass Sefa Test	
6	Drawer Slides	As Per The Manufacturer Recommendation, It Should Pass Sefa Test	
7	Sink (Pp Sink)	As Per The Manufacturer Recommendation, It Should Pass Sefa Test	
8	Fume Hood Liners	Trespa/Fundermax	
9	Work Surface	Jet Black Granite	
10	Fume Hood Face Velocity Monitor	Tel, Schnider Electronic, Synaa Lab	
11	Light Fixture	Crompton, Philips, Wipro.	
12	Remote Control Valves	Broen-Lab, Watersaver.	

13	Lt 1.1 Kv Frls Flexible Cable	Kei /Rr Cable/ Havells/ Lapp / Finolex	
14	Internal Wiring (Fire Resistant Low Smoke Wires(Frls))	Kei /Rr Cable/ Havells/ Lapp / Finolex.	
15	Db's And Mcb's	Schneider / Legrand/ Hager/Siemens	
16	Terminals	Multi / Braco/ Connectwell / Dowells	
17	Drain Pipe	Prime/ Godavari	
18	Spot Extractor	Fumex, Alsident, Nedermann	
19	Chemical Cabinets / Pharmacy Cabinets / Tall Cabinets	Asecos, Duperthal.	
20	Eyewash	Water Saver / Broen Lab.	
21	Epoxy Marine Edges	Simmons	
22	Ductless Fume Hood & Fume Hood Base Storage Units	Erlab / Air Clean, Usa	
23	Constant Air Volume (Cav)	Systemair / Aldes / Trox	
24	Autosash for Fume hood	Tel / Schnieder Electronic / Equivalent	
25	Bio Safety Cabinets	Nuaire / Esco Labs / Equivalent	
26	Ivc	Citizen	

ANNEXURES

ANNEXURES
01 - LOWER GROUND FLOOR LAB FURNITURE LAYOUT - SCOPE OF WORK
02 - LOWER GROUND FLOOR LAB FURNITURE LAYOUT
03 - LAB FURNITURE BOQ
04 - C-FRAME - ISLAND TABLE
05 - C-FRAME - WALL BENCH WITH OVERHEAD CABINETS
06 - C-FRAME - WALL BENCH WITH SINK
07 - C-FRAME - WALL BENCH WITH SPOT EXTRACTOR
08- Typical fume hood and snorkel connection details
09- Typical ducting details

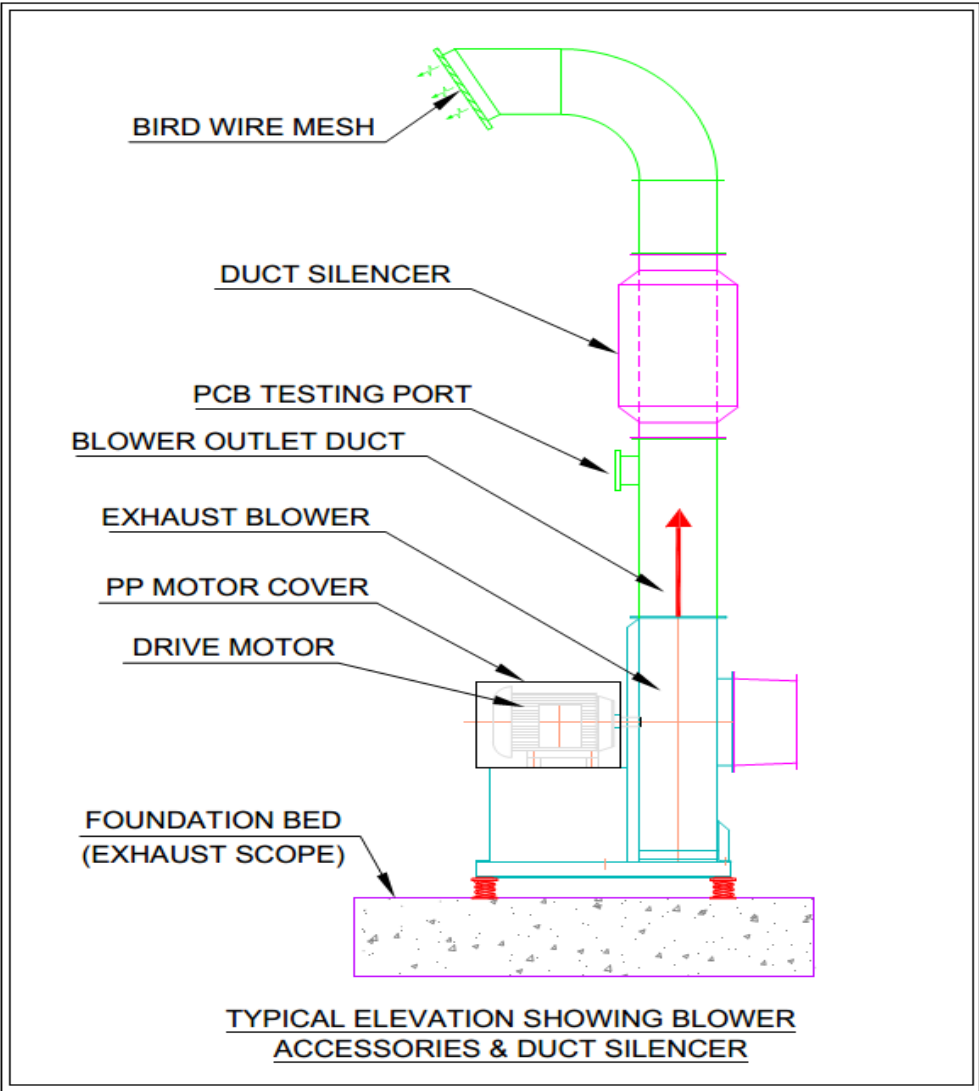
PART-2 EXHAUST SYSTEM

A standby exhaust blower has to be proposed, connected to the existing scrubber blower. The proposed exhaust blower shall be located in the terrace floor & connected through the PP FRP exhaust ducting.

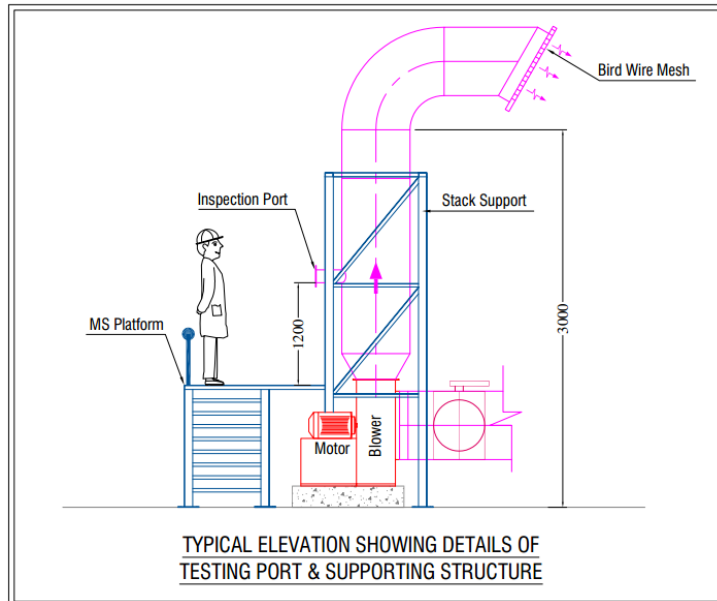
The Exhaust air from Snorkel & Fume Hoods shall be ducted through PP FRP ducting connected to the exhaust blower, wherein these fumes will be scrubbed in the existing scrubber before letting it out to atmosphere at a height of three mtrs from the terrace level.

MAIN FEATURES / CONSIDERATION OF THE PROPOSED EXHAUST SYSTEM

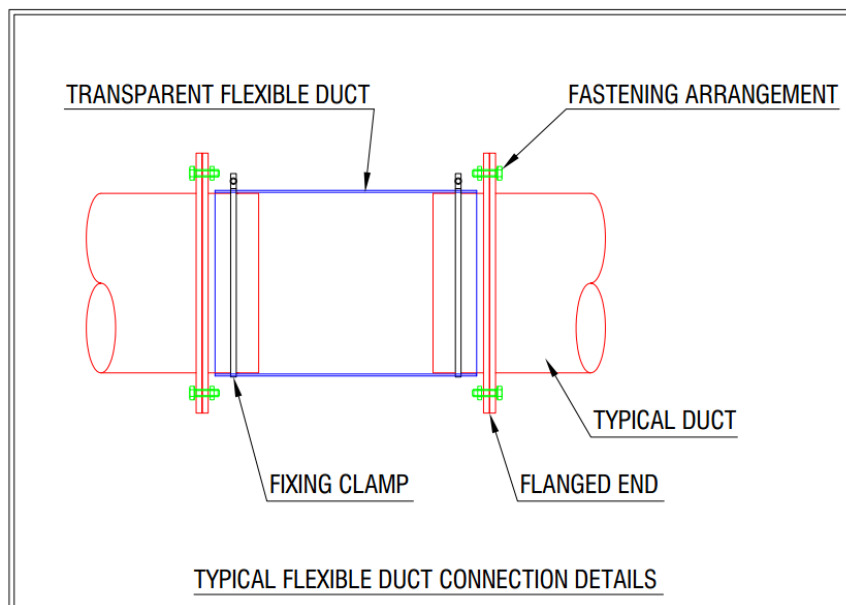
- The Fume Hood Exhaust air volume considered is for guidance purpose only.
- All blowers to be selected as per tender BOQ capacities.
- Corrosion resistant, centrifugal backward type, aerodynamically designed, statically & dynamically balanced, low noise level, imported make Exhaust PP blowers are proposed for this project.
- The vertical blower outlet duct shall be let out at minimum three mtrs height from the terrace level.
- 100 mm thick Mineral wool / Rock wool insulation material of 96 Kg/M3 density, sandwiched between the external Plain PP sheet & internal Perforated PP sheets. Insulation shall be spread equal across the silencer to avoid any air pocket. Chicken mesh along with RP Tissue Paper over & above Mineral Wool Insulation shall be considered.
- The blower outlet duct shall have a silencer to reduce the air noise, the silencer shall be made out of outer & inner layer PP FRP ducting the space between them shall be filled with Mineral wool insulation. Internal duct of the silencer shall be perforated with suitable size holes (minimum 16 mm dia & pitch of 30 mm) the silencer shall be with both ends flanged (For more details refer silencer specification & drawing). The inner & Outer duct area shall be considered as a part of PP FRP ducting, Whereas the Mineral wool insulation shall be supplied as per tender specification & part of insulation line item.



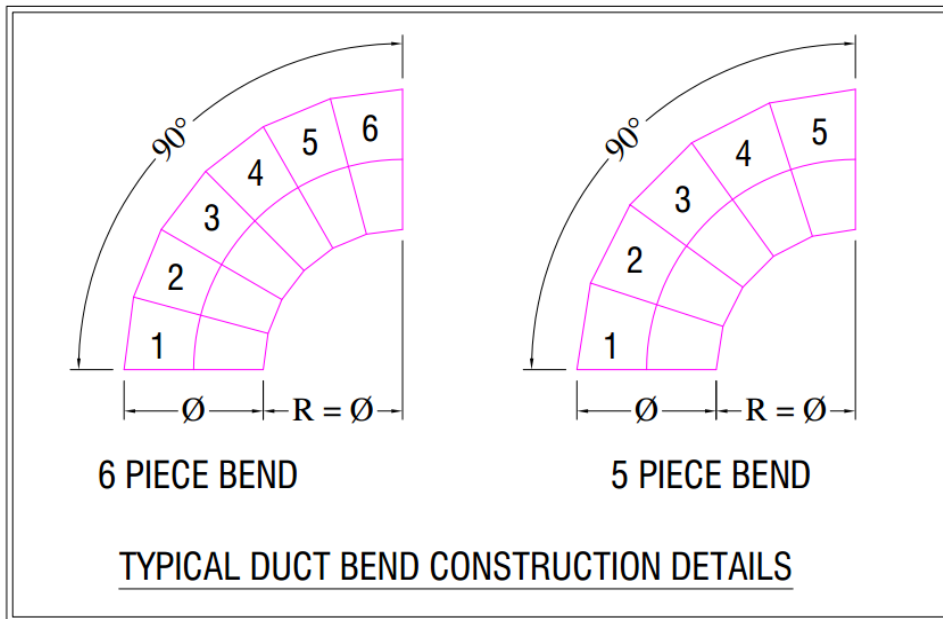
- Each blower outlet duct shall have a testing port / sampling port at suitable accessible height.



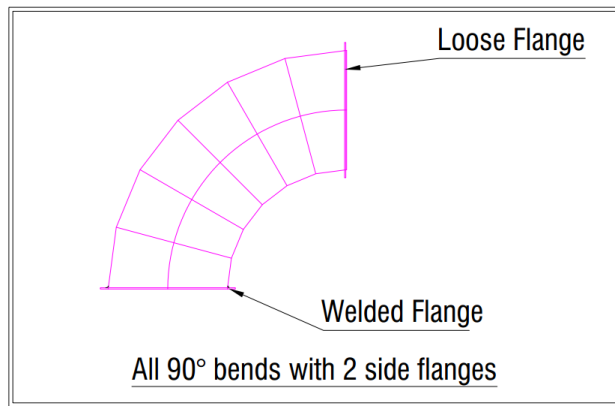
- Blower Inlet & Outlet shall have Flexible connection made out of transparent PP sheet along with flanged spigot & fixing GI clamps on the both ends. The proposed arrangement shall be as shown in the figure below.



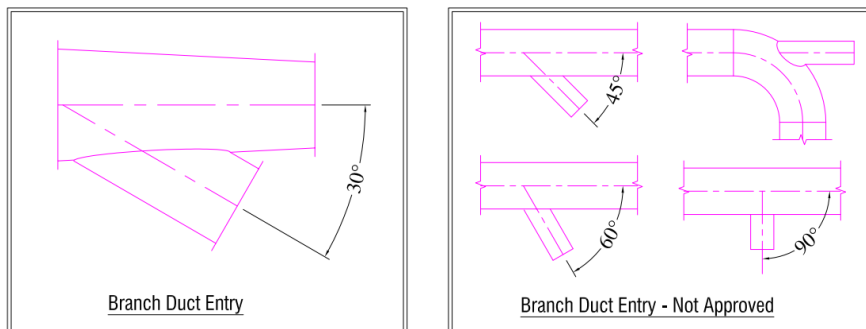
- Fire resistant Isophthalic resin shall be used for binding FRP over & above PP ducting.
- 5mm thk Neoprene gasket shall be used in between each flange joints.
- All the duct bends shall be of smooth with 5 / 6 - piece construction.

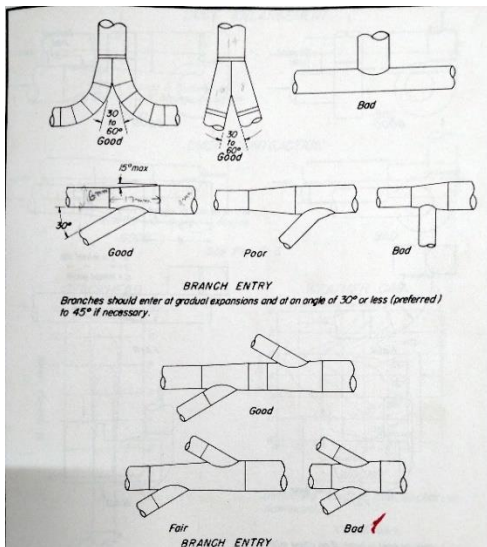


- The 90 Deg bends / ducts shall have flanges on both sides. (Minimum one side loose flange).



- All branch duct entry shall be 30 Deg to the 'Y' piece / main duct.





EQUIVALENT RESISTANCE IN FEET OF STRAIGHT PIPE

See Fig. 6-24

Pipe D	90° Elbow * Centerline Radius			Angle of Entry		H, No of Diameters		
	15 D	20 D	25 D	30°	45°	1.0	.75 D	.5 D
3"	5	3	3	2	3	2	3	9
4"	6	4	4	3	5	2	3	12
5"	9	6	5	4	6	2	4	16
6"	12	7	6	5	7	3	5	20
7"	13	9	7	6	9	3	6	23
8"	15	10	8	7	11	4	7	26
10"	20	14	11	9	14	5	9	36
12"	25	17	14	11	17	6	11	44
14"	30	21	17	13	21	7	13	53
16"	36	24	20	16	25	9	15	62
18"	41	28	23	18	28	10	18	71
20"	46	32	26	20	32	11	20	80
24"	57	40	32			13	24	92
30"	74	51	41			17	31	126
36"	93	64	52			22	39	159
40"	105	72	59					
48"	130	89	73					

* For 60° elbows — 0.67 x loss for 90°
 45° elbows — 0.5 x loss for 90°
 30° elbows — 0.33 x loss for 90°

R, No. of Diameters	Loss Fraction of VP
2.75 D	0.26
2.50 D	0.22
2.25 D	0.26
2.00 D	0.27
1.75 D	0.32
1.50 D	0.39
1.25 D	0.55

ROUND ELBOWS

R/D	Loss, Fraction of VP					
	Aspect Ratio, W/D					
	0.25	0.5	1.0	2.0	3.0	4.0
0.0 (Mitre)	1.50	1.32	1.15	1.04	0.92	0.86
0.5	1.36	1.21	1.05	0.95	0.84	0.79
1.0	0.45	0.28	0.21	0.21	0.20	0.19
1.5	0.28	0.18	0.13	0.13	0.12	0.12
2.0	0.24	0.15	0.11	0.11	0.10	0.10
3.0	0.24	0.15	0.11	0.11	0.10	0.10

SQUARE & RECTANGULAR ELBOWS
ELBOW LOSSES

- The maximum distance between the two duct supports shall be not more than 2500 mm.
- The Construction / Fabrication of PP exhaust duct shall be round in cross section & Elliptical duct construction is not accepted.
- All flanges shall be made at factory only, no drilling of holes at site is acceptable.
- Radium Sticker showing blower number, airflow directions & future provision on the duct surface shall be provided as per direction of consultant / engineer incharge.



SPECIFICATIONS FOR PP-FRP DUCTING AND ACCESSORIES

Technical Specification for PP-FRP Ducting:

- PP means PPGL: One side smooth & glossy finish and other end is mat finish.
The smooth surface should be the inner surface of the duct.
On mat side, FRP lining to be done.
- FRP Lining to be done on the outer surface of PPGL I.e. on mat side.
One-layer FRP is one mm.
The final layer should be with fine mat to have smooth and good finish.
- Fire resistant Isophthalic resin to be used
- All the flanges should be properly ground and dressed.
- Duct support distance should not be more than 2500 mm.
- Any duct length should not be more than 2500 mm.
- The finish paint should be admiral grey unless specified by client.
- 5 mm Thick Neoprene gasket to be used between the flange joints.

STANDARD FOR CIRCULAR DUCT FLANGE DETAILS

STANDARD FOR CIRCULAR DUCT FLANGE DETAILS						
SL NO	DUCT DIAMETER	FLANGE THICKNESS	OUTER DIA	PCD	NO OF HOLES	HOLE DIA
	D	F	OD	PCD	B	A
1.	150	30 x 8	210	186	4	8
2.	175	30 x 8	235	211	4	8
3.	200	30 x 8	260	236	4	8
4.	225	40 x 8	285	261	8	8
5.	250	40 x 8	310	286	8	8
6.	275	40 x 8	335	311	8	8
7.	300	40 x 8	360	336	8	8
8.	325	40 x 8	385	361	8	8
9.	350	50 x 8	410	380	12	10
10.	375	50 x 8	435	405	12	10
11.	400	50 x 8	460	430	12	10
12.	425	50 x 8	485	455	16	10
13.	450	50 x 8	510	480	16	10
14.	475	50 x 8	535	505	16	10
15.	500	50 x 8	560	530	16	10
16.	550	50 x 8	610	580	16	10
17.	600	50 x 8	660	630	16	10
18.	700	50 x 8	760	730	16	10

The diagram illustrates a circular duct flange with the following labeled dimensions: **D** is the duct diameter, **OD** is the outer diameter, **PCD** is the pitch circle diameter, **F** is the flange thickness, **A** is the hole diameter, and **B** is the number of holes. The text 'A Ø Holes, B Nos' is positioned above the diagram.

Thickness of PP Flange for Duct shall be 2 times of the specified Duct Thickness over & above FRP coating

NOTE:- FLANGE THICKNESS

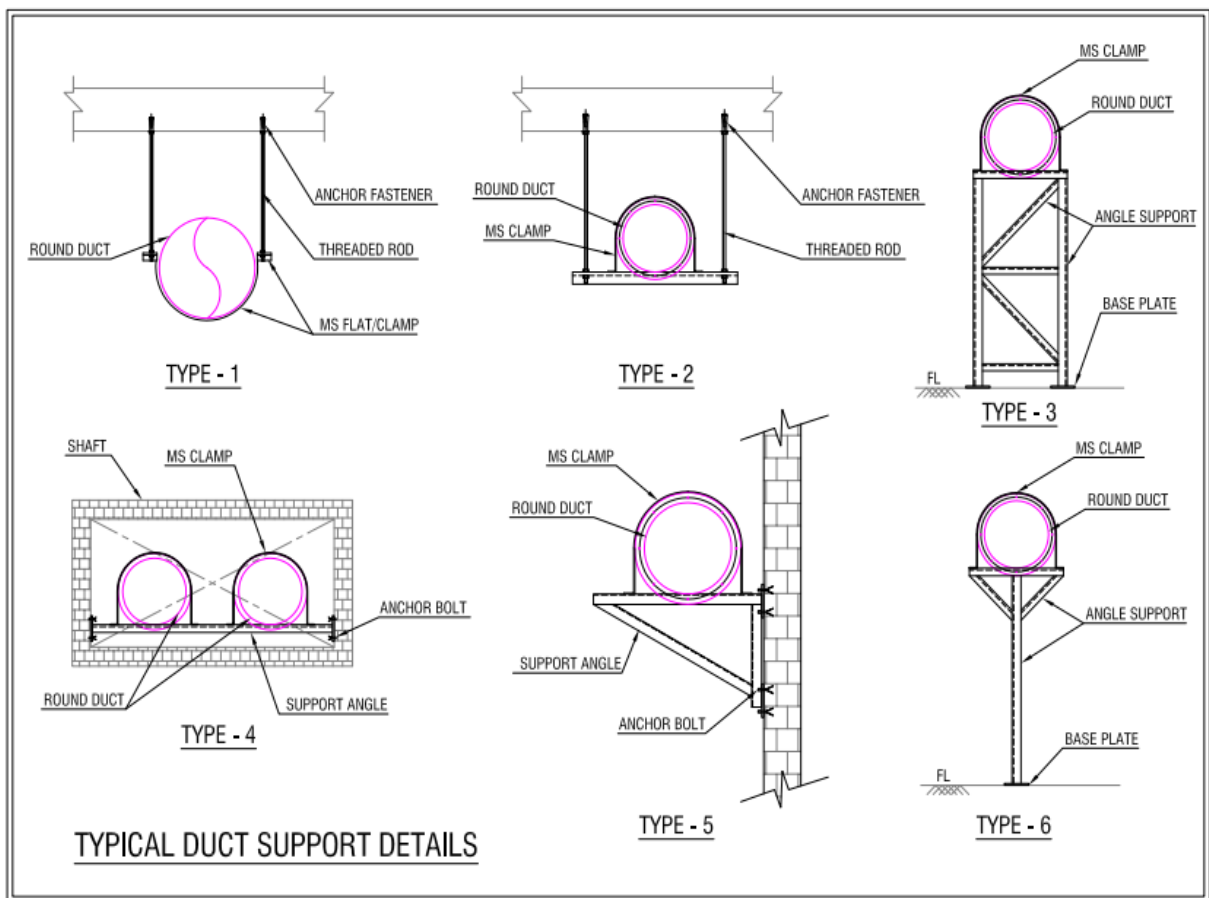
- Ducting upto 500 mm Dia - Flange thickness shall be 6 mm PP + 3 mm FRP
- Ducting above 501 mm Dia - Flange thickness shall be 8 mm PP + 3 mm FRP

SUPPORT SYSTEM

All duct supports which are coming within the building shall be a part of PP FRP ducting line item, whereas the duct supports in the terrace floor area shall be considered a part of MS support BOQ line item.

A completely supporting system consisting of fully threaded rods, double L bottom brackets nuts, washers, clamps for circular ducts and anchor bolts as supplied.

To provide the required thermal brake effect, Neoprene or equivalent material of suitable thickness shall be used between duct joints.



Duct supports Type 1, 2, 4 & 5 are considered as a part of ducting, whereas type 3 & 6 OR similar type of duct support proposed on terrace area shall be considered as a part of MS structural support & can be claimed separately under respective BOQ line item.

INSTALLATION

TOOLS AND TACKLES FOR SITE WORK:

For duct assembly and Installation, the use of suitable tools and tackles should be used to give the required duct quality and speed of installation including.

- a) Drilling machine with drill bits – for drilling holes on the PP/FRP flanges.
- b) Hammer drill machine with drill bits – for drilling holes in building structure for anchors.
- c) Hoisting system – for lifting the duct assembly up to mounting heights.
- d) The duct pricing shall inclusive of all above facility.

INSTALLATION PRACTICE:

- a) All necessary allowances and provision shall be made for beams, pipes, or other obstructions in the building whether or not the same are shown on the tender drawings. Where there is interference/ fouling with other beams, structural work, plumbing and conduits, the ducts shall be modified suitably as per actual site conditions.
- b) Ducting over false ceiling shall be supported from the slab or from beams. In no case shall any duct be supported from false ceilings hangers or be permitted to rest on false ceiling. All Sheet work in dead or furred down spaces shall be erected in time to occasion no delay to other Vendor's work in the building.
- c) All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge.

DAMPERS AND FLEXIBLE HOSE

Volume control damper sets shall be provided where specified according to the specifications in the offer BOQ. Dampers shall be double thickness heavier than the thickness of the large duct & shall be rigid in construction.

The volume control dampers shall be of an approved type, lever operated & complete with locking devices which will permit the dampers to be adjusted & locked in any positions.

Construct blades of 3 mm thick PP MOC, provide heavy-duty molded self-lubricating nylon bearings, 13mm (1/2") diameter Plastic axles spaced on 225mm (9") centers. Construct frame of 300 mm diameter outer with Flange for fitting minimum 6 bolts and nuts. The outer shell body shall be a transparent material of Poly propylene.

Automatic manual volume opposed blade shall be not over 225mm wide. The dampers for fresh air inlet shall additionally provide with fly mesh screen, on the outside of 0.8mm thickness with fine mesh.

MANUALLY ADJUSTABLE DAMPER SETS

Damper sets shall be arranged in substantial supporting frames and each blade shall be mounted on a shaft, which turns in sintered bronze bearings. All damper blades shall be inter-connected by means of a suitable bar linkage for ganged operation. All dampers shall be arranged with spindle horizontal and shall be sized to handle the air quantities shown on the drawings. Where manually adjustable damper sets are installed in ductwork or other accessible locations the operating shafts shall be extended through the duct and a lockable quadrant fitted.



PVC DUCT HOSE

BIRD SCREENS

Galvanized woven mesh or weld mesh bird screens in rigid galvanized iron frames shall be installed (with 2 coat of paint) behind all exhaust air openings to the outside of the building.

FLEXIBLE CONNECTIONS

Provide flexible duct connections wherever ductwork connects to vibration isolated equipment and on all exhaust final connections to spot extractor and as indicated in the tender schematic drawings. Flexible connections shall be fitted to isolate fans from equipment's and/or ductwork. The connections shall be arranged to permit the renewal of the connection without disturbing the duct work or the plant. The metal parts of connected equipment shall be separated by not less than six inches and installed

with sufficient slack to compensate for free movement of fans or spring vibration isolators.

JOINT MEASUREMENTS

The following procedure for measurement shall be followed for the purpose of billing in case of items subject to variation in quantities.

SIZE	SWG	Th	ANGLE
UP TO 750	24	0.63	25x3
751 TO 1500	22	0.80	40x3
1501 TO 2250	20	1.00	40x3
ABOVE 2251	18	1.25	40x6

SHREET		Kg/Sq M	Angle	Kg/RMT
SWG	Th			
24	0.63	4.95	ISA 25x3	1.10
22	0.80	6.30	ISA 30x3	1.40
20	1.00	7.85	ISA 40x3	1.80
18	1.25	9.80	ISA 40x6	3.50
16	1.60	12.35	ISA 50x6	4.30
14	2.00	15.70	ISA 60x6	5.40
12	2.50	19.60	ISA 65x8	7.70
10	3.15	24.75	ISA 75x8	8.90
08	4.00	31.40	ISA 75x10	11.00

PLATE		Kg/Sq M	Flat	Kg/RMT
Th	Angle			
5.00	25x3 Flat	39.25	25x3 Flat	0.60
6.00	30x3 Flat	47.10	30x3 Flat	0.70
8.00	30x6 Flat	62.80	30x6 Flat	1.40
10.00	40x6 Flat	78.50	40x6 Flat	1.90
12.00	50x6 Flat	94.20	50x6 Flat	2.40

Rod	Kg/RMT	Channel	Kg/RMT
ISRO 6	0.20	ISMC 75x40	6.80
ISRO 8	0.40	ISMC 100x50	9.20
ISRO 10	0.60	ISMC 125x65	12.70
ISRO 12	0.90	ISMC 150x75	16.40
ISRO 16	1.60	ISMC 175x75	19.10
ISRO 20	2.50	ISMC 200x75	22.10
ISRO 25	3.80		

The Pythagoras Theorem

$C^2 = A^2 + B^2$
 $C = \sqrt{A^2 + B^2}$

Payment for ducting shall be on the basis of the external surface area of the ducting. The rate per square meter of the external surface shall include flanges, gaskets for joints, bolts and nuts, duct supports and hangers, vibration isolation pads or suspenders, flexible connections, inspection doors, dampers, turning vanes, straightening vanes, and any other item which will be required to complete the duct installation except external insulation and finish thereon. The external area shall be calculated by measuring the over-all width and depth (including the corner joints) in the centre of the duct section and over-all length of each duct section from flange face to flange face in case of duct lengths with uniform cross section. Total area will be arrived at by adding up the areas of all duct sections. In case of taper piece average width and depth will be worked out as follows:
 W1 = Width of small cross section
 W2 = Width of large cross section
 D1 = Depth of small cross section
 D2 = Depth of large cross section
 Average Width = (W1 + W2)/2
 Average Depth = (D1 + D2)/2
 Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct/sections. Face to face length for taper piece shall be the mean of the lengths measured face to face from the center of width and depth flanges. For special pieces like bends, branches, and tees, etc., the same principle of area measurement as for linear lengths shall be adopted, except for bends and elbows, the length of which shall be the average of the lengths of inner and outer periphery along with curvature of angle of the piece. Duct measurements for calculation of area shall be taken before application of insulation (if any).

Closeout Submittals such as Operation and maintenance manuals, including as-built ducting layout, final P& ID diagrams, unit location drawing and component lists, shall be provided as closeout submittals.

SPECIFICATION FOR CORROSION RESISTANT THERMOPLASTIC CENTRIFUGAL EXHAUST BLOWER

The exhaust fans supplied and installed shall be of 'Centrifugal Corrosion Resistant' type and shall be capable of delivering the design airflow against all duct static losses.

The fans shall be robust in construction and suitable for continuous duty operation. It shall be mounted with ease of maintenance and shall be installed with proper "vibration isolators" and "flexible connectors" on both the inlet and outlet to minimize vibration transmission to ductwork and supporting structure.

The Blower selected shall be silent and vibration free during operation, Blower outlet velocity Not to Exceed 15 m/s and the Blower speed shall not exceed 3000 rpm. The sound pressure level shall not exceed 75 dBA @ 3m (free field conditions) at the design operating conditions.

The proposed Blower and motors shall be suitable for outdoor installation and operation. It shall come fitted with a protective polypropylene (PP) motor cover to prevent direct rain impact and splashes onto the motor.

Aerodynamic performance of the fan shall be design, tested and comply in accordance to 'AMCA' & 'ISO 5801' standard.

The fan's sound level shall be design, tested and comply in accordance to 'ISO 5136.2' standard.

Fan size from 125 mm Dia to 400 mm Dia

The casing shall be of self-supporting design and manufacture using "twin-sheet" thermoforming technology. The material of construction shall be **fire retardant polypropylene (PPs)** for fire safety and shall be suitable against the "corrosive" media commonly present in the exhaust system. No metal parts shall be expose and be in contact with the airstream. The casing shall come with factory fitted drain pipe at the lowest point.

The casing design shall come with removable inlet cone that allow for easy inspection and cleaning without major removal of the adjoining ductworks.

The fan impeller design shall consist of twenty (20) injection moulded forward curved blades (inclined impeller design @ Ø180mm and below) and the material of construction shall be **fire retardant polypropylene (PPs)**. It shall be suitable for use against the "corrosive" media commonly present in the exhaust system.

The torque transmission between the impeller bore and fan shaft shall be by a propriety design aluminum clamp adapter system or "keyway" for Ø38mm shaft diameter.

A standard **polyethylene (PE)** hub cap shall be fitted onto the impeller hub to prevent the corrosive 'media' from contacting the shaft.

The impeller shall be shall be design and "statically" balanced in accordance to **ISO 1940-1 G6.3** standard.

The casing and motor shall be suitably supported by an **electro-galvanized** fan stand.

If the environment is highly corrosive, a **AISI 304SS** fan stand and fasteners shall be proposed instead; where applicable.

The proposed fan shall be driven by an international premium make TEFC motor and shall come but not limited to the followings: -

- Premium efficiency (IE3)
- Class 'F' insulation and class 'B' temperature rise
- IP55
- 3 x PTC thermistors
- VSD duty
- 415V/3Ph/50Hz
- IEC design and standards

Fan size from 450 mm Dia to 1250 mm Dia

The fan casing shall be of self-supporting plastic construction, design and welded by machine. The material of construction shall be **polypropylene (PP)** and shall be suitable against the "corrosive" media commonly present in the exhaust system. No metal parts shall be exposed and be in contact with the airstream. The casing shall come with factory fitted drain cap (NG25) at the lowest point.

The fan impeller design shall consist of twenty (20) forward curved blades and the material of construction shall be **polypropylene (PP)**. It shall be suitable for use against the "corrosive" media commonly present in the exhaust system.

The torque transmission between the impeller bore and fan shaft shall be by a standard taper lock system.

One **polypropylene (PP)** impeller of each production batch shall be tested in an over-speed test stand at 10% above its maximum impeller speed.

The impeller shall be dynamically balanced over two stages and shall be design and tested in accordance to **ISO 1940-1 G6.3** standard.

Initial balancing to prepare the impeller for testing in a centrifuge for a period of twenty-four (24) hours.

Final balancing before delivery.

A standard **polypropylene (PP)** hub cap shall be fitted onto the impeller hub to prevent the corrosive 'media' from contacting the shaft.

The casing and motor shall be suitably supported by a "**electro-galvanized modular design**" fan stand that allow or facilitate "partial stand part" replacement; when required.

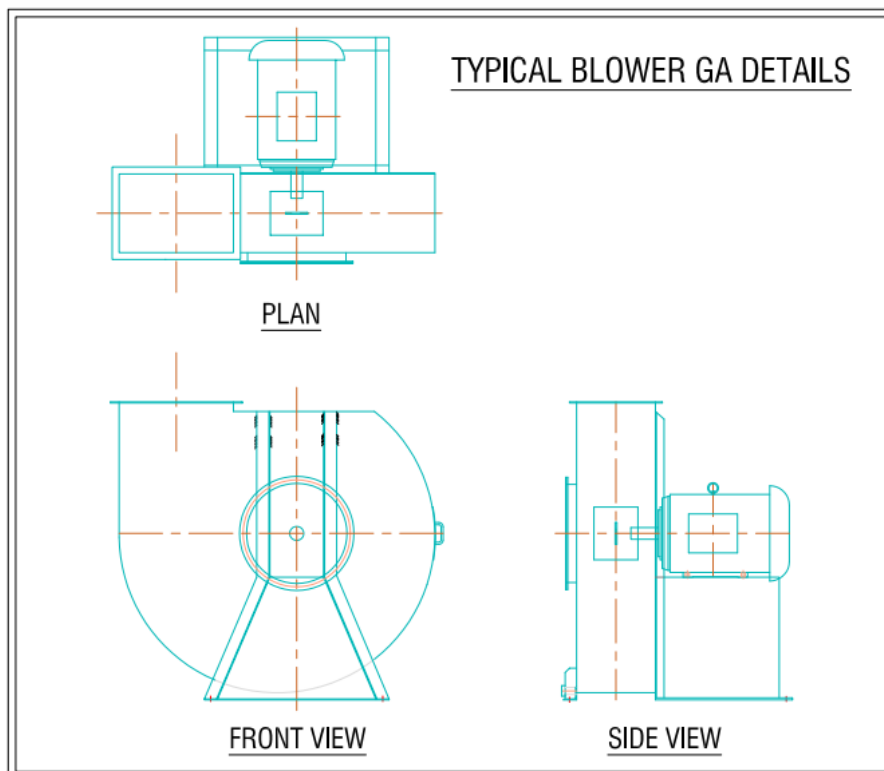
If the environment is highly corrosive, a **AISI 304SS (or AISI 316L)** fan stand and fasteners shall be proposed instead; where applicable.

The proposed fan shall be driven by an international premium make TEFC motor and shall come but not limited to the followings: -

- Premium efficiency (IE3)
- Class 'F' insulation and class 'B' temperature rise
- IP55
- 3 x PTC thermistors
- VSD duty
- 415V/3Ph/50Hz
- IEC design and standards

During the tender submission stage, the vendor shall submit the following documents: -

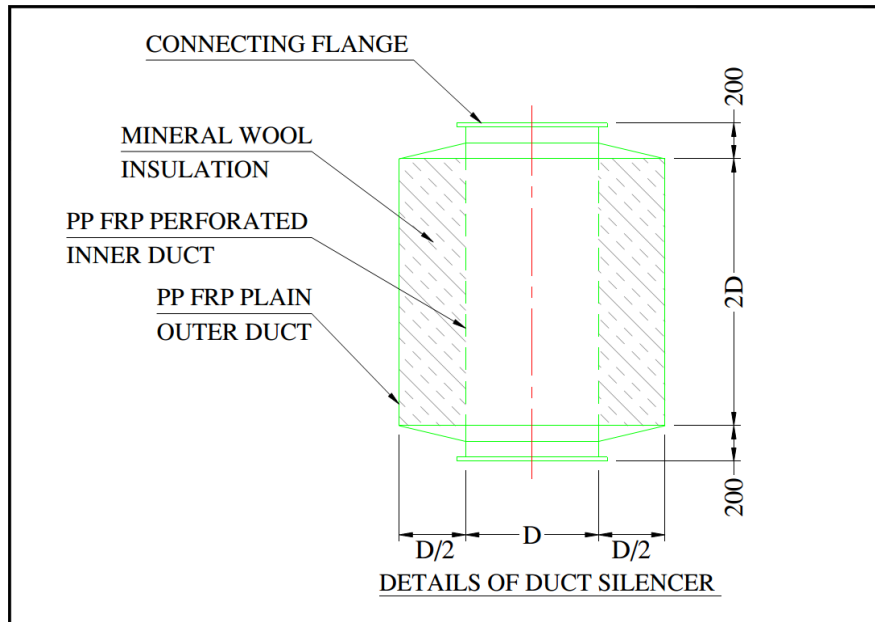
- Certified fan performance curve
- Dimensional drawing
- Technical data sheet
- Material datasheet (prove of suitability against exhaust gases)
- FAT procedures
- The Vendor shall submit a calculation of all losses to consultant & get it approved prior to ordering of equipment.
- The casing shall be of self-supporting design, thermoformed (size 400 and below), welded by machine (automatically welded for size 400 and below). The material of construction shall be fire retardant polypropylene (PPs) for fire safety and suitable for use against corrosive 'medium' and a maximum allowable operating temperature of 70°C.
- Impeller material shall be fire retardant polypropylene (PPs) for fan size up to 400 (polypropylene {PP} for fan size 450 and above) suitable for use against corrosive 'medium' and a maximum allowable operating temperature of 70°C. It shall consist of 20 forward curved blades injection moulded up to size 710 (thermoformed blades, automatically welded from 800). The impeller balancing shall be tested in accordance to VDI2060, Q6.3 standards.
- Each impeller above size 450 shall be tested in an over speed test stand above its nominal rate and dynamically balanced on two levels in accordance to VDI2060, Q6.3 standards.
- Stainless steel stand shall be used to support the fan and the motor for sizes up to 400 in view of the corrosive environment. Sturdy metal galvanized steel stand shall be used from fan size 450 onwards.
- The fans shall be from one of the approved makes only.



DUCT SILENCER

The blower outlet duct shall have a silencer to reduce the air noise, the silencer shall be made out of outer & inner layer PP FRP ducting the space between them shall be filled with Mineral wool insulation. Internal duct of the silencer shall be perforated with suitable size holes (minimum 10mm dia & pitch of 25mm) the silencer shall be with both ends flanged (For more details refer silencer specification & drawing). Mineral wool insulation shall be supplied as per tender specification.

DETAILS OF DUCT SILENCER

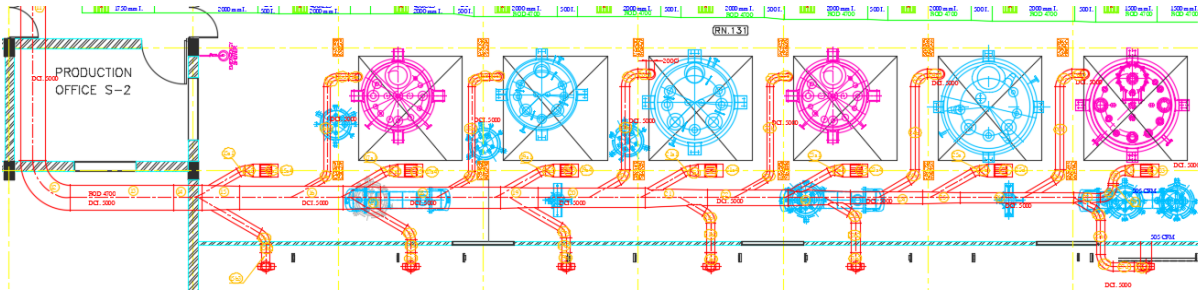


The above-mentioned details in the drawing is the minimum requirement for silencer, the vendor shall design the duct silencer to reduce the noise level & achieve 75 dB @ 1 mtr from the blower assembly.

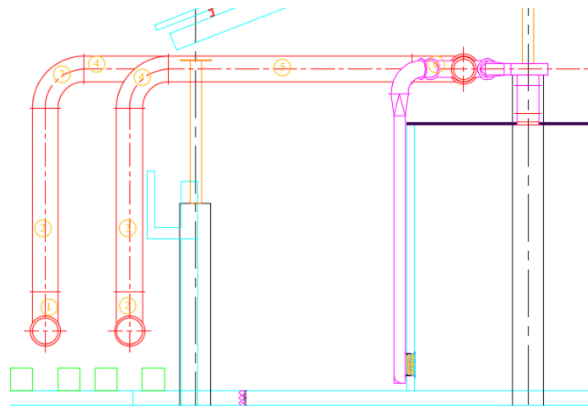
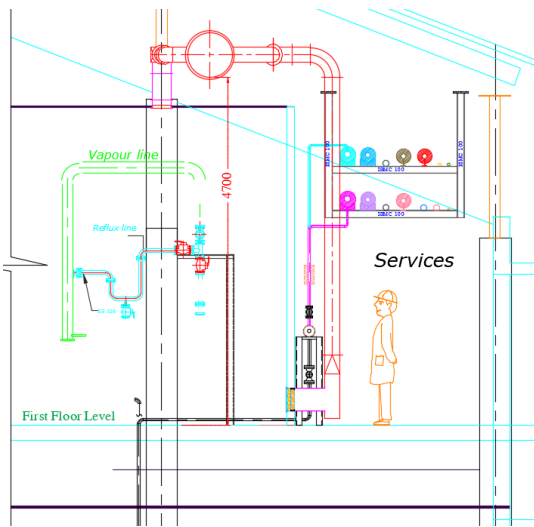
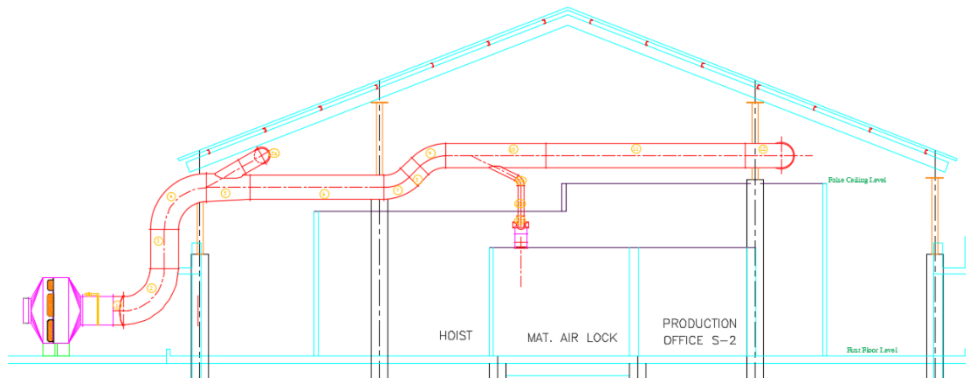
TEST RUN AND COMMISSIONING:

- Check, whether inlet and outlet are connected to ducts or protected by a protection grid.
- Check mechanical and electrical safety devices; make sure, they are properly installed.
- Remove foreign bodies, which still might be in the housing or ducts.
- Check the rotation of the impeller by means of a quick switch on/off of the motor; it
- Must run in the direction as shown on the arrow. In case of wrong direction, change the connection of the wires.
- To protect the motors against overload, the fans shall never be operated with open
- Inlet or outlet. For test runs, the inlet has to be covered with a suitable plate.
- The current (Amps) as indicated on the motor data plate shall never exceed. The fan has to be checked for its' smooth running.

TYPICAL DRAWING SHOWING THE MAIN DUCT & BRANCH DUCT CONNECTION DETAILS



TYPICAL DRAWING SHOWING THE SECTION DETAILS





EXHAUST SYSTEM TESTING & COMMISSIONING FORMAT – SHEET 1

BLOWER TAG NO:-						
FUME HOOD						
SI NO.	NO. OF FUME HOOD	SIZE	SASH HEIGHT (MM)	SASH AIR VELOCITY (FPM)	AIR VOLUME (CFM)	TOTAL EXHAUST (CFM)
1						
2						
3						
SNORKEL						
SI NO.	NO. OF SNORKELS	---	---	AIR VELOCITY (FPM)	AIR VOLUME (CFM)	TOTAL EXHAUST (CFM)
1						
2						
SOLVENT CABINETS						
SI NO.	NO. OF CABINETS	---	---	AIR VELOCITY (FPM)	AIR VOLUME (CFM)	TOTAL EXHAUST (CFM)
1						
2						
VENT POINT FOR REACTORS / CONDENSER / ISOLATORS						
SI NO.	NO. OF VENT POINTS	---	---	AIR VELOCITY (FPM)	AIR VOLUME (CFM)	TOTAL EXHAUST (CFM)
1						
2						

EXHAUST SYSTEM TESTING & COMMISSIONING FORMAT – SHEET 2

SI NO.	BLOWER TAG NO.	CLUSTER NO.	FREQUENCY (Hz)	RPM	EXHAUST AIR VOLUME (CFM)
1.					
2.					
3.					
4.					
5.					

EXHAUST SYSTEM TESTING & COMMISSIONING FORMAT – SHEET 3

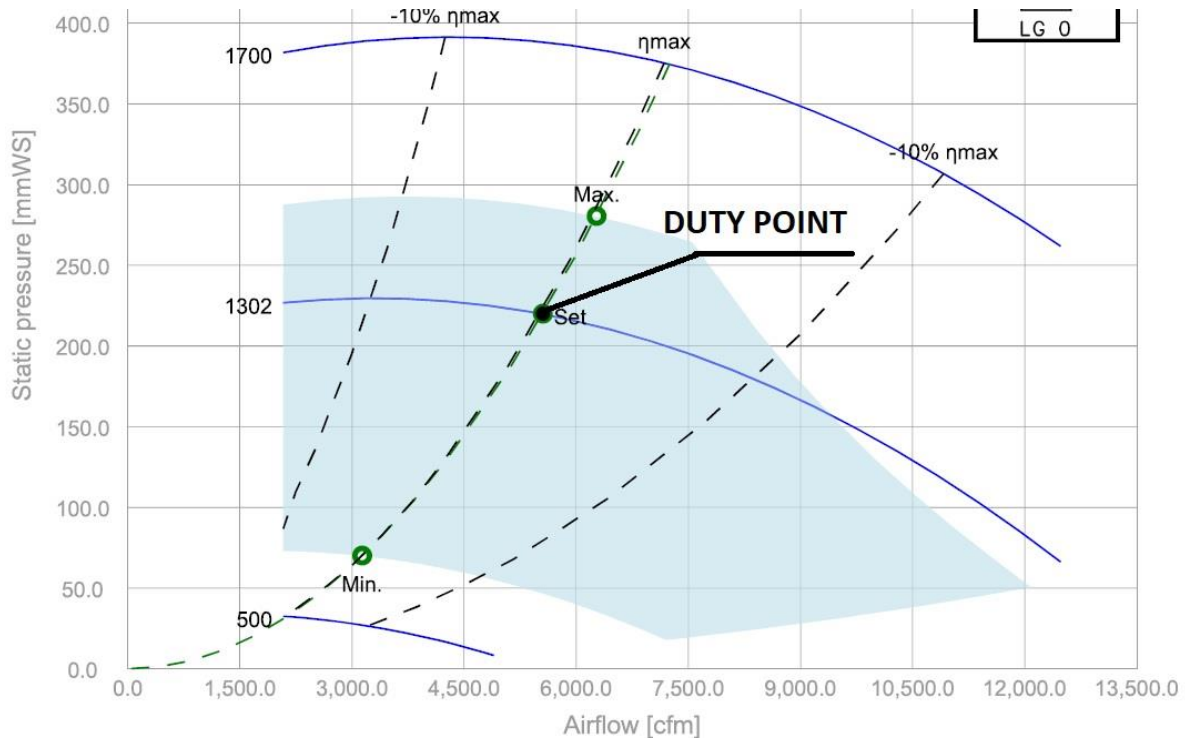
BLOWER COMMISSIONING FORMAT	
BLOWER TAG NO	
CLUSTER NO	
BLOWER SIZE	
STATIC PRESSURE (MM)	
FLOW VELOCITY (m/s)	
STAFHT POWER (kW)	
MOTOR CAPACITY (kW)	
MECHANICAL EFFICIENCY (%)	
OPERATING IMPELLER SPEED (RPM)	
MAXIMUM IMPELLER SPEED (RPM)	
STARTING CURRENT (AMPS)	
RUNNING CURRENT (AMPS)	
SOUND PRESSURE @ 3 MTR LEVEL (dB)	
BLOWER INLET SIZE (MM)	
BLOWER OUTLET SIZE (MM)	
STATIC WEIGHT (KG)	
DYNAMIC WEIGHT (KG)	

SUBMITTALS FOR CONSULTANT APPROVAL

- Vendor to submit exhaust summary sheet as per their respective fume hood air volumes.
- Vendor to submit P & ID based on the final requirement. (P & ID should be submitted in the same format as mentioned in the tender).
- Exhaust ducting shop drawing.
- The Vendor shall submit a calculation of all Pressure losses in the duct system, prior to ordering of Exhaust Blowers. A sample selection sheet is shown in exhibit below.
- Provide dimensional drawings and product data on each laboratory exhaust fan assembly.
- Provide fan curves for each fan at the specified operation point, with the flow, static pressure and horsepower clearly plotted.
- Damper selection, pressure loss chart & GA drawing.
- Supporting structure GA drawings with respective weights & quantities.

- Civil coordination drawing showing wall / floor cut-out details, construction details of skirting around floor opening & foundation pedestal details for exhaust blower.
- Vendor to coordinate with other services like Civil, Electrical, Gas & lab controls.
- Commissioning report for individual blower / exhaust system.

SAMPLE BLOWER SELECTION



SAMPLE PRESSURE DROP SELECTION SHEET

PROJECT : IISC, BANGALORE				CONSULTANT : MJ ASSOCIATES, BANGALORE						
SCB-14 (FUME HOOD EXHAUST)										
DUCTING PRESSURE DROP CALCULATION										
SI No.	Description	Air Vol	Duct	Duct C/s	Duct Length	Duct Length	Velocity	Press Drop per	Actual P D	
		CFM	dia	area	in mm.	in Ft.	FPM	100 ft in inch	Drop in inch	Ind PD
Discharge Side										
1	Transition Piece	900	250	0.0491	1000	3.28	1704	0.56	0.018	0.018
2	St Duct	900	250	0.0491	3000	9.84	1704	0.56	0.055	0.073
3	Duct Silencer								0.100	0.173
4	Flexible Connection								0.150	0.323
5	Weather Cowl								0.250	0.573
Suction Side										
1	Flexible Connection								0.150	0.723
2	Manual Damper								0.250	0.973
3	Transition Piece	900	250	0.0491	1000	3.28	1704	0.56	0.018	0.992
4	St Duct	900	250	0.0491	1000	3.28	1704	0.56	0.018	1.010
5	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	1.089
6	St Duct	900	250	0.0491	3000	9.84	1704	0.56	0.055	1.144
7	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	1.222
8	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	1.300
9	Wet Scrubber								3.000	4.300
10	St Duct	900	250	0.0491	1100	3.61	1704	0.56	0.020	4.320
11	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	4.399
12	St Duct	900	250	0.0491	5800	19.02	1704	0.56	0.106	4.505
13	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	4.584
14	St Duct	900	250	0.0491	14000	45.90	1704	0.56	0.257	4.841
15	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	4.919
16	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	4.997
17	St Duct	900	250	0.0491	4000	13.11	1704	0.56	0.073	5.071
18	90° Bend	900	250	0.0491	4267	13.99	1704	0.56	0.078	5.149
19	St Duct	900	250	0.0491	500	1.64	1704	0.56	0.009	5.158
20	Flexible Connection								0.200	5.358
21	Manual Damper								0.250	5.608
22	Suction Hopper								0.250	5.858
23	Fume Hood (Suc Presssure)								1.000	6.858
									Total	6.858
CFM	900			STATIC INCH	8				Static Pressure =	6.86
EFFICIENCY	50	60							Dynamic Pressure =	0.18
BKW	2.03	1.69							Total Pressure =	7.04
MOTOR CAPACITY	9.30	7.50							Safety 5% =	7.39
The exhaust blower shall be designed for 900 cfm at 8" Static Pressure										

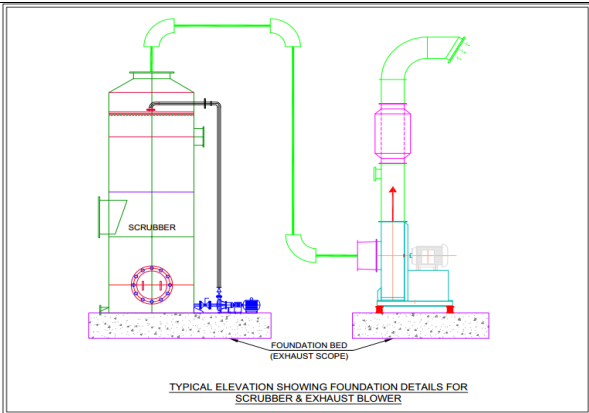
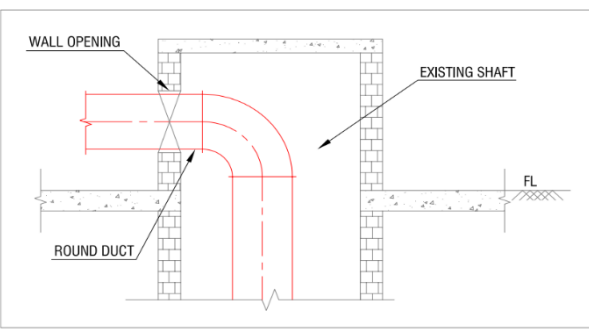
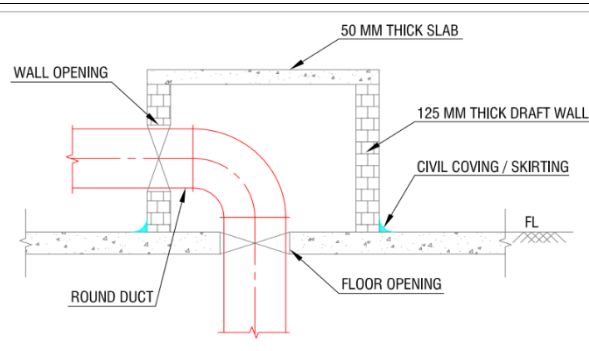
SPECIFICATIONS FOR MOTOR AND ACCESSORIES

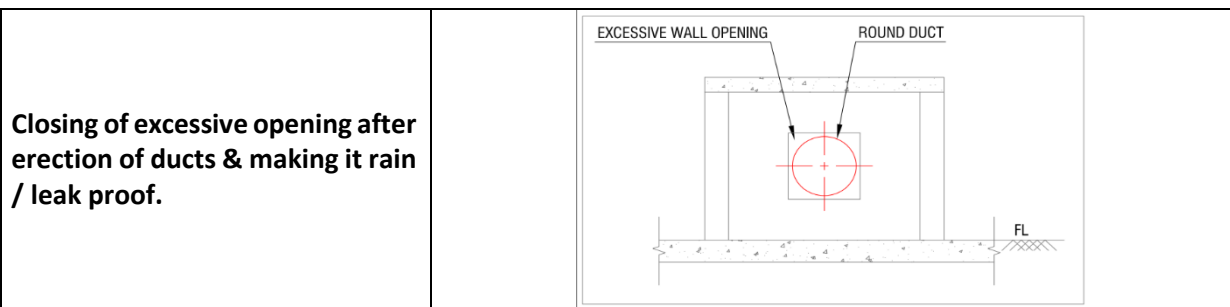
Use an electric motor built to IEC standards flange mounted (B5) and Foot mounted (B3), also in ex-protected or multistage versions, for the drive. The impeller hub is coated with aluminium. Power transmission from motor to impeller by means of a directly mounting the impeller on motor shaft. The impeller is fixed on to a flange bearing and the tightening adopter system guarantees secure mechanical connection.

Motor Standard IEC three-phase motors in accordance with IEC. Mounting B5 and B3 Available in motor-mounted (IP55) or cabinet-mounted versions.

The fan shall be driven by a standard TEFC electric motor with class ‘F’ insulation and class ‘B’ temperature rise. Motor shall be suitable for outdoor installation with IP55 protection and suitable for operation with 415V/3Ph/50Hz electrical supply. Motor supplied shall be in accordance to IEC standards.

PP motor guard / cover shall be supplied along with blower & motor assembly.

<p>Foundation Bed for Scrubbers & Exhaust blowers. Minimum 200 mm thickness OR Based on the equipment loading.</p>		
<p>Making necessary holes for duct entry in walls.</p>		
<p>Making necessary holes for duct entry in floors, construction of draft wall around the opening & ceiling with 50 mm thick slab & making it rain / leak proof.</p>		



CLOSEOUT SUBMITTALS

Closeout Submittals such as Operation and maintenance manuals, including as-built ducting layout, final P& ID diagrams, unit location drawing and component lists, shall be provided as closeout submittals.

INSTRUCTIONS

The Following points to be read in conjunction with BOQ & understand before Quoting.

- **Refer the above tender specification for all the line items mentioned in the Exhaust BOQ & quote accordingly.**
- Installation, integration, testing, balancing, commissioning & documentation work of all the BOQ line items & including making / preparing shop drawings, technical data sheet, coordination with drawings of other services of this tender and submission for approval, checking the design and its functionality of the whole system including the cost of all accessories, termination, connections, conduiting, nuts & bolts as per tender requirement manufacturer's requirements, all necessary supports from ceiling, walls, floors as required for all items mentioned in the BOQ & its accessories necessary to make the whole system operational. The rate shall be inclusive of the cost of all items labour removal of debris, dirt and rubbish accumulated as a result of installation / commissioning of the exhaust system and accessories and leaving the premises broom clean and orderly etc.,
- The final documentation includes commissioning reports, warranty / guarantee certificates, 6 sets of as built drawing hard copies & soft copy in DVD. Operational & Maintenance manuals and Handling over documents to be submitted.
- The vendor shall design the duct silencer to reduce the noise level & achieve 75 dB @ 1 mtr from the blower assembly.
- Support clamps for flexible hose to be provided at all user points.
- All Drawings, Technical submittals & installation procedure should be as per Good engineering practices. Drawings & material approval must be obtained before fabrication.

PART-3 GAS TUBING WORKS:

The scope of work shall cover supply, storage at site, transportation to site, Installation, fabrication/assembly, laying/erection, painting, testing and commissioning of the industrial tubing & piping system for Gas Distribution System for the project as a whole with necessary supports and supporting structures. The erection work shall be carried out as per the instructions of manufacturer and working drawings to be prepared by the Contractor and duly approved by the consultant. Scope of work shall include the following services:

1. GAS DISTRIBUTION SYSTEM:

Distribution of Nitrogen, Carbon dioxide and Gas cabinet for Zero air and Oxygen for laboratory Equipment's shall be planned to draw from Gas cylinders. Manifold shall be equipped with Semi-Auto Change Over facility (Changeover pressure for cylinder shall be set at 12 bar), which is proposed at Ground floor gas bank area (outside the building). The Gas shall be suitably, safely controlled to be taken to the required user point with header Tubing system of 3/4" OD, 1/2" OD & 1/4" OD SS316 MOC (tubes and fittings).

2. GAS TUBING:

Gas tubing shall be 3/4", 1/2", 1/4" OD or any other sizes shall be seamless tubing, and bright annealed SS316L stainless and steel shall be factory cleaned for the use of high purity gas services. The tube shall have the wall thickness as mentioned in BOQ. Gas distribution lines shall be indicated with color coding.

3. TUBE FITTINGS:

The fittings shall be compressed type & orbital weld type for all sizes. The fitting shall hold the working pressure without any leak. All the fitting end connections shall be compatible to the supplied tubing. The fittings should be nut ferrule and shall be made from SS 316L. The 1/4 inch Tee joint shall be made from SS 316L. All the fittings shall be factory cleaned suitable for laboratory high purity gas service.

4. BALL VALVES:

Ball valves of required size shall be installed at each source point of the service. The 1/2-inch size valve shall be SS316 with reinforced PTFE seat material with working pressure of 0 to 25Kg/cm². Point of use control valves with a leak free valves and precision regulators. All the Ball valves (supplied and installed for Gas Tubing) shall be stainless steel.

5. PRESSURE GAUGE:

Pressure gauge shall be stainless steel pressure gauges of minimum 2inch dial size to be installed in the Semi Auto change over system and cylinder regulator. Pressure gauge shall be suitable for laboratory gas service. The material of construction shall be SS316.

6. HIGH PRESSURE SEMI - AUTO GAS CHANGE OVER SYSTEM

The Gas change over system shall be semi-automatic to the gas distribution system. The Gas change over system shall be compact and preferably enclosed model designed for easy change of gas cylinders while in operation. The Gas change over system shall have provision to clean or purge lines before adding a new cylinder. Semi-automatic change over system is considered for Nitrogen and Carbon dioxide.

The changeover system shall have Electrical Contact Pressure Transmitter for standby cylinder changing over indication in lab level with maximum inlet pressure, Pressure Control range - 0 to 10 Bar;

Changeover Pressure - 12 Bar. The Contact Pressure Transmitter shall have RS 485/232 output, in order to provide necessary feedback (for Alarm and Display) to the Gas Detection Station.

The gas changeover system shall have two diffusion resistant pressure regulators in a single body. The primary changeover regulator shall connect to an active and reserve cylinder. The gas change over system shall be a complete unit with Vent Valve, Inlet Pressure Gauge, Inlet Valve, Outlet Pressure Gauge and Outlet Valve, etc for the intended use.

Mounting the brackets, clamps, supports cases, etc, for aesthetically laying for the gas lines to be included.

7. REGULATORS:

Capacity of the respective regulators to be checked by varying:

- Inlet pressure from 15 bars to 140 or 200 bars in case of Primary Regulators, maintaining constant pressure for range from 8 to 12 or 50 (as needed) on the downstream.
- Inlet pressure from 8 bars to 30 bars in case of gas Secondary Regulators, maintaining constant pressure for ranges from 0 to 10 bars on the downstream.

All tests will be carried out in the Regulator manufacturer's premises using compressed nitrogen gas, and for gases other than compressed nitrogen, the Supplier / Contractor should indicate "equivalent air / gas flow rates" to be maintained during performance testing, corresponding to the actual flow rates indicated in the BOQ and P&ID'S.

The Tenderer should furnish a clear plan for the set-up and procedure that they propose to adopt for performance testing.

While every Primary Regulator will be subjected to performance test, 20% of the total number of Secondary Regulators in a given category will be taken up for performance testing. This number can be increased as may be decided by the client representative witnessing the tests, in case any regulator within the lot is found deviating from the specifications.

8. Gas Cabinets:

90minutes Fire rating approved as per (EN 14470-2) Gas cylinder cabinets. The bottoms, top, sides and doors shall be fabricated of 1.2mm thk steel and shall be all double panel construction with a 40mm air space between panels. All joints shall be welded, or screwed, to provide a rigid enclosure. The wing door shall stainless-steel piano hinges and shall be fully insulated. The doors are self-closing and synchronized so that both doors will always fully close. Units 440mm long have only one door, self-closing, and equipped with a three-point latching system and hold-open feature. The cabinet shall have interior finish same as exterior. The cabinet shall have Exhaust air connections.



TECHNICAL SPECIFICATIONS FOR GAS TUBING WORKS:

1. GENERAL:

The erection of tubing's and valves & fittings shall be carried out according to the latest engineering practices and according to the working drawings, specifications, erection and instructions. The erection shall be carried out by highly skilled workmen.

The Contractor shall take care of positioning, leveling and laying/joining of all tubing's and cylinder bank as well as supporting structures within the required accuracy and tolerance limits. It shall be deemed as a contractual obligation that the tubing's are not thrown out of alignment or lifted off during commissioning and subsequent operation.

There may be more than one contractor working in the area at the same time. As such the work has to be carried out in proper coordination and consultation with all other parties concerned with the work. The Contractor shall take due notice of the working conditions, practices and agreements prevalent in the area of the plant site and satisfy himself before quoting.

The Contractor shall be responsible for paying strict attention to statutory regulations for prevention of accidents and to other safety rules. The regulations for prevention of accidents shall be displayed at appropriate places and should be distinctly visible to all personnel working in the area.

The Contractor shall supply all required consumables, construction and erection materials, petrol, diesel oil, kerosene, solvents, sealing compounds, tapes, brazing and soldering materials, welding sets, tube bending machines, cables, clamping tools, gauges, erection bolts, nuts and packing sheets/compounds, temporary supports, wooden blocks, spacers, templates, jute and cotton wastes, sand and emery paper etc as required for satisfactory completion of work.

The Contractor shall make his own arrangement for handling the tubes & fittings at the stores and transporting it to the site of installation.

Technical specifications to be submitted for approval for all the bought-out Items

Tubes shall be laid using poly amide box clamps on mounting rail supports.

Bending of tubing shall be made with a tube bender. Bending radius shall be for 1" and ¾"-4D, ½" and

¼"-3D. All tube bends must be uniform with no kinks, flats, or wrinkles.

All the threaded joints shall be applied with oxygen compatible PTFE anaerobic thread sealant (Approved by fittings supplier).

Compression/ Face seal fittings shall be installed as per manufacturer's recommendations. Above ½" fittings shall be swaged with hydraulic/ pneumatic swaging machine.

Once tubing installation is completed, the system shall be flushed with nitrogen (99.999%) to remove all foreign matters from inside the tubes and in acceptance with commissioning engineer. Bypass or remove purifiers or other equipment that could be adversely affected before nitrogen flush out.

The contractor should offer leak free gas controller and distribution system for laboratory gases, such as Nitrogen Helium gas, Spare gas-1 and Spare gas-2. The distribution system shall include all the necessary tubing's, tube fittings, cylinder connections with accessories, point of use pressure regulator, isolation valves, control valves, pressure gauges etc, required to feed from gas bank to the laboratory work benches. All the tubing should be supported in aesthetically colored, anodized and power coated aluminum casings.

All the completed lines shall be maintained in +ve pressure with Nitrogen to avoid contamination. Required gases should be arranged by the contractor.

Tubes passing through masonry walls, beams, underground, foundations etc. shall be taken through cut-outs. If any tube requires embedded sleeve, the material of sleeve shall be SS-304 to avoid corrosion. Spacing between parallel runs of tubes carrying different services should be individually clamped and aligned as per the requirements. The clamps & supports shall be ensured to safely carry the weight of pipes.

2. WELDING

All tubing headers shall be of seamless construction with joints welded using automatic orbital welding machine with argon gas purging.

Tube to Tube or Tube to fittings/valves welding shall be done using automatic TIG welding.

Isometric drawing shall be prepared before start of welding work.

Quality System of the Tubing Manufacturer shall have approval from ASME quality system certificate as material organization.

Tubing shall be clearly marked with heat code, lot code, outer diameter and wall thickness as in the inspection certificate.

Tubing sizes up to 1" OD shall be bright annealed. Tubing with outside diameter larger than 1" OD shall be supplied in annealed and pickled condition.

Tubing shall have carbon content < 0.030%

All cutting and welding equipment should be cleaned of any impurities or particulates.

Clean area shall be provided for welding. The room should be maintained clean at all times.

All piping and fittings should be cleaned prior to and after welding.

Proper edge preparation before welding different tubes / fitting, while carrying out the weld joints to ensure no cutting/ welding burrs, other contaminants etc., enter into the tubes.

Assemblies should be bagged after welding and the bags removed just prior to making field welds.

Welding and fitting technicians should use overshoes and clean room gloves. The gloves are worn to prevent fingerprint oils from getting onto the pipe.

The use of a clean area and clean area procedures will protect the welds and reduce the defect incidents associated with contaminates in the welding areas.

Daily, the first and last production joint needs to go through external visual examination then cut open axially and check welding.

Each qualified welder should be formally qualified with a certificate qualifying him or her for a certain type of weld, as per welding procedure for welder qualifications mentioned in American Society of Mechanical Engineers (ASME) & American Welding Society (AWS).

100% Weld joints to be tested by helium mass spectrometer with evacuation method.

The mode of measurement of tubing's shall be in units of length along the center line of installed tubes including all compression tube fittings, unions, bends elbows, tees, concentric and eccentric reducers, inspection pieces, etc. The above accessories shall be measured as part of piping length along the center line of installed tubes and no special rates for these accessories shall be permitted.

3. TUBINGS & SUPPORT:


Tubing shall be inclusive of necessary specialties like bolts, nuts, washers, U-clamps, cutting, bending, welding (Orbital welding to be considered for joining tubes above false ceiling without unions), Tagging (Acrylic) etc. The rate quoted to be inclusive of necessary wall bores, cutting through walls as per tender dwg. Mode of measurement shall be in running Meters of installed tubes as per the tender BOQ.

GI rail, threaded rod, stuff clamps, expansion bolts, nuts & washers etc shall be measured in unit lengths of installed qty as per the tender BOQ. The quoted rates shall include sourcing of all such items viz. welding machine, tool and tackles, other support items etc. that are required to complete the work in all respects.

4. DATA SHEETS & SPECIFICATIONS:

i. GENERAL SPECIFICATION FOR SS TUBING:

All the items shall meet the specifications.

SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Seamless Tube	
2	MOC	SS 316	
3	Ref. Standard	ASTM A 269	
4	Size	As per BOQ	
5	Make	As specified in BOQ/List of approved Makes	
7	Sustain Pressure	248 Bar	
8	End Connection	Plain	

ii. MATERIAL OF CONSTRUCTION:

- Seamless tubing shall be made of SS material and cold drawn instrumentation type. Tubing should be dual certified as TP 316 / 316L.
- Seamless tubing should have a minimum of 2.5% molybdenum so as to ensure high resistance to corrosion.
- Seamless tubing should have carbon content $\leq 0.030\%$.
- Seamless tubing hardness should be max of HRB 90.
- Seamless tubing sizes up to 1" OD should be bright annealed. Tubing with outside diameter larger than 1" OD should be supplied in annealed and pickled condition.
- Seamless tubing shall have Tolerance on Wall Thickness $\pm 10\%$.

iii. MARKING, PACKING & SHIPMENT:

- All tubing must be clearly marked with heat code, lot code, outer diameter and wall thickness as in the inspection certification.
- Tubing shall be supplied with plugged ends.
- All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.
- Items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

iv. DESIGN & MANUFACTURE

- Seamless tubing manufacturers should have ISO 9001/9002 certification and as well as product approvals from TUV and JIS.
- Quality System of the Tubing Manufacturer should have approval from ASME quality system certification as material organization.
- Tolerance for 316/316L tubing from 6 to 42mm OD as per DIN/2391/ED 10305-1 & tolerance on wall thickness should be $\pm 10\%$.
- Seamless tubes shall be certified as per NACE/ MR0175 for Hardness.
- Tubing shall be manufactured in an integrated Mill with hot extrusion process.

All fittings shall be designed in conformance with the requirements of ASME B31.3 and applicable standards. Area classification applicable for all items shall be Class-1, Division-1, Group-D as per NEC Zone-1 Group-IIA/ II-B as per IS/ IEC specification or equivalent specification. All fittings shall be designed so that all parts/ components meet the requirements for the specified area classification.

The tube fitting shall consist of the following precision machined parts: a) body, b) front ferrule, c) back ferrule and d) nut. The design configuration of all components shall present surface-to-surface contact, one part to another, keeping unit stresses below galling levels, for use on SS tubes conforming to ASTM A269 TP316.

Fittings shall be rated for at least the design pressure stipulated in the material requisition. The design of the fittings shall ensure that they shall be capable of holding full tube burst pressure after only one and a quarter turn pull up of the nut.

The threaded end of the fittings shall be NPT as per ASME B1.20.1, SAE AS 71051.

The fittings shall hold the tube with collecting action producing a firm grip on the tube without substantially reducing the tube wall thickness.

The fitting body shall not have any machined stop or shoulder to preclude additional tightening in

subsequent make-up.

Fittings shall not torque the tubing during original or subsequent make-up of the connection and use geometry for inspection before and after making up the fittings shall not require disassembly for inspection before or after makeup.

All tube fittings shall be Gauge able for sufficient pull up after one and quarter turn. All tube fittings shall have a gauge able shoulder and there will be no radius at the point where the shoulder meets the neck of the fitting body. A Gap Inspection Gage shall be used to check for insufficient pull-up.

The gap inspection gauge shall be easily insert able at finger tight position of nut. The gap inspection gauge shall not be insert able between the nut and shoulder of the fitting after completing only one and a quarter turn pull up of the nut.

The tube seat counter bore in the body shall be faced flat 90° to the axis of the tubing to minimize tube expansion and subsequent galling.

The sealing and gripping power of the fitting shall be controlled such that the action between ferrules will overcome commercial variations in tubing wall thickness, hardness, and diameter.

v. Front Ferrule

The front ferrule shall provide a long, smooth repeatable seal by contact with body.

The front ferrule shall remain in an elastic condition to compensate for thermal stresses and to accomplish repeated make and break.

vi. Back Ferrule

The rear ferrule shall collet the tubing surface, improving the performance of the tubing in the systems of high impulse or vibration.

The back ferrule will have a uniform surface hardening. This surface hardening will be a low-temperature carburization, avoiding carbide formation. It will follow a disclosed and auditable process procedure.

The rear ferrule shall have a machine recess on the inside diameter and shall have complete surface hardening so as to substantially remove the required pull up torque. Both the requirements i.e., complete surface hardness and machined recess shall be met for all rear ferrules.

Nuts shall have silver plated threads to act as a lubricating agent to avoid galling and to reduce tightening torque.

The manufacturer shall be able to offer tube fittings with specially cleaned and packed to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C for Oxygen.

All tube fittings provided by the supplier shall be NACE MR0175 certified by default.

vii. INSPECTION & TESTING

Testing of the Tubing should be in accordance with SS142353/142343, DIN 17456/58, NFA 49 - 117/217, ASTM A213, ASTM A269, ASTM A312, and EN 10216-5.

Tubing supplier should furnish an "INSPECTION CERTIFICATE" indicating:

- Material description
- Steel making process.
- Heat code
- LOT code
- Leak test: Eddy current test according to ASTM A-450
- Test result of chemical composition, tensile test, hardness test, flaring test and flattening test.

The manufacturer should supply material compliance certificate.

The manufacturer shall submit typical type test reports for the following test carried out on random

samples of two ferrule fittings: -

- Hydrostatic Pressure Test: Fittings should undergo testing conducted to evaluate the tube gripping ability of assembled tube fittings to sustain hydraulic over pressure, attaining up to 3.5 times working pressure without hydraulic leakage and up to 4 times the working pressure without fitting material rupture or tube slippage.
- Helium Proof / Nitrogen Re-make Test: Fittings should undergo testing conducted to evaluate the performance of tube fittings with 1.5 times the working pressure with Helium and at rated working pressure with Nitrogen after every re-make for 25 such re-makes.
- Helium Leak Test: Fittings should undergo testing to ensure that leakage is not in excess of 1.0×10^{-9} atm-cc/sec with the test assembly evacuated to approx. 20 millitorr while maintaining a differential pressure of 1 atm between the inside and outside of the assembly.
- Sodium Chloride Stress Test: Fittings should undergo testing conducted to evaluate the effect of an environment that promotes stress corrosion cracking (SCC); conducted as per ASTM B117-95 standards.
- Rotary Flex Test: Fittings should undergo testing conducted to evaluate the fatigue endurance reliability of tube fittings when installed on tubing subjected to fully reverse rotary beam flexure.
- Vibration Test: Fittings should undergo testing conducted to evaluate the amount of cantilever deflection that can be applied to a tube and fitting assembly and still pass through 10,000,000 cycles without failure.
- Tube Burst Test: Fittings should undergo testing conducted to evaluate the grip of tube fittings on tubing at the burst pressure of the tubing.
- Fire (Burn) Test with water quench: Fittings should undergo testing conducted to evaluate the performance when exposed to a 1,500°F burn and a water quench based on API 607 standards.
- High Impact Shock Test: Fittings should undergo testing conducted to evaluate the performance when subjected to shock test conducted as per ASTM F1387-99 standards. Should satisfy the requirements of ASTM F1387 Standards. The above shall be witnessed and certified by the U.S Department of Navy.

viii. TEST REPORTS & CERTIFICATES

The manufacturer should provide material compliance certificates.

Fittings manufacturer should have ISO 9001 certification and as well as product approvals from TUV, ASTM, ASME, BSI, DNV, GOST, Lloyds Registrar of Shipping & PED and also the most stringent fitting specification ASTM F1387, witnessed by the US Navy.

MARKING, PACKING & SHIPMENT

Heat code traceability number shall be etched on both body and nut of each fitting. All fitting shall be etched to identify manufacturer and material.

Replacement nuts and ferrules shall be packaged in a manner so as to allow safe and simple replacement.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

Items shall be wrapped and packaged in such a way that they can be preserved in original as new

condition.

Local Stock: Manufacturer or authorized distributor shall carry significant amount of stock to the tune of 500 no's of the tube fittings each in their local stocks.

ix. DOCUMENTATION

All documents shall be furnished in English language only.

At the time of bidding, bidder shall submit following documents:

Reference list of the previous supply for similar items, giving following details:

- Name of the customer.
- Specification of the item i.e., size & pressure and temperature rating.
- Service
- Quantity
- Year of Supply
- Test procedures and typical certificates to be submitted as per clause 5.3 and 5.4 of this specification.
- Manufacturer Quality Control Plan and sampling plan.
- Copy of ISO 9000 certification for supplier/ manufacturer.

The manufacturer should supply material compliance certificates.

x. WARRANTY

Manufacturer & its authorized distributors should offer a comprehensive Warranty covering the performance of the product against any defects in material or workmanship for 1 years' time of the product. A certificate to this effect must be issued on their respective Company letter head

5. GENERAL SPECIFICATION FOR AUTO CHANGEOVER REGULATORS:

i. MATERIAL OF CONSTRUCTION

- The Regulator body, stem & range spring shall made of SS 316.
- Material of construction of the diaphragm shall be Alloy X-750
- Material of construction of seat shall be either PCTFE or PEEK depending on the pressure rating of the regulator.
- All wetted lubricants must be PTFE based.

ii. DESIGN & MANUFACTURE

All Auto changeover manifolds shall ensure continuous gas delivery by automatically switching between sources to extend gas supply.

Diaphragm sensing regulators enable precise pressure regulation. In order to achieve greater sensitivity and longer life, a convoluted diaphragm shall be used.

All auto changeover manifolds must have a Supply Pressure Effect of approx. 0.01%.

All auto changeover manifolds shall be supplied as a complete system with tube fittings, inlet/outlet/vent valves, pressure gauges & suitable single & double stage pressure reducing regulators mounted suitably on a SS 304 panel, except for manifolds supplied for Oxygen service. All regulators used must comply with the specifications listed below.

All regulators shall have a two-piece design that offers linear load on the diaphragm seal when the cap ring is tightened, eliminating torque damage to the diaphragm during assembly.

The diaphragm of the pressure regulator shall have a convoluted, no perforated design ensuring greater sensitivity and longer life.

All pressure reducing regulators must include a 25µm filter that is held in the inlet port to prevent any foreign particles from entering the regulator. In addition, the filter must be supported by a retainer ring to prevent it from accidentally falling out.

The poppet must be supported by a poppet damper to keep the poppet aligned thereby reducing vibration & resonance.

The diaphragm shall be supported by a braced stop plate to protect against a ruptured diaphragm.

All auto changeover manifolds & all components for Oxygen system shall be suitably cleaned for Oxygen service and quoted accordingly.

Manufacturer shall be able to Regulators with specially cleaned and packed to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C for oxygen service.

All Regulators used must meet the technical specification listed in the earlier part of this document.

iii. INSPECTION & TESTING

Shell testing shall be performed on all components to a requirement of no detectable leakage with a liquid detector at 80 psig (5.5 bar) nitrogen.

All regulators must be 100 % factory tested for changeover pressure.

iv. TEST REPORTS & CERTIFICATES

The manufacturer shall supply material compliance certificate. Regulator manufacturer should have ISO 9001 certification and as well as product approvals from TUV, ASTM, ASME, BSI, DNV, GOST, Lloyds Registrar of Shipping & PED.

v. MARKING, PACKING & SHIPMENT

Heat code shall be marked on Regulator body to facilitate traceability. All Regulators shall be etched to identify manufacturer and material.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

Each item shall be properly tagged and package separately to facilitate easy identification.


All items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

6. GENERAL SPECIFICATION FOR SS BALL VALVES:

i. MATERIAL OF CONSTRUCTION

- The valve shall be of Single piece design with forged / machined body made of material conforming to ASTM A479 & A276 Type SS 316.
- Material of construction of ball stem shall confirm to ASTM A276 Type SS 316.
- Material of construction of packing shall be Modified PTFE / D1710 type 1, Grade 1, Class B.
- Manufacturer shall be able to provide multiple options for seat packing materials Reinforced PTFE, Alloy X-750, Carbon/glass PTFE, PEEK & UHMWPE.
- Manufacturer shall be able to provide multiple options for stem packing materials maintenance kits and color handle kits.
- stainless steel locking bracket / stainless steel stop lock plate
- body hex nuts (4-bolt valve kits only)
- stainless steel lever handle

ii. Ball Valve:

SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Ball Valve	
2	MOC	SS 316	
3	Flow Pattern	2 Way Shut off, Straight Pattern	
4	Size	1/4" OD	
5	Make	As specified in BOQ/List of approved Makes	
6	Design Pressure	20 Bar	
7	End Connection	OD CF	

iii. DESIGN & MANUFACTURE

Valve shall employ a live-loaded packing system that reduces need for packing adjustment improves thermal cycle performance and compensates for wear.

Packing shall be a single-piece design constructed of modified PTFE which reduces potential leak points and has virtually no dead space. Valve sizes above 3/8" shall have standard PTFE packing.

Manufacturer shall be able to offer Ball Valves with specially cleaned and packed to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C for oxygen service.

Design pressure shall be at least twice the working pressure & Burst pressure may be almost four times the working pressure of the ball valves.

The back ferrule of Ball Valves' end fitting shall have a machined recess on the inside diameter and shall have complete surface hardening to substantially reduce the required pull up torque. Both the requirements i.e., complete surface hardness and machined recess shall be met for all rear ferrules of sizes ranging from 1/4" to 1" OD & 6mm to 25mm OD.

All Ball Valves with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

Single piece ball Valve shall employ a balanced trunnion, patent -pending design that supports packing volume, minimizing thermal effect.

iv. INSPECTION & TESTING

The valve shall be factory tested with Nitrogen at 1000 psig (69 bar). Maximum allowable seat leakage shall be 0.1 std cc/min.

v. TEST REPORTS & CERTIFICATES

The manufacturer shall supply material compliance certificate.

For Sour Gas service - Materials for wetted components are selected in accordance with NACE Specification MR0175 for sulfide stress cracking resistant materials.

Valve manufacturer should have ISO 9001 certification and as well as product approvals from TUV, ASTM, ASME, BSI, DNV, GOST, Lloyds Registrar of Shipping & PED.

Valves are helium leak tested at a pressure of 1×10^{-4} Torr. The maximum allowable leak rate is 4×10^{-9} std cm³/s.

vi. MARKING, PACKING & SHIPMENT

Heat code shall be marked on valve body to facilitate traceability. All valves shall be etched to identify manufacturer and material.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

All items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

7. GENERAL SPECIFICATION FOR SS NEEDLE VALVES:

i. MATERIAL OF CONSTRUCTION

All 316 SS Needle valves body to conform to ASTM A182/ A479 and stem material, packing nut to conform with 316 SS/ A276.

Material of construction of Upper and lower packing shall be PFA/D3307.

Manufacturer shall be able to provide multiple options for seat packing materials kits, Lockable handles and color handles kits.

Manufacturer should be able to provide multiple options for stem packing materials, O-ring maintenance kits and color handle kits.

Manufacturer shall be able to provide multiple options for O ring materials like Buna C, Buna N, Ethylene propylene & Karlez.

All Needle Valves with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

ii. DESIGN & MANUFACTURE

Manufacturer shall be able to provide needle valves either with Integral bonnet / Union bonnet design. The back ferrule of Needle Valves' end fitting shall have a machined recess on the inside diameter and shall have complete surface hardening to substantially reduce the required pull up torque. Both the requirements i.e., complete surface hardness and machined recess shall be met for all rear ferrules of sizes ranging from 1/4" to 1" OD & 6mm to 25mm OD.

Manufacturer shall be able to offer Needle Valves with specially cleaned and packed to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C for oxygen service.

All Needle Valves with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

Manufacturer shall be able to offer at least 3 types of stem tip designs to suit for different applications parameters.

iii. INSPECTION & TESTING

The valve shall be factory tested with Nitrogen at 1000 psig (69 bar). Maximum allowable seat leakage shall be 0.1 std cc/min.

Design pressure should be at least twice the working pressure & Burst pressure may be almost four times the working pressure of the Needle valves.

iv. TEST REPORTS & CERTIFICATES

The manufacturer shall supply material compliance certificate.

For Sour Gas service - Materials for wetted components are selected in accordance with NACE Specification MR0175 for sulfide stress cracking resistant materials.

Valve manufacturer should have ISO 9001 certification and as well as product approvals from TUV, ASTM, ASME, BSI, DNV, GOST, Lloyds Registrar of Shipping & PED.

v. MARKING, PACKING & SHIPMENT

Heat code shall be marked on valve body to facilitate traceability. All valves shall be etched to identify manufacturer and material.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

Each item shall be properly tagged separately to facilitate easy identification.

All items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

8. GENERAL SPECIFICATION FOR SS CHECK VALVES:

i. MATERIAL OF CONSTRUCTION

Check valve body and poppet to conform to 316 SS / A479.

If the check valve has an elastomer as a wetted component, a variety of sealing materials shall be made


available.

Manufacturer shall be able to provide multiple options for Seal kits.

For corrosive gases If the check valve has an elastomer as a wetted component, a variety of sealing materials including Kalrez and Teflon shall be made available.

All Check Valves with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

ii. Non-Return Valve /Check Valve:

SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Non-Return Valve / Check Valve	
2	MOC	SS 316	
3	Flow Pattern	1 Way Flow	
4	Size	1/4"	
5	Make	As specified in BOQ/list of approved makes.	
6	Working Pressure	230 Bar (As per BOQ), Cracking Pressure 0.5 Micron	
7	End Connection	1/4" OD	
8	Service	Suitable for all Gases	

iii. DESIGN & MANUFACTURE

The back ferrule of Check Valves' end fitting shall have a machined recess on the inside diameter and shall have complete surface hardening to substantially reduce the required pull up torque. Both the requirements i.e., complete surface hardness and machined recess shall be met for all rear ferrules of sizes ranging from 1/4" to 1" OD & 6mm to 25mm OD.

Manufacturer shall be able offer Check Valves with specially cleaned and packed to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C for oxygen service.

All Check Valves with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

Check Valve with fixed pressure, are cycled six times prior testing, every check valve is tested to ensure it seals within 5's at the appropriate seal pressure.

iv. INSPECTION & TESTING

The valve shall be factory tested with Nitrogen at 1000 psig (69 bar). Maximum allowable seat leakage shall be 0.1 std cc/min. Design pressure should be at least twice the working pressure & Burst pressure may be almost four times the working pressure of the Check valves.

v. TEST REPORTS & CERTIFICATES

Manufacture should provide material compliance certificate.

Valve manufacturer should have ISO 9001 certification and as well as product approvals from TUV, ASTM, ASME, BSI, DNV, GOST, Lloyds Registrar of Shipping & PED.

vi. MARKING, PACKING & SHIPMENT


Heat code shall be marked on valve body to facilitate traceability. All Check Valves shall be etched to identify manufacturer and material.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

Each item shall be properly tagged and package separately to facilitate easy identification.

All items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

9. GENERAL SPECIFICATION FOR HOSE:

SR NO	DESCRIPTION	SPECIFICATION	
1	Tech. Name	Hose	
2	MOC	SS 316	
3	Ref. Standard	ASME B 16.34	
4	End Connection	1/4" NPTF x 1/4" NPTF 3/4" BSPF(LH) x 3/4" BSPM(LH) (For LPG)	
5	Service	All Gases	
6	Working Pressure	230 Bar	
7	Make	As specified in BOQ/list of approved makes.	

i. MATERIAL OF CONSTRUCTION

Manufacturer should be able to offer Hose with 316 SS over braid.

Manufacturer shall provide 316L SS core & 316L SS braided hoses where permeation is undesirable.

All 316 SS Hoses end connections for the hose assembly can be permanent (crimped) design or reusable (compression style).

ii. DESIGN & MANUFACTURE

Manufacturer shall be able to provide multiple cover options without changing hose technical data.

Manufacturer shall provide an option of carbon black filled PTFE core for applications that require static dissipation.

All Hoses with SS Nut & Ferrule end fittings shall have a gauge able shoulder. There will be no radius at the point where the shoulder meets the neck of the fitting body. The gauge able shoulder will allow a Gap Inspection Gage to be inserted between the nut and shoulder; 180 deg. flush around the neck of the fitting, to check for insufficient pull-up. The Gap Inspection Gage will not fit between the nut and shoulder of a sufficiently pulled-up fitting on the initial pull up and it must be consistently reliable.

All Hoses with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

iii. INSPECTION & TESTING

Every assembly is pressure tested with water at room temperature for 30 seconds to a requirement of no detectable leakage. Testing is performed at 1000 psig (69 bar), or 225 psig (15.5 bar) if an end connection is rated below 1000 psig (69 Bar).

Design pressure should be at least twice the working pressure & Burst pressure may be almost four times the working pressure of the Hoses.

iv. TEST REPORTS & CERTIFICATES

The manufacturer shall supply material compliance certificate.

PTFE material complies with FDA regulation 21CFR Part 177.1550, USP <88> Class VI, and 3-A.

v. MARKING, PACKING & SHIPMENT

Heat code shall be marked on hose to facilitate traceability. All Hoses shall be etched to identify manufacturer and material.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

Each item shall be properly tagged and package separately to facilitate easy identification.

All items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

10. GENERAL SPECIFICATION FOR FILTERS:

i. MATERIAL OF CONSTRUCTION

Filter body, bonnet & bonnet nut to conform to 316 SS / A479.


The minimum nominal pore size of filter element shall be 0.5µm.

The filter element shall be of grade SS 316.

Maintenance kits shall be made available for field replacements.

All Filters with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

ii. INLINE FILTER:

SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Inline Filter	
2	MOC of Contact Part	SS 316 (For Other Gases) SS 316L (For H2)	
3	End Connection	1/4" NPTF x 1/4" NPTM	
4	Make	As specified in BOQ/list of approved makes.	
5	Micron	0.5 Micron	
6	Working Pressure	150 Bar	

iii. DESIGN & MANUFACTURE

All filters with SS Nut & Ferrule end fittings shall have a gauge able shoulder. There will be no radius at the point where the shoulder meets the neck of the fitting body. The gauge able shoulder will allow a Gap Inspection Gage to be inserted between the nut and shoulder; 180 deg. flush around the neck of the fitting, to check for insufficient pull-up. The Gap Inspection Gage will not fit between the nut and shoulder of a sufficiently pulled-up fitting on the initial pull up and it must be consistently reliable. The back ferrule of filter's end fitting shall have a machined recess on the inside diameter and shall have complete surface hardening to substantially reduce the required pull up torque. Both the requirements i.e., complete surface hardness and machined recess shall be met for all rear ferrules of sizes ranging from 1/4" to 1" OD & 6mm to 25mm OD.

Manufacturer shall be able to offer Filters with specially cleaned and packed to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C for oxygen service. Design pressure shall be at least twice the working pressure & Burst pressure may be almost four times the working pressure of Filters.

All Filters with SS Nut & Ferrule end fittings shall have a gauge able shoulder.

iv. INSPECTION & TESTING

Every Filter shall be factory tested with Nitrogen at 1000 psig (69 Bar) to a requirement of no detectable leakage with liquid leak detector.

v. TEST REPORTS & CERTIFICATES

The manufacturer shall supply material compliance certificate. For Sour Gas service - Materials for wetted components are selected in accordance with NACE Specification MR0175 for sulfide stress cracking resistant materials.

Filter manufacturer should have ISO 9001 certification and as well as product approvals from TUV, ASTM, ASME, BSI, DNV, GOST, Lloyds Registrar of Shipping & PED.

MARKING, PACKING & SHIPMENT

Heat code shall be marked on Filter to facilitate traceability. All Filters shall be etched to identify manufacturer and material.

All the items shall be suitably wrapped and packaged to withstand rough handling during ocean shipment and inland journey.

Each item shall be properly tagged separately to facilitate easy identification.

All items shall be wrapped and packaged in such a way that they can be preserved in original as new condition.

11. M. S. fabricated support framework for in Cylinders and Manifolds:

Construction : Arc Welding and Bolting.

Finish : One Coat of Primer & two Coates Synthetic enamel paint.


Material Used : MS. Channel / Angle/ Plate as per IS: 808/1730 / 1731

Cylinder Brackets with Chain

MOC : Powder coated M.S. with powder coated G.I. chain

Aesthetically designed gas cylinder brackets with powder coated chain suitable for holding the cylinder securely in upright position.


i. Cylinder Bracket with Chain:

SR NO	DESCRIPTION	SPECIFICATION	
1	MOC	GI	
2	Specifications	Aesthetically designed gas cylinder brackets with powder coated chain suitable for holding the cylinder securely in upright position.	

12. NUT BULLNOSE


Specifications : 1/4" NPTM X 5/8" BSP RH /LH nut suitable for individual gas.

Nut : Bar stock Brass


SR NO	DESCRIPTION	SPECIFICATION	
1	Tech. Name	Nut Bullnose	
2	MOC	SS 316	
3	Specification	1/4" NPTM X 5/8" BSP RH /LH nut suitable for individual gas. A sintered filter of 25 micron is inbuilt in bull-nose connector to prevent entry of dust / impurities in gas handling system.	

SR NO	DESCRIPTION	SPECIFICATION	
4	Service	Suitable for all gases	
5	Working Pressure	230 Bar	
6	Make	As specified in BOQ/list of approved makes.	

13. TUBE FITTING:


SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	End Cap	
2	MOC	SS 316	
3	Size	1/4"	
4	End connection	Compression End	
5	Make	As specified in BOQ/list of approved makes.	
6	Design Pressure	150 Bar	
7	Service	All Gases	

14. END CAP:


SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Equal Tee	
2	MOC	SS 316	
3	Ref. Standard	ASTM A 269	
4	Size	1/4"	
5	Make	As specified in BOQ/list of approved makes.	
6	Design Pressure	150 Bar	

7	Service	All Gases	
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15. UNION:


SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Union	
2	MOC	SS 316	
3	Size	1/4"	
4	End connection	Compression End	
5	Make	As specified in BOQ/list of approved makes.	
6	Design Pressure	150 Bar	

16. REGULATOR WITH CONNECTOR:

SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Regulator	
2	MOC	SS 316	
3	Size & Connection of Regulator	1/4" NPTF	
4	Pressure Range	Inlet Pressure 14 Bar Outlet Pressure 1 to 10 Bar	
5	Connector Size for Regulator	As specified in BOQ	
6	Flow	10-150 LPM OR 10-300 LPM	
7	Make	As specified in BOQ/list of approved makes.	
8	Services	All Gases	

17. TUBE HOLDING CLAMP


SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Tube Holding Clamp	

2	MOC	Polypropylene	
3	Size	As per BOQ	
4	Make	As specified in BOQ/list of approved makes.	
5	Service	For All Tubes	


18. TAGGING

SR NO	DESCRIPTION	SPECIFICATION
1	Tech. Name	Tagging
2	Construction	Acrylic
3	Standards	ASME 13.1- 2007
4	Make	As specified in BOQ/list of approved makes.

19. MANIFOLD BLOCK

SR NO	DESCRIPTION	SPECIFICATION	IMAGE
1	Tech. Name	Manifold Block (60mm x 60mm)	
2	MOC	SS 316	
3	Size	As per BOQ	
4	Make	As specified in BOQ/list of approved makes.	
5	Service	For All Tubes	

20. UNISTRUT SUPPORT:

SR NO	DESCRIPTION	SPECIFICATION	
1	Tech. Name	Unistrut Support (Slotted / Without Slotted)	
2	Construction	GI Channel along with Bolting System, Size 41 x 41 x 2 mm Thk/ 41 x 41 x 1.5 mm Thk.	
3	Raw Material	GI Unistrut , L Bracket, Washer & Nut, Spring Nut & M10 GI Threaded Rod	

21. SPECIFICATION OF PRESSURE GAUGE:

SL NO	SPECIFICATION		DESCRIPTION
1	Model no.	:	To be specified by vendor
2	Dial size	:	4" & 8"
3	Bottom entry size	:	1/2" BSP
4	Diaphragm	:	SS 316
5	Contact parts	:	SS316/SS316 Teflon Lined/Haste alloy
6	Movement	:	SS 316
7	Block	:	SS 316
8	Design range	:	Upto 15 Kg/cm ²
9	Operating range	:	As per BOQ
10	Accuracy	:	+ / - 1 % of range span
11	Over range protection	:	125 %
12	Case & bezel	:	SS 304 with screwed Bezel of ABS plastic.
13	Mounting	:	Direct with bottom entry
14	Standard fitments	:	Micro adjustable pointer (internal) blow out disc.
15	Documentation	:	Calibration certificate traceable to National Standard.

22. NON-RETURN OR CHECK VALVE SPECIFICATIONS:

Sl	Descriptions	Data
1	Body	: SS 316
2	Ends	: Spring type ASA 150 flanges
3	Flange holes	: As per ANSI.B.16.5
4	Mfg. Std	: API 6D/API 594
5	Rating	: 150 # RATING
6	Bore	: Full port
7	Disc	: CF 8
8	Hinge	: CF 8
9	Trim	: CF 8
10	Sealing ring	: EPDM
11	Free open pressure	: < 0.2 bar g
12	Spring	: SS 316
13	Service	: Compressed Air, Ultra High Pure Nitrogen and Argon
14	Vacuum	: Na
15	Studs & nuts	: SS 304
16	Maximum temperature	: 150 °c
17	Minimum temperature	: -20 °c
18	Maximum pressure	: 10.5 bar g
19	Minimum pressure	: *
20	Make	: *
21	Hydro test pressure	:
22	Body	: 30 bar g
23	Seat	: 23 bar g
24	Location	: Pressure line
25	Size	: As per BOQ
26	OTHERS	: Valve to be epoxy painted

GUARANTEE:

The contractor shall guarantee that the materials and workmanship of the entire system are of the first-class quality. All the equipment's / apparatus shall be guaranteed to yield the specified ratings of discharge and quality. Any defective equipment / material / workmanship found short of the specified quality shall be rejected. Guarantee certificate of equipment's from suppliers / manufacturers shall be handed over to the client.

DEFECTS AND LIABILITY:

All the equipment's / materials and the system shall be guaranteed against defective material and workmanship for a period of 12 months from the date of commissioning to the Owners along with all relevant documentation. The contractor shall repair, rectify, and replace all the defective materials, components free of cost. In addition, normal maintenance shall be carried out periodically during the defects and liability period including replacement of spares, as required.

TESTING:

The entire segment of main, branch header and individual line connection piping will be flushed with Air or Nitrogen gas as specified before pressure testing is carried out. All compressed gases and compressed zero air lines that are connected with double compression joints and weld joints should be flushed with 99.99% pure compressed Nitrogen gas for ½ hrs. For all the compressed air lines, that are connected with double compression joints and weld joints should be flushed with compressed air as the media and should be flushed for ½ hrs.

While flushing keep open all the taps. By doing these the entire lengths of tubing will be flushed and will be clean with dust particles. While carrying-out the flushing operation pressure regulators, diaphragm valves etc. which are inline should be removed / bypassed.

The flushing has to be done in pressurized condition. During flushing intermittent valve opening and closing has to be done at all the final termination points.

After through flushing, the entire segment of main header, branch header and individual line connection piping will be pneumatically tested. At least 1.5 times the working pressure. (for e.g., 10 bar AWP, 15 bar ATP). The line will be considered free of leakage only if the Pressure does not drop over a period of 24 hrs. With line locked by specific testing gas as mentioned under:

For Nitrogen Helium gas, Spare gas-1 and Spare gas-2. and other inert gases the end connections will be double compression ferrule or threaded (NPT / BSP-P) type fittings.

All the butt weld joints will be carried out by means of Orbital weld technique (Automatic TIG welding with Argon 99.999% as inert gas).

Supply of compressed air / Zero air / nitrogen / other gases required for testing and commissioning shall be in the scope of this tender and the same will not be provided by Client / PMC. No payment shall be made to contractor on this account.

INSTRUCTION MANUAL / COMPLETION DRAWINGS / TRAINING:

The contractor shall furnish detailed instruction and operation manual of the system. The contractor shall also furnish detailed completion drawings inclusive of control schematics. The contractor shall train the client in the operation and maintenance of the system.

CODES & STANDARDS FOR GAS TUBING WORKS:

All piping works covered under this specification shall comply with currently applicable statutes, regulations and safety codes. They shall comply in all respects with the requirements of the latest editions of the codes and standards. In case of conflict between codes and standards referred to in this

specification or documents enclosed with specification.

For the design of the utility systems various international standards and codes, as applicable, will be used. Below mentioned gives the list as applicable:

- American Society for Testing and Materials (ASTM)
- A269 Seamless and Welded Austenitic Stainless-Steel Tubing for General Service TP 316
- A370 Standard Methods and Definitions for Mechanical Testing of Steel Products
- A632 Seamless and Welded Austenitic Stainless-Steel Tubing (Small Diameter) for General Service
- A-262 Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
- ASME B31.8 Clause 841.126 Gas Safety Code
- ASME G93 level C OXY Cleaning
- IS-2379: 1990 (R2006), (R2007-05) Pipe Colour Code
- American National Standards Institute (ANSI)
- B31.1 Code for Pressure Piping, Chemical Plant and Petroleum Refinery Piping
- B31.3 Process Piping
- Section IX Welding Qualification
- Welding Procedure/Qualification: ASME B 31.3/31.8, ASME Sec IX & IS: 817
- ASME Sec IX & IS: 814: Material Specifications, Welding rods, Electrodes & filler wire etc.
- ANSI-B-16.5: Pipe Flanges & Flanged Fittings:
- ASME/ANSI-B-16.10: Face-to-Face & End-to-End Dimensions of Valves
- ANSI-B-18.2.1: Square & Hex Bolts & Screw.
- ANSI-B-18.2: Stud & Nuts.
- IS: 2825 – 1969: Code of unfired pressure vessel.
- IS: 4682 – 1974: Code of Practice for lining of vessels
- Vessels - 4.5 mm thick (3 x 1.5)
- Piping - 3.0mm thick (2 x (1.5) shore hardness 65 + 5A.
- IS: 6392 – 1971: Steel pipe flanges. ASME: B 16.5- 1988
- IS: 1363 - 1992: Hexagon head bolts, (Part - 1 to 3) screws and nuts of product Grade-C
- IS: 1364 - 1983: Hexagon head bolts, screws, and nuts of product Grade A & B.
- IS: 5822 – 1994: Code of practice for laying of electrically welded steel pipes for water supply.
- IS: 10221 – 1982: Code of practice for coating and wrapping of underground M.S. pipelines.
- IS: 554 – 1985: Dimensions for pipe threads.
- IS: 778 – 1984: Specification for copper alloy gate, globe and check valves for water works purpose.
- IS: 780 – 1984: Specification for sluice valves for water works purpose.
- IS: 781 – 1984: Specification for cast copper alloy screw down bid taps and stop valves for water services.
- IS: 5312: Specification for (Part-1 & 2) 1984/86 swing check reflux valves - single/multi door pattern.
- API – 594: Check valves: wafer, wafer-lug, and double flanged type.
- IS: 13095 - 1991: Butterfly valves for general purpose.
- IS: 1703 – 2000: Specification for copper alloy float valves for water supply fittings.
- IS: 9890 - 1981: General purpose ball valves.
- IS: 5290 - 1993: Specification for landing valves.
- IS: 2712 - 1998: Compressed asbestos fiber jointing.
- IS: 7318 - 1974: Approval tests for welders (Part-1) when welding procedure is not required.
- IS: 7307 - 1974: Approval tests for welding procedures.
- IS: 814 – 1991: Covered electrodes for manual metal arc welding.
- IS: 816 – 1969: Code of practice for use of metal arc welding for general construction in M.S.

- IS: 7810 – 1999: Approval test for welders working to approved welding procedures.
- IS: 5 – 1994: Colors for ready mixed paints and enamels.
- IS: 2379 – 1990: Colour code for identification of pipelines.
- IS: 800 – 1984: Code of practice for general construction in steel.
- IS: 7215 – 1974: Tolerance for fabrication of steel structure
- IS: 456 – 2000: Code of practice for reinforced concrete.

TECHNICAL SPECIFICATIONS FOR GAS LEAK DETECTION SYSTEM, GAS BANK CHANGEOVER MONITORING DDC PANEL AND ANNUNCIATOR PANEL:

1. GAS LEAK DETECTION SYSTEM TECHNICAL SPECIFICATIONS:

a) Gas Detector

- The LEL Gas Detector to be compatible with BMS. The enclosure of the instrument shall be non-corrosive high strength, which prevents spark generation.
- Information brochure / literature of the LEL Gas Detector to be provided along with the offer.
- The LEL Gas Detector shall have option for using English Language in display.

b) Display

- The instrument shall have an illuminated LCD / LED Display.
- The instrument shall have provision for illuminated liquid crystal display / LED Light integral part of the instrument with back light is automatic with alarms & for viewing in dark.

c) Sensors

- Detector shall be Electrochemical based type suitable for Oxygen Depletion detection.
- Plug-in sensor for easy and quick maintenance.
- Detector shall be calibrated on Methane gas (CH₄).

d) Measurement range

1. The Gas Detector shall be capable of the following minimum measurement.

Natural Gas 0% to 100% of LEL with a resolution of 1% of LEL

Response time: Maximum 10 secs, with Electrochemical based type detector.

2. Accuracy

Combustible (±) 2% LEL for 0-50% LEL & (±) 3% LEL for 50-100% LEL

e) External condition, Humidity and Temperature

- The Gas Detector shall be capable of working in the 15% to 95% of Relative Humidity typical or more / wider range.
- The Gas Detector shall be capable of working in minimum temperature range -20°C to +60°C.
- Equipment must be IP66 certified for dust and water ingress.
- Equipment should have Radio Frequency Interference protection duly certified. Certificate of the same to be submitted.
- The instrument shall have an in-built facility with wire or wireless for continuous data logging for minimum for all the sensors, one month, 24 X 7, at one minute interval. Necessary software for the purpose of provided to be provided at the cost of the contractor supply. Data Logging

Facility shall have facility of data transfer to PC through connecting port and software shall be compatible for Windows 8.

- Weatherproof as per IP66 or better for dust and water ingress.
- Resistance to EMI/RFI and shall comply with EMC Directive 2004/108/EC. Certificate for the same need to be submitted along with the supply.

f) Power Supply

- The equipment should be provided with rechargeable Lithium ion or Nickel cadmium battery with battery charger working on 220-240 V AC supply.
- With full charge of the battery, the instrument shall have battery backup at least 10 hours under non alarm condition with pump in on condition.
- Charger shall have the facility to indicate whether the equipment is charging or not.

g) Sampling

- Auto-Suction integral pump.
- Pump should be operated by the same battery of the main equipment or separate battery. However, complete instrument shall be compact and one unit only. Whole equipment shall be charged at a time in single cradle & charger.
- The remote sampling should be able to draw the sample from min 20 feet.
- Supply of sampling probe along with suitable tubing adapter.
- Supply of minimum 20 feet length sampling tube to be provided with the instrument.
- The pump must contain a replaceable filter to prevent the ingress of liquids and dust into the instrument.
- The filter must be easily accessible without disassembling the instrument.

h) Safety & Protection

- Party has to provide the authorized Local Distributor certificate from the parent company, in case the meter is imported.
- Equipment, battery, and sensors should be of the manufacturing lot not more than six months older from the date of supply.
- The Gas Detector shall have rugged protective housing of IP – 66 (water and dust or equivalent). Body of the detector shall be made suitable covered by rubber or other suitable material to provide proper shock resistance.

i) Attachment & Accessories

- The instrument shall be provided with a rugged protective housing or carry case with shoulder strap having padded cushion of IP – 66 (water and dust or equivalent). Protective housing or carry case should withstand High Impact.
- Calibration cup adaptor with tubing and sample probe.
- Rechargeable battery along with battery charger.
- Tool kit for maintenance, instruction manual and training CD.
- Data Logging Kit, Leads and PC software.
- One spare filter shall be with each instrument.

Calibration

- The Gas Detector shall have calibration system with one-button calibration with auto-zero capability.
- To be calibrated with bottled gas in terms of % LEL. Zero and span adjustment facility should be provided.
- Initially the instrument to be supplied with calibration at the cost of the supplier. Calibration certificate from NABL accredited Laboratory to be provided along with the supply. Calibration certificate of standard / calibration gas used with traceability to National / International standards shall also be provided along with the supply.
- The instrument shall be periodically calibrated by the supplier for the next two years from the date of supply by collecting equipment from the site under two-year service contract for calibration to be quoted separately under SOR. Periodicity for calibration with certification is once in a six months for next two years. Calibration and maintenance of the detectors including necessary replacement of spares, consumables free of cost for one year shall be in scope of supplier.

j) Guarantee/Warranty:

- The instrument to be provided with Guarantee/Warranty for the complete equipment including Sensors & Battery for minimum period of One Years from the date of receipt at site.
- Guarantee/Warranty Certificate to be provided along with the supply.

k) Specifications:

a) Type: -Electrochemical Type Gas Sensor for oxygen.

Make & Model: - To be specified by vendor.

b) Operating Environment:

- Temperature: - Ambient to 60degC
- Humidity: - 5 - 99% RH

c) Range: - 0-100% LEL

d) Accuracy: - +/- 3% FSD

e) Output: - 4-20 mA / RS 485

f) Response time: - ~ 20 sec

g) Housing: -

- Sensor SS 316, IP 66
- Enclosure Certified Explosion proof IIA & IIB.

h) Display LCD/LED indication: - Local & Remote

i) No. of sensor heads: - 1 Nos.

j) Approvals: - Certification: ATEX/IECEX/CSA

l) Gas Monitoring System:

➤ Type: - Micro-Controller Based.

➤ Make & Model no.: - To be specified by vendor.

➤ Input voltage: - 230 V AC, 50 Hz

➤ Configuration: - Based on number of detectors, hooter, valves for Channel system

➤ Signal input: - Standard 4-20mA from Transmitter Equiv. to % LEL

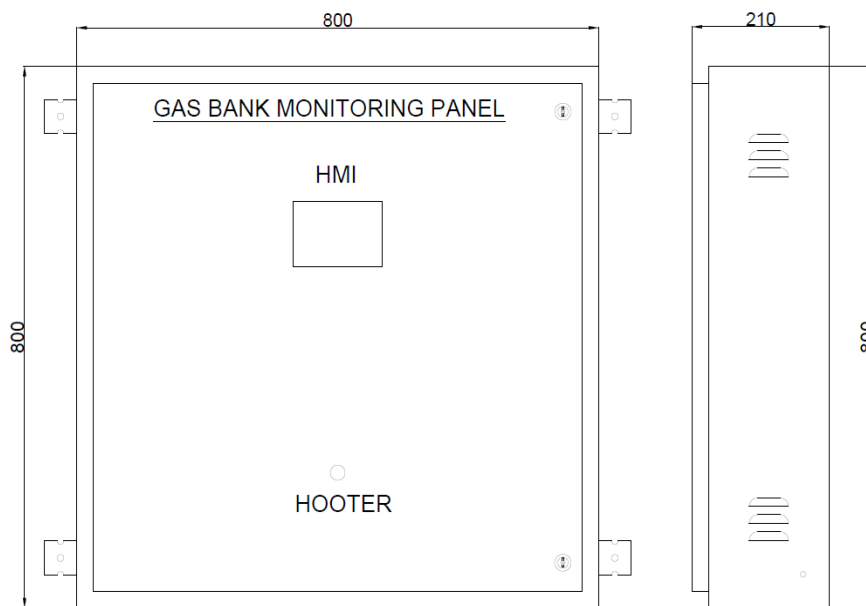
➤ Display: - Intelligent Alphanumeric 16 x 1 Characters LCD Type with Back-lit Facility.

- Display information: - Scrolling CH. No. with % LEL Data.
- Indications: - 4 LEDs per CH. for HEALTHY, WARN, ALARM, FAULT.
- Controls: - ACCEPT, RESET.
- Alarms: - 2 Preset Alarms in % LEL Range for each Channel
 - WARN
 - ALARM
- Audio output: - Built-in Buzzer with 'ACK' Facility.
- Relay output: - One Volt free Relay Contact each for
 - MASTER ALARM
 - FAULT
- Housing: - Weatherproof for Safe Area Installation.
- Mounting: - Wall Mounting Enclosure.
- Accessories: - Cable Glands as required.

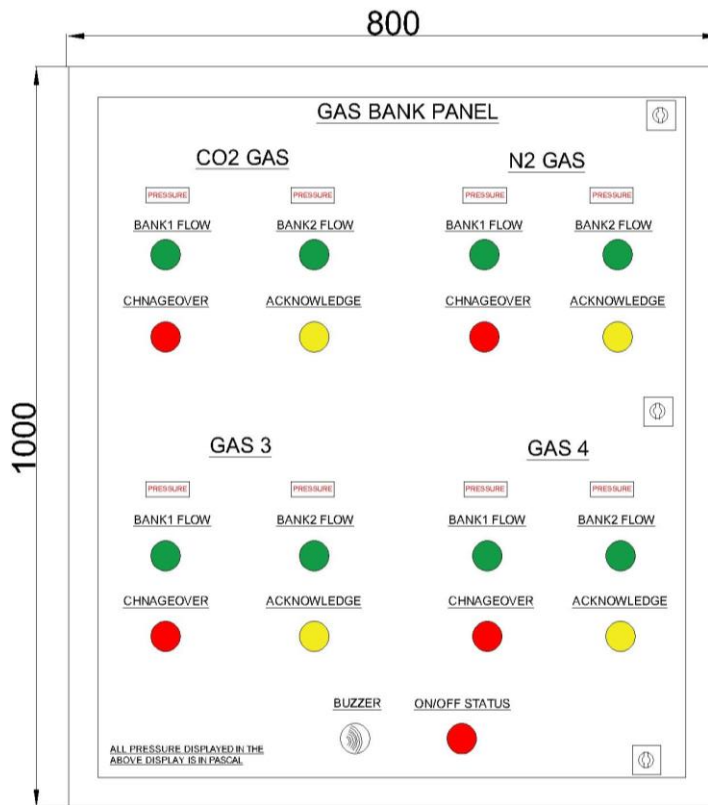
m) Inspection & testing:

- Pre-dispatch inspection shall be carried out at suppliers' place for performance of the system. Manufacturer test certificates shall be furnished at the time of inspection.

2. GAS BANK CHANGEOVER MONITORING DDC PANEL AND ANNUNCIATOR PANEL:



ANNUNCIATOR DISPLAY: Annunciator Display Panel should be complete with Visual Display (LED) for bank changeover and status of each bank (with pressure value displayed), Acknowledgement Switch, Power Supply for visual and audio equipment and Programming and Testing of logic for annunciator function.



ANNUNCIATION PANEL DISPLAY (SAMPLE).

DDC CONTROLLERS: The IP Based direct digital control (DDC) system shall be designed with functions distributed both physically and functionally over the field controllers.

1. DDC controllers shall be capable of fully “stand- alone” operation i.e., in the event of loss of communication with other DDC’s or Control Station, they shall be able to function on their own.
2. The controllers shall consist of minimum single 32-bit microprocessors for reliable throughput, based with EEPROM based operating system (O.S.).
3. DDC controller shall have inbuilt web engine and shall be compatible with TCP/IP communication. Controller providing web access via router/gateway is not acceptable.
4. DDC controller should have onboard graphical user interface.
5. DDC must have facility of data validation locally at controller level.
6. The Controllers shall have proportional control, Proportional plus Integral (PI) Control, Proportional plus Integral plus Derivative (PID) Control, Two Position Control and Time Proportioning Control and algorithms etc., all in its memory and all available for use by the user, i.e., all the control modes shall be software selectable at any time and in any combination. The analog output of Proportional Control, PI Control and PID Control shall continuously be updated and output by the program shall be provided. Between cycles the analog output shall retain its last value. Enhanced integral action in lieu of Derivative function shall not be acceptable.
7. All DDC controllers shall be capable of handling voltage, milli-ampere, resistance, or open and closed contacts inputs in any mix, if required.

Analog inputs/outputs of the following minimum types shall be supported:

- a. 4-20 mA.
 - b. 0-1 volts.
 - c. 0-10 volts.
 - d. 0-5 volts, and
 - e. 2-10 volts.
 - f. Resistance Signals (either PTC or NTC)
 - g. (PT 100, PT 1000, PT 3000, Balco 500, NI 1000)
8. Digital input/output types to be supported shall be, but not limited to the following:
- a. Normally open contacts.
 - b. Normally closed contacts.
9. Controllers requiring fan cooling are not acceptable.
10. The controllers shall be housed in vandal proof boxes to protect them from tampering by any unauthorized personnel. All DDC controllers used in plant room spaces and external application shall be housed IP54/IP66 rating enclosures.
11. The minimum communication should be 100MBPS for each of the controllers.
12. DDC should be forward compatible type so that any expansion or upgrade of the system required in the future is easily taken care off without scrapping / removing / disturbing the existing working system.
13. DDC should allow user to include graphics, if required, however it shall be of static in nature.
14. All DDC Should be capable of sending email to specific user in the event of alarm, identified by end user / consultants.

3. DATA COMMUNICATION

1. Each controller shall have equal rights for data transfer and shall report in its predetermined time slot. There shall be no separate device designated as the communication's master. Those systems using dependent controllers shall be pointed out by the contractor and a dual redundant transmission media with automatic switching and reporting in the event of line faults will have to be provided.
2. The communication network shall be such that:
 - a. Every DDC must be capable of communicating with all DDC's.
 - b. Network connected devices with no messages to transmit shall indicate "No failure" message each cycle. Lack of this message after successive retries shall constitute a communication or device failure.
 - c. Each controller is to be provided with a communication watchdog to assure that the failure is reported to central station.
 - d. Error recovery and communication initialization routines are to be resident in each network connected device.
 - e. The communication protocol shall incorporate CRC (Cyclic Redundancy Check) to detect transmission errors.

3. All the System Integration Units shall be linked together on a Local Area Network.
4. The communication network shall include provision for automatically reconfiguring itself to allow all operational equipment to perform as efficiently as possible in the event of single or multiple failures.

GDS SYSTEM MAKE LIST		
SL.NO	DESCRIPTION	MAKES
1	GAS DETECTORS & HOOTER	Ambetronics / Daegar / Gastron
2	GAS LEAK DETECTION PANEL	Neptune Controls-Bangalore Controler /Equivalent
3	GAS BANK MONITORING DDC PANEL	Neptune Controls-Bangalore Controler /Equivalent
4	PRESSURE TRANSMITTER	Radix / Global Electronics
5	CONDUITS	Bharath / AKG / BEC
6	CABLES	Ravicab / Polycab / Power flex
7	CABLE TRAY.	Profab / Pushpak
8	POWER SOCKETS	Northwest/ Legrand
9	WIRE	Ravicab / Polycab / Power flex

DRAWINGS:

The drawings enclosed herewith are for the general guidance to the Contractor. The contractor shall upon the award of the work, furnish detailed and coordinated shop drawings necessary to carry out the work at site. These shall be submitted to the Consultant & client for approval and the work shall be commenced only after the approval of the drawing by the Consultant & client.

Drawing/Information Required from Successful contractor on award of work:

1. Piping layout, Cross sectional, Isometric drawings, P & ID, MTO.
2. Necessary civil scope drawing for the system.
3. Bar chart showing engineering, manufacturing and dispatch of each equipment and erection services.
4. Drawing, literature, and technical data sheet of all bought out items.
5. Schedule for valves and piping material.

QUALITY PLAN:

The contractor shall furnish the quality plan for site works, Quality plan shall include Fabrication, Installation methods.

For All works, Proper storage of Items, Installation supervision. Quality plan shall be submitted to Client & PMC & approval shall be taken.

11.4 COMPLIANCE:

The bidder shall provide a compliance certificate indicating conformity to the technical specifications (Annexure IV).

Bidder is free to add any information that can help in assessing technical quality of the solutions proposed and which touches upon the parameters/attributes for technical assessment. The information provided in the technical bid will be used for understanding and assessing/evaluating the quality of product (paver blocks) being proposed by the bidder. The bidders are requested to include only the relevant information which is organized in a logically structured form and submitted along with bid document under the heading 'Compliance' with an index.

ABBREVIATIONS:

AHU	Air Handling Unit
BIS	Bureau Of Indian Standards
BMS	Building Management System
BOQ	Bill Of Quantity
CFM	Cubic Feet Per Minute
CFR	Code of Federal Regulation, United States of America
CHW	Chilled Water
CMH	Cubic Meter Per Hour
CNC	Controlled But Not Classified
CRC	Cyclic Redundancy Check
D	Depth
DDC	Direct Digital Controller
EMI	Electromagnetic Interference
EN	European Standards
FAT	Factory Acceptance Test
FF	First Floor
FFL	Finished Floor Level
GF	Ground Floor
H	Height
HDPE	High-Density Polyethylene
HPLC	High Performance Liquid Chromatography
HVAC	Heating, Ventilation and Air Conditioning
I/O	Input / Output
IP	Internet Protocol
IQ	Installation Qualification
IS	Indian Standards
ISI	Indian Standards Institute
ISO	International Organization for Standardization
IT	Information Technology
KW	Kilo Watts
L	Liter
LAF	Laminar Air Flow Unit
LCD	Liquid Cristal Display
LED	Light Emmiting Diode
LEL	Lower Explosive Limit
ML	Milliliter
MOC	Material Of Construction
MS	Mild Steels
N2	Nitrogen
NA	Not Applicable
NBC	National Building Code
NC	Not Controlled

NMT	Not More Than
NTC	Negative Themister Coefficient
OD	Outer Diameter
OQ	Operational Qualification
PC	Personal Computer
PSI	Pounds Per Square Inch
PTC	Positive Themister Coefficient
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
R&D	Research And Development
RA	Return Air
RFI	Radio Frequency Interference
RH	Relative Humidity
SOP	Standard Operating Procedure
SP	Static Pressure
SPD	Surge Protection Device
Sq ft	Square Feet
SQM	Square Meter
SS	Stainless Steel
TCP	Transmission Control Protocol
TOR	Terms of Reference
TR	Tonnes of Refrigeration
UL	Underwriters Laboratories
URS	User Requirement Specifications
W	Width

ANNEXURE-I

**DECLARATION OF LOCAL CONTENT
[For Local Content of Products, Services or Works]**

To,

The Registrar

Indian Institute of Science, Bangalore - 560012

Subject: Declaration of Local Content Tender Reference No:

Name of Tender/Work: Supply, Installation, Testing and Commissioning of Audio-Visual Systems at the IDR Building in IISc, Bangalore

With reference to Order No. P- 45021/2/2017-PP(BE-II) dated 16-09-2020 of DPIIT, Ministry of Commerce and Industry, Govt. of India, we fall under the following category of supplier (please tick the correct category) for the items for which this tender has been floated and being bided.

- Class I local supplier – has local content equal to more than 50% at -----(name of location).
- Class II local supplier – has local content more than 20% but less than 50% at ----- (name of location).
- Non-local supplier – has local content less than or equal to 20% at -----(name of location).

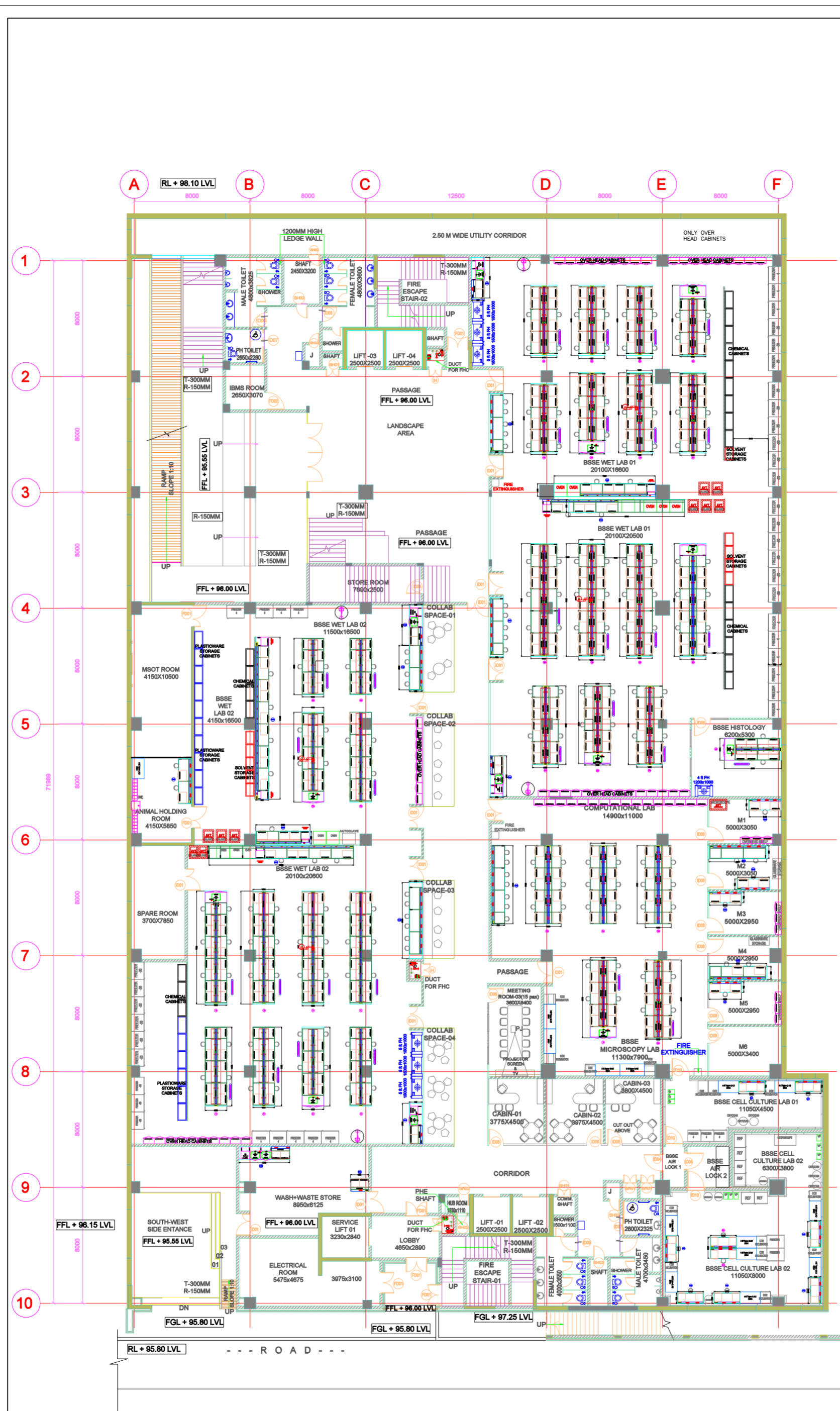
We are solely responsible for the abovementioned declaration in respect of category of supplier. False declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which we may can be debarred for up to 2 years as per Rule 151(iii) of the General Financial Rules along with such other actions as may be permissible under law.

Signature & seal of the company

Name and address of the organization

.....

.....



REVISION		
REV NO	DATE	DESCRIPTION
R0	21.12.2023	INITIAL ISSUE

LEGEND :

	SWIVEL CHAIR WITH BACK REST
	SERVICE DROPPER
	REAGENT SHELF
	ELECTRICAL RACEWAY
	BASE FRAME - C STRUCTURE
	BASE CABINET 750mm (W) x 550mm (D) x 900mm (H)
	BASE CABINET 500mm (W) x 550mm (D) x 900mm (H)
	OVERHEAD CABINET 750mm (W) x 400mm (D) x 700mm (H)

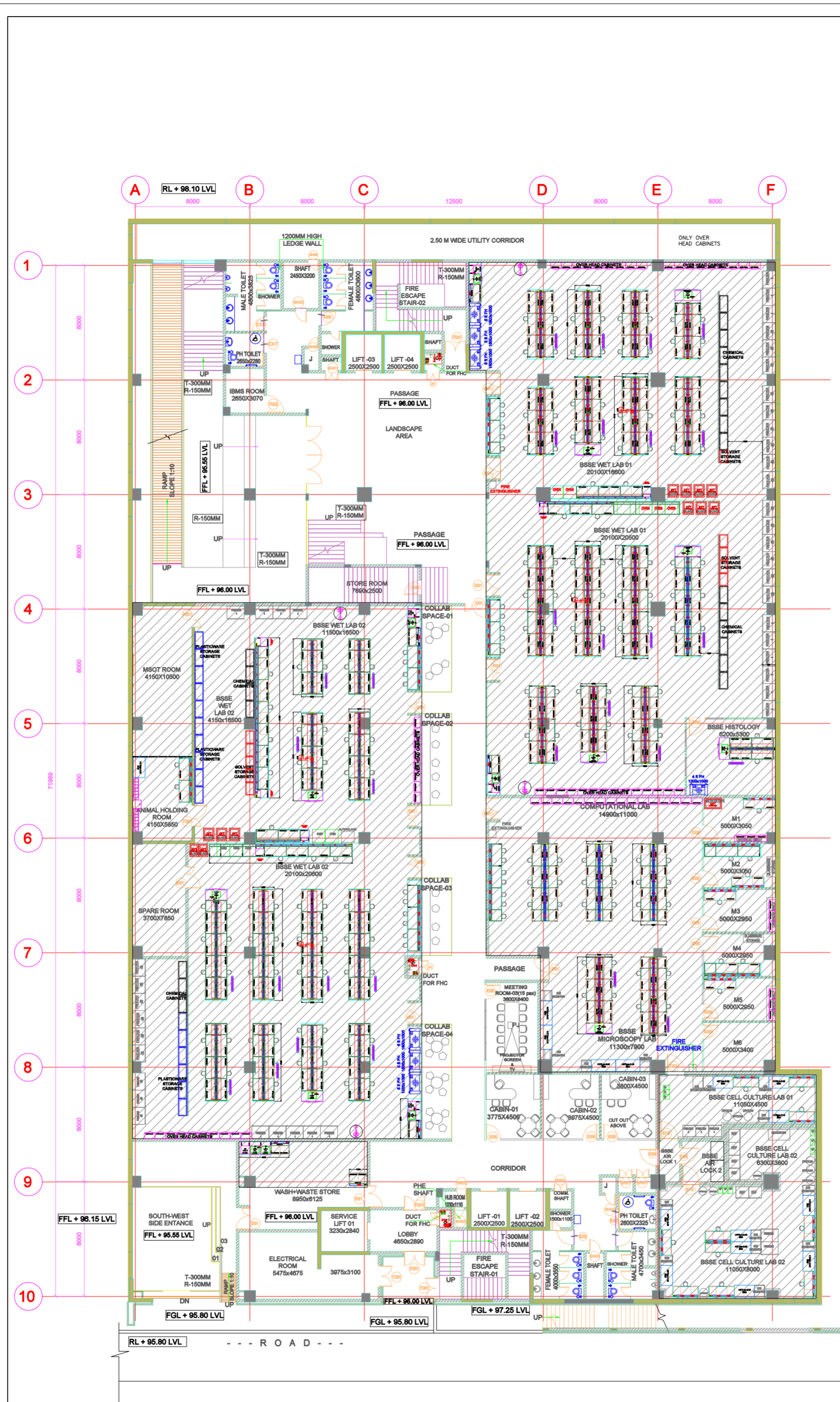
TECHNICAL CONSULTANTS :
MJA PHARMATECH PRIVATE LIMITED
 #45, 1st Floor, 5th Cross, 8th Main Road,
 Vasanthanagar, Bangalore - 560 052.
 Tel: +91-80-2220 4636/222 84583 /41131518

CLIENT:
INDIAN INSTITUTE OF SCIENCE (IISc)
 BANGALORE

PROJECT:
 INTER DISCIPLINARY RESEARCH
 (IDR)/TCS X HUB BUILDING AT IISc

DRAWING TITLE:
 LOWER GROUND FLOOR LAB
 FURNITURE LAYOUT

DATE	05.01.2023	
DRAWN	PRANAV	
CHECKED	SJA	REVISION
APPROVED	SJA	R0
SCALE	NTS	PAGE - A0
PROJECT NO.	CODE	DRAWING NO.
MJ-482	LBF-DDR	3502



REVISION		
REV NO	DATE	DESCRIPTION
R0	21.12.2023	INITIAL ISSUE

TECHNICAL CONSULTANTS :

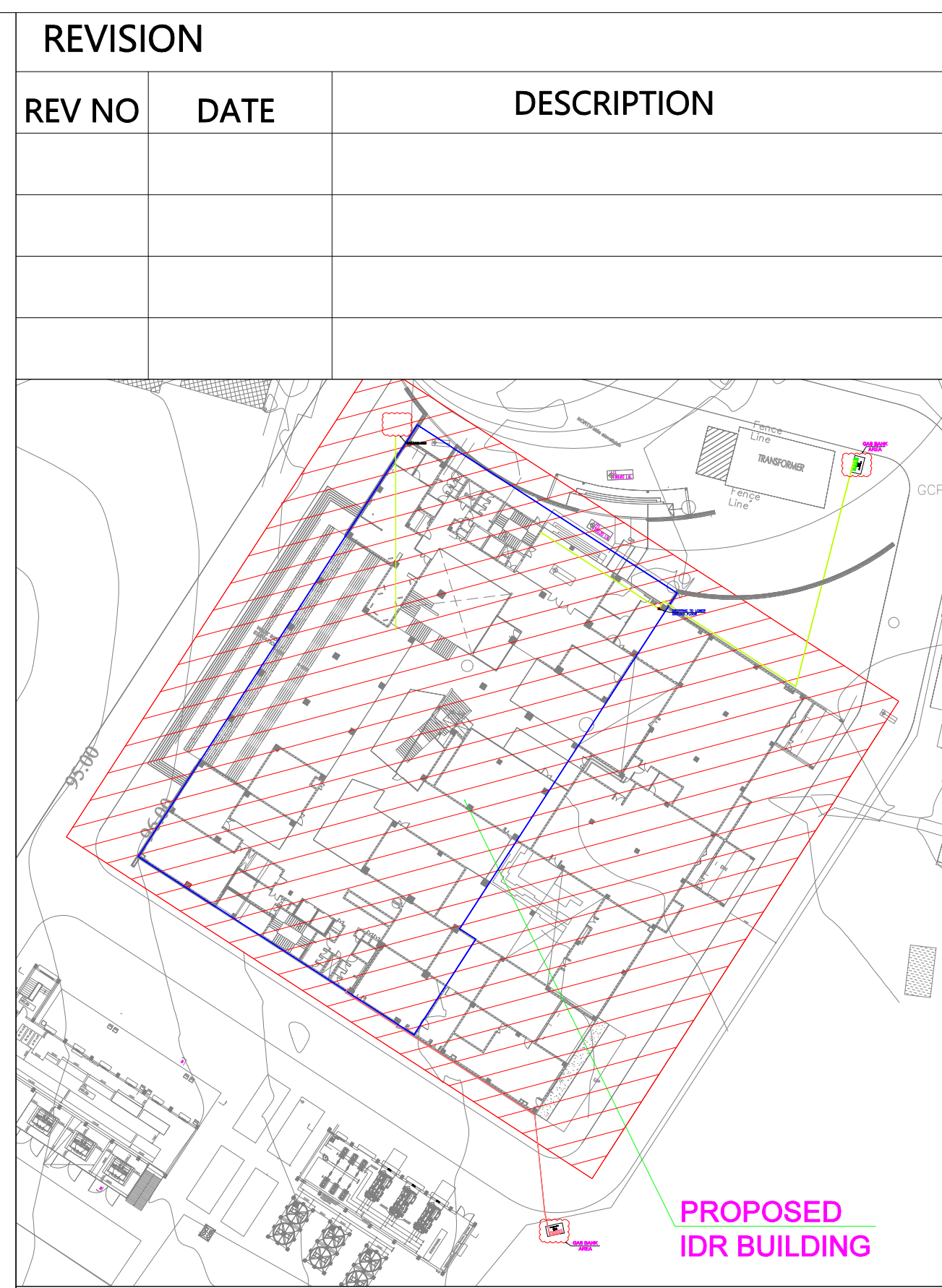
MJA PHARMATECH PRIVATE LIMITED
 #45, 1st Floor, 5th Cross, 8th Main Road,
 Vasanthanagar, Bangalore - 560 052.
 Tel: +91-80-2220 4636/222 84583 /41191518

CLIENT:
INDIAN INSTITUTE OF SCIENCE (IISc)
 BANGALORE

PROJECT:
INTER DISCIPLINARY RESEARCH (IDR)/TCS X HUB BUILDING AT IISc

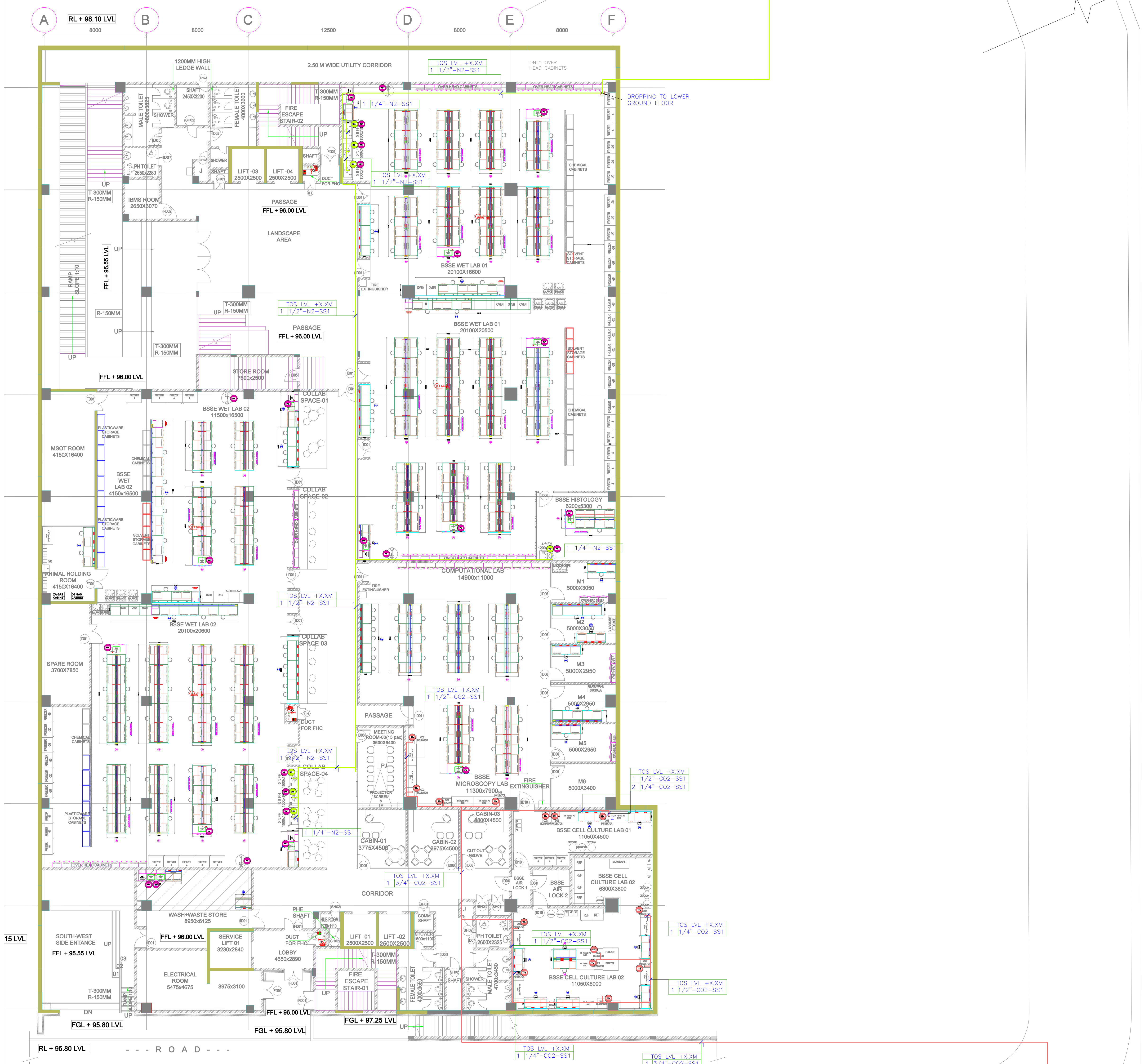
DRAWING TITLE:
LOWER GROUND FLOOR LAB FURNITURE LAYOUT - SCOPE OF WORK

DATE	05.01.2023	
DRAWN	PRANAV	
CHECKED	SJA	REVISION
APPROVED	SJA	R0
SCALE	NTS	PAGE - A0
PROJECT NO.	CODE	DRAWING NO.
MJ-482	LBF-DDR	3501



LEGEND:

1.		POTABLE WATER(PW)
2.		CARBON DIOXIDE(CO2)
3.		NITROGEN(N2)



TECHNICAL CONSULTANTS :

MJA PHARMATECH PRIVATE LIMITED
 #45, 1st Floor, 5th Cross, 8th Main Road,
 Vasanthanagar, Bangalore - 560 052.
 Tel: +91-80-2220 4636/222 84583 /41131518

CLIENT:

INDIAN INSTITUTE OF SCIENCE (IISc)
BANGALORE

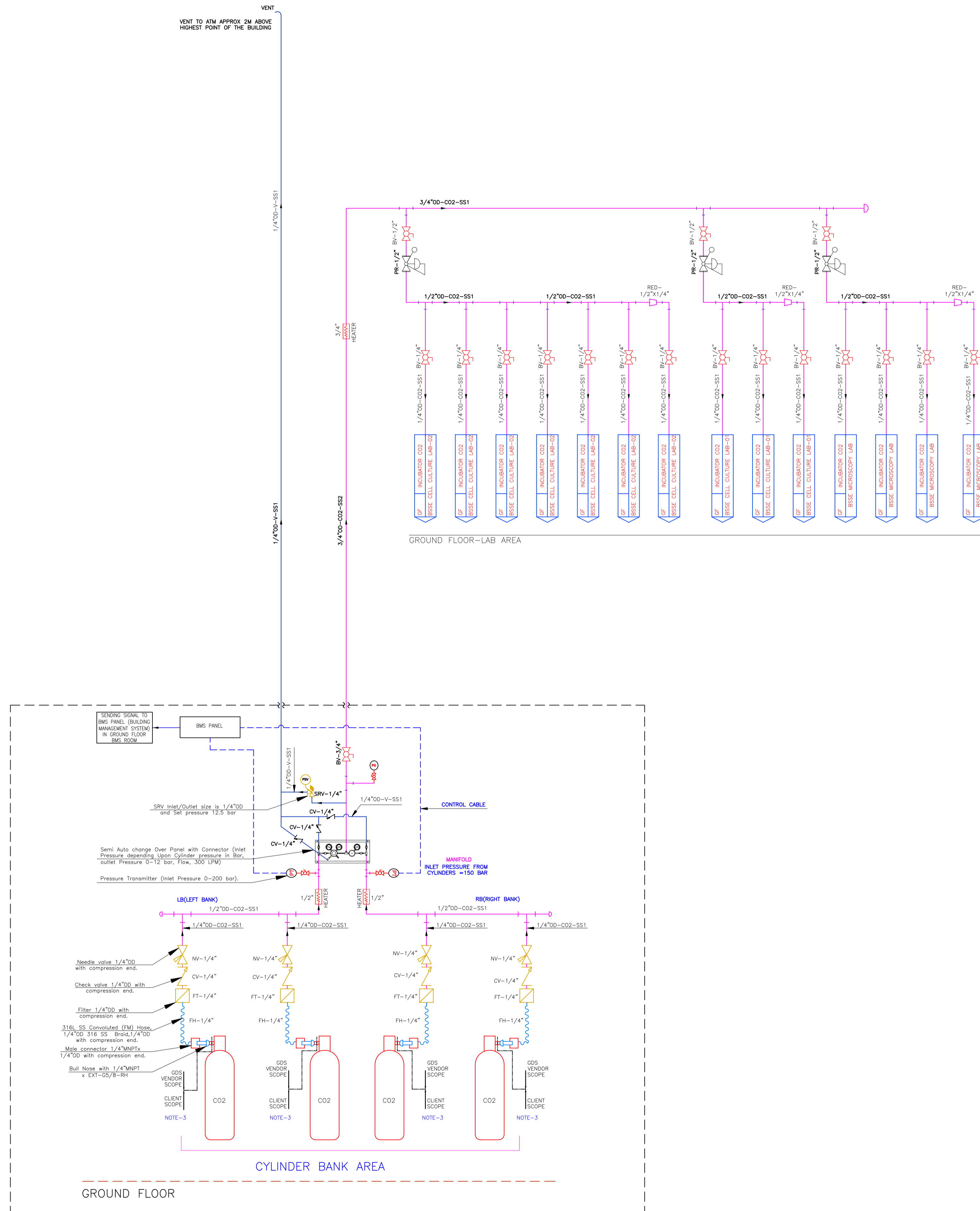
PROJECT :

INTER DISCIPLINARY RESEARCH (IDR)/TCS X HUB BUILDING AT IISc

DRAWING TITLE:

LOWER GROUND FLOOR LAB PIPING LAYOUT

DATE	19.01.2024	
DRAWN	MOTHILAL	
CHECKED	RAGHU	REVISION
APPROVED	DBS	RO
SCALE	NTS	PAGE - A0
PROJECT NO.	CODE	DRAWING NO.
MJ-482	EQPT-PIPE	2801



REVISION		
REV NO	DATE	DESCRIPTION

LEGEND:

CO2	CARBON DI-OXIDE (CO2)
SS1	SS316
	BALL VALVE (BV)
	PRESSURE TRANSMITTER (PT)
	PRESSURE GAUGE (PG)
	PRESSURE REGULATOR (PR)
	CHECK VALVE (CV)
	NEEDLE VALVE (NV)
	SAFETY RELIEF VALVE (SRV)
	REDUCER (RED)
	AIR VENT (AV)
	SS316 FLEXIBLE HOSE
	FILTER
	END CAP
	BULL NOSE (BN)
	CONTROL CABLE

LINE TAGGING:

3/4"OD-CO2-SS1

MOC-SS316
GAS NAME
LINE DESIGNATION
TUBE SIZE

NOTE:

1. CONSIDERED ORBITAL WELDING.
2. USER POINT IS NOT FINALIZED. SHOWN IN THE P&ID IS TENTATIVE LOCATION ONLY.
3. GAS CYLINDER WILL BE SUPPLIED BY OWNER, THE CONNECTION UP TO BULL NOSE AS PER LATEST IS SPEC AND THREADING WILL BE PROVIDED

TECHNICAL CONSULTANTS :

MJA PHARMATECH PRIVATE LIMITED
#45, 1st Floor, 5th Cross, 8th Main Road,
Vasanthanagar, Bangalore - 560 052.
Tel: +91-80-2220 4636/222 84583 /41131518

CLIENT:

INDIAN INSTITUTE OF SCIENCE (IISc)
BANGALORE

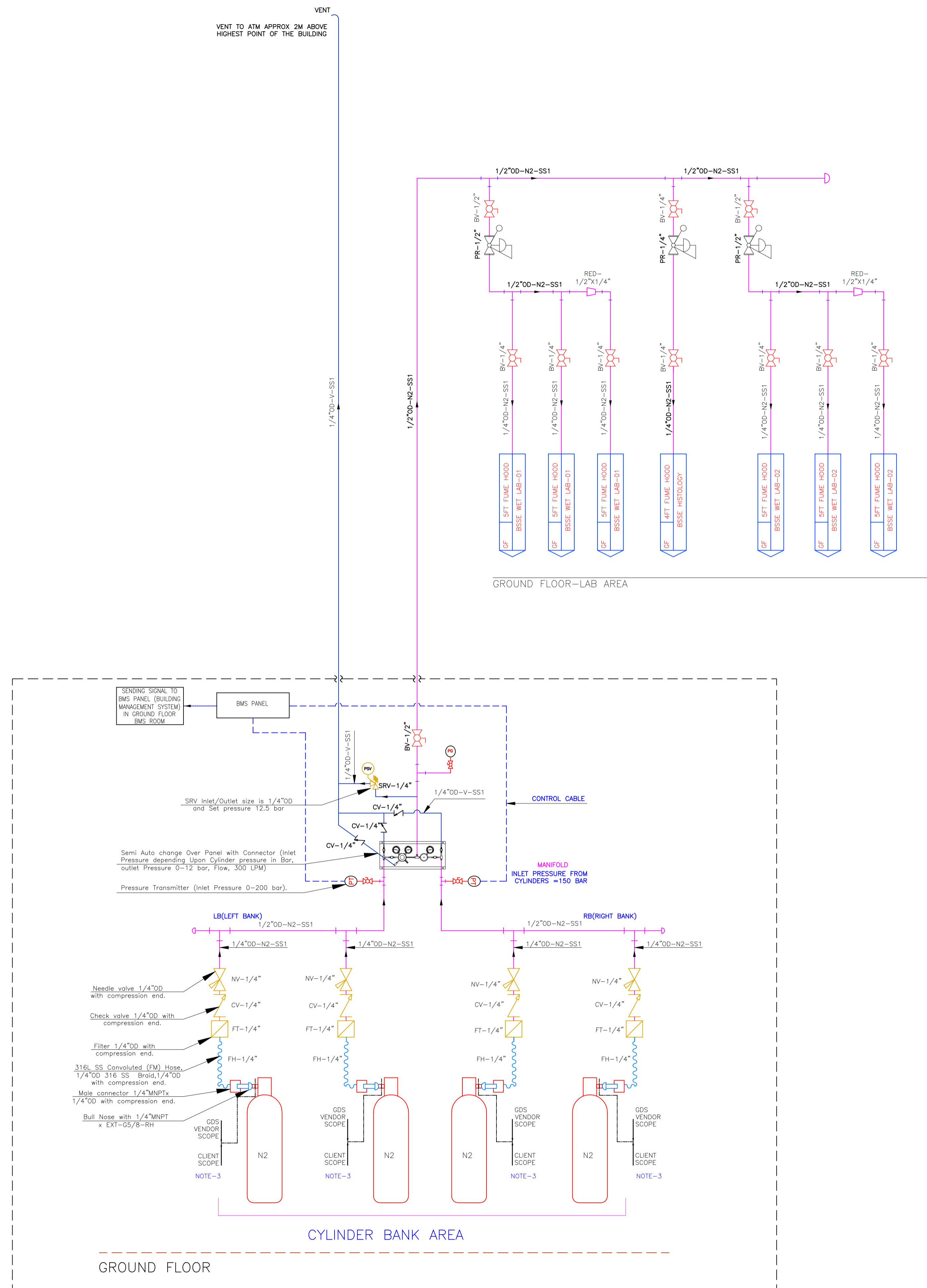
PROJECT :

INTER DISCIPLINARY RESEARCH (IDR)/TCS X HUB BUILDING AT IISc

DRAWING TITLE:

P&ID FOR CARBON DI-OXIDE (CO2)

DATE	19.01.2024	
DRAWN	MOTHILAL	
CHECKED	RAGHU	REVISION
APPROVED	BDS	R0
SCALE	NTS	PAGE - A0
PROJECT NO.	CODE	DRAWING NO.
MJ-482	PIPE-DR	2802



REVISION		
REV NO	DATE	DESCRIPTION

LEGEND:

N2	NITROGEN GAS
SS1	SS316
	BALL VALVE (BV)
	PRESSURE TRANSMITTER (PT)
	PRESSURE GAUGE (PG)
	PRESSURE REGULATOR (PR)
	CHECK VALVE (CV)
	NEEDLE VALVE (NV)
	SAFETY RELIEF VALVE (SRV)
	REDUCER (RED)
	AIR VENT (AV)
	SS316 FLEXIBLE HOSE
	FILTER
	END CAP
	BULL NOSE (BN)
	CONTROL CABLE

LINE TAGGING:

1/2"OD-N2-SS1

MOC-SS316
GAS NAME
LINE DESIGNATION
TUBE SIZE

NOTE:

1. CONSIDERED ORBITAL WELDING.
2. USER POINT IS NOT FINALIZED. SHOWN IN THE P&ID IS TENTATIVE LOCATION ONLY.
3. GAS CYLINDER WILL BE SUPPLIED BY OWNER. THE CONNECTION UP TO BULL NOSE AS PER LATEST IS SPEC AND THREADING WILL BE PROVIDED

TECHNICAL CONSULTANTS :

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CLIENT:

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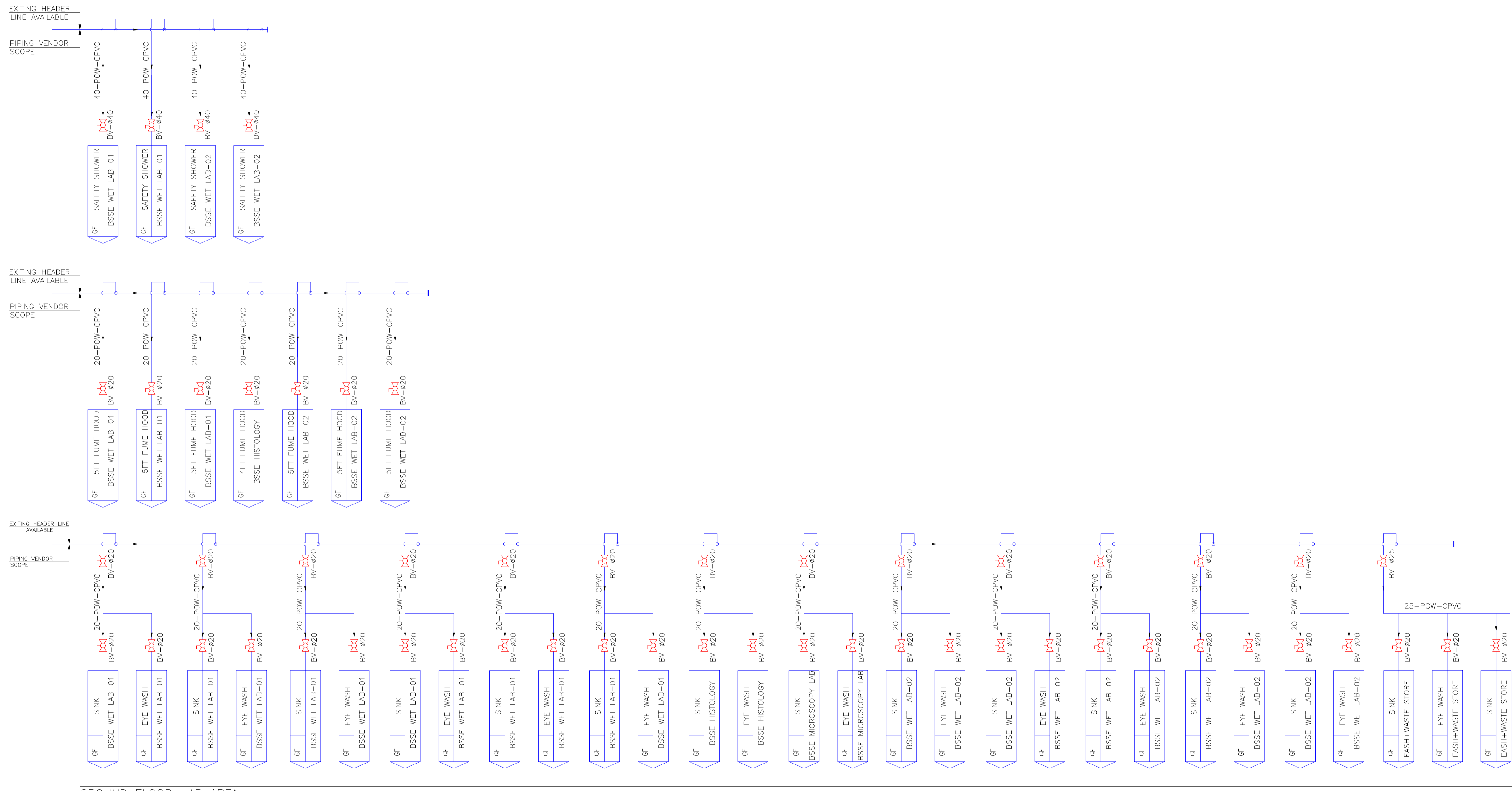
PROJECT :

INTER DISCIPLINARY RESEARCH (IDR)/TCS X HUB BUILDING AT IISc

DRAWING TITLE:

P&ID FOR NITROGEN (N2)

DATE	19.01.2024	
DRAWN	MOTHILAL	
CHECKED	RAGHU	REVISION
APPROVED	DBS	R0
SCALE	NTS	PAGE - A0
PROJECT NO.	CODE	DRAWING NO.
MJ-482	PIPE-DR	2801



GROUND FLOOR-LAB AREA

REVISION		
REV NO	DATE	DESCRIPTION

LEGEND:

POW	POTABLE WATER
CPVC	CHLORINATED POLYVINYL CHLORIDE
	BALL VALVE (FLANGED END)-BVF
	BALL VALVE (SCREWED END)-BVS
AFC/BFC	ABOVE FALSE CEILING/BEFORE FALSE CEILING
	PRESSURE GAUGE

PIPE IDENTIFICATION:

PIPE SIZE(OD-mm) | SERVICE | PIPE MOC

Example: 40-POW-CPVC

VALVE IDENTIFICATION & SPECIFICATION:

VALVE TYPE | END CONNECTION | TAG NO

Example: BV S 01

- BW - BUTTERFLY VALVE
- BV - BALL VALVE
- NRV -NON RETURN VALVE
- CV - CONTROL VALVE
- BLV - BALANCING VALVE
- WT - WAFER TYPE
- ST -STRAINER
- S - SOCKET END
- F - FLANGED END

TYPICAL USER POINT DETAIL:

ROOM NO. EQUIPEMENT NAME
ROOM NAME
FLOW RATE

NPS - NOMINAL PIPE SIZE
DN - DIAMETER NOMINAL
OD - OUTER DIAMETER
PIPE SIZE AS PER
ISO 161-1 - PN 16

TECHNICAL CONSULTANTS :

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CLIENT:

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BANGALORE

PROJECT :

INTER DISCIPLINARY RESEARCH (IDR)/TCS X HUB BUILDING AT IISc

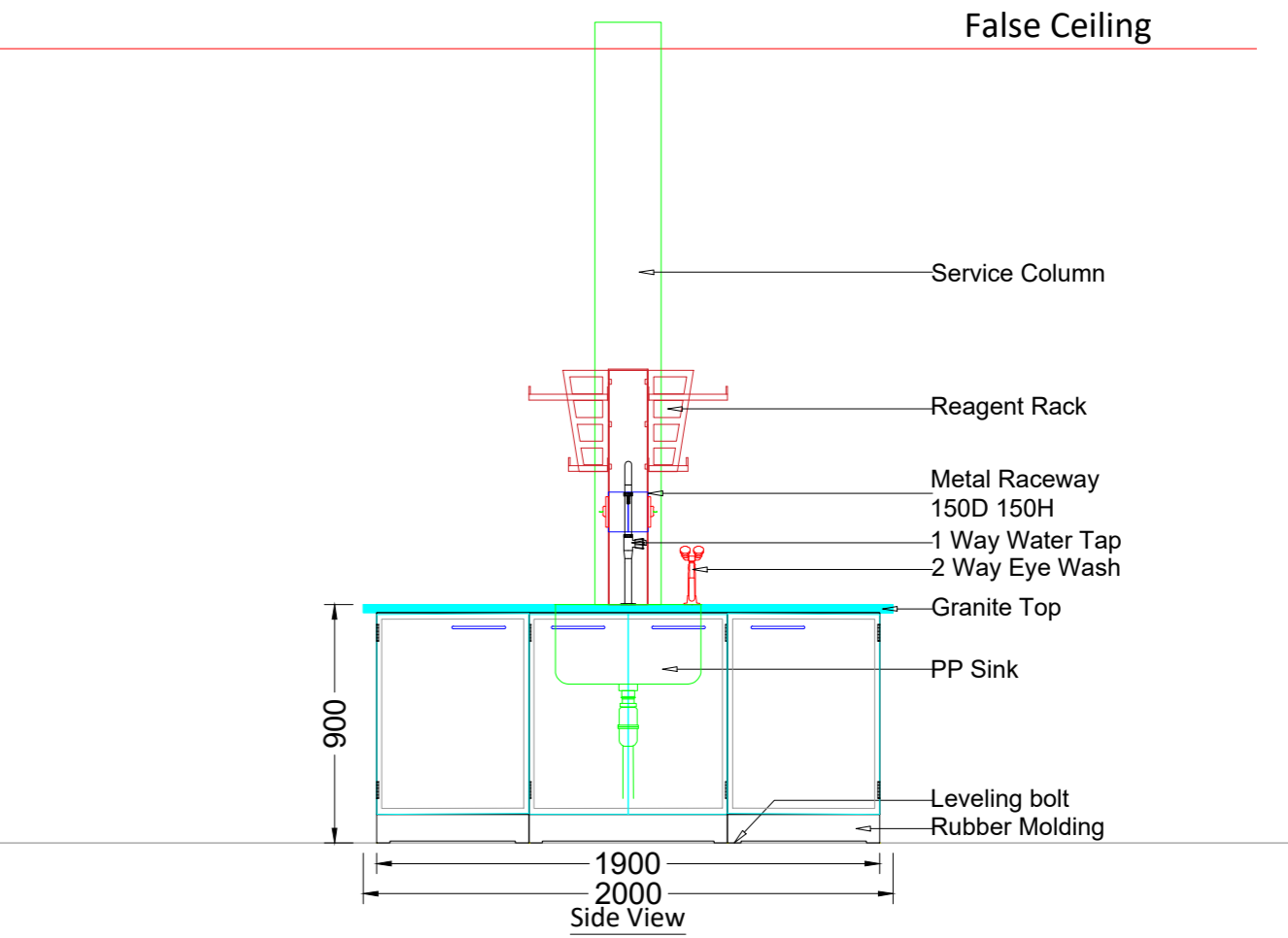
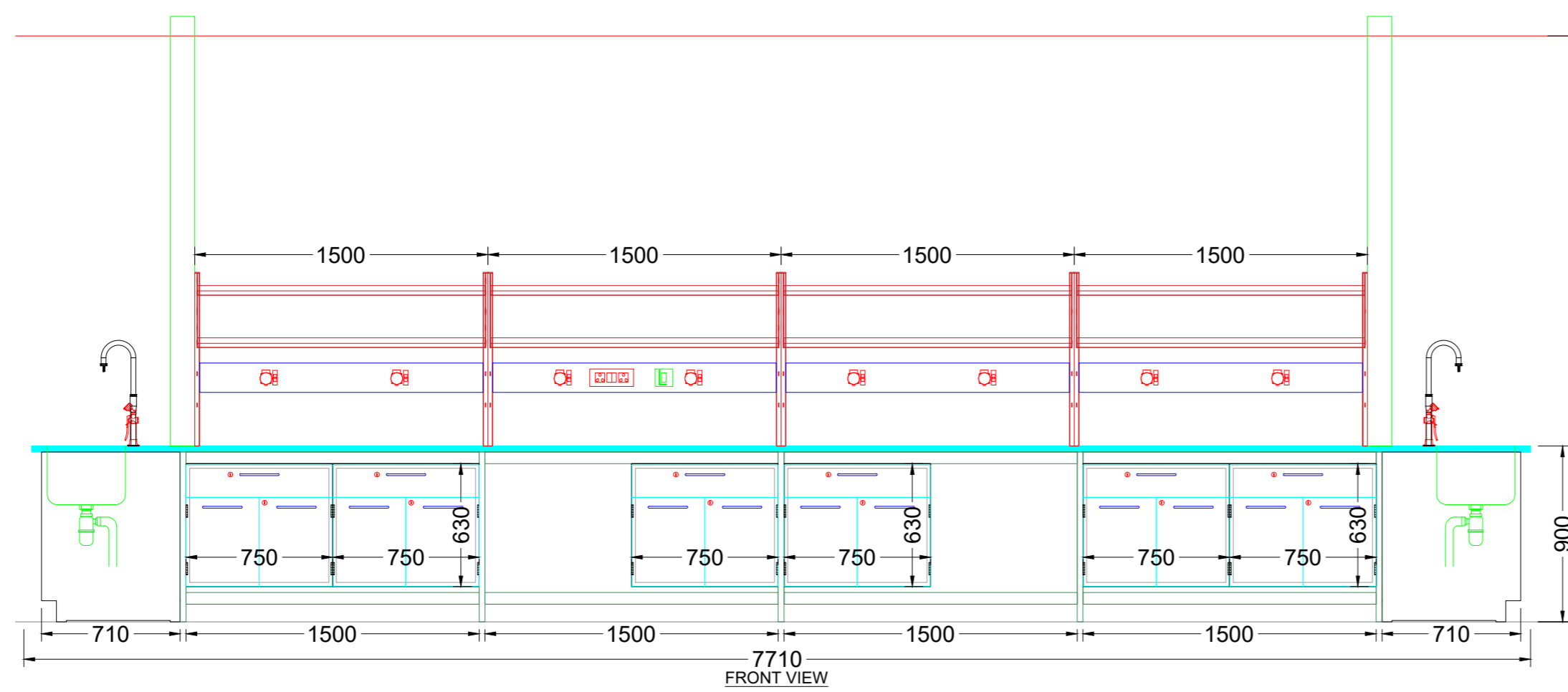
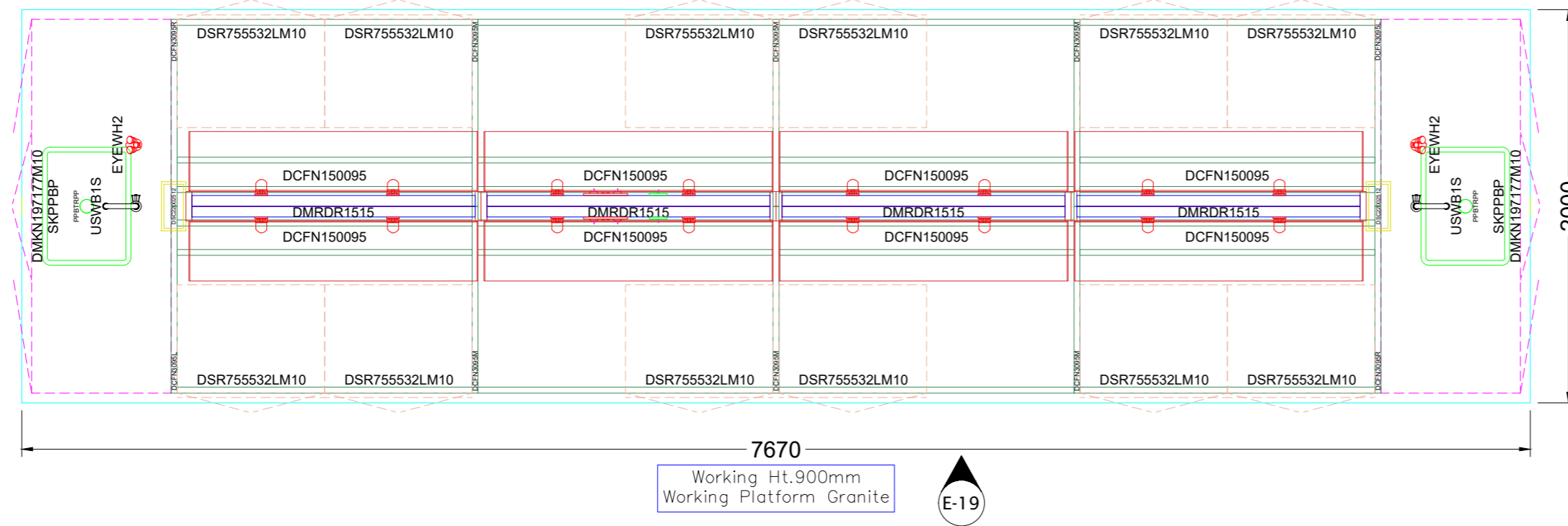
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P&ID FOR POTABLE WATER (POW) DISTRIBUTION

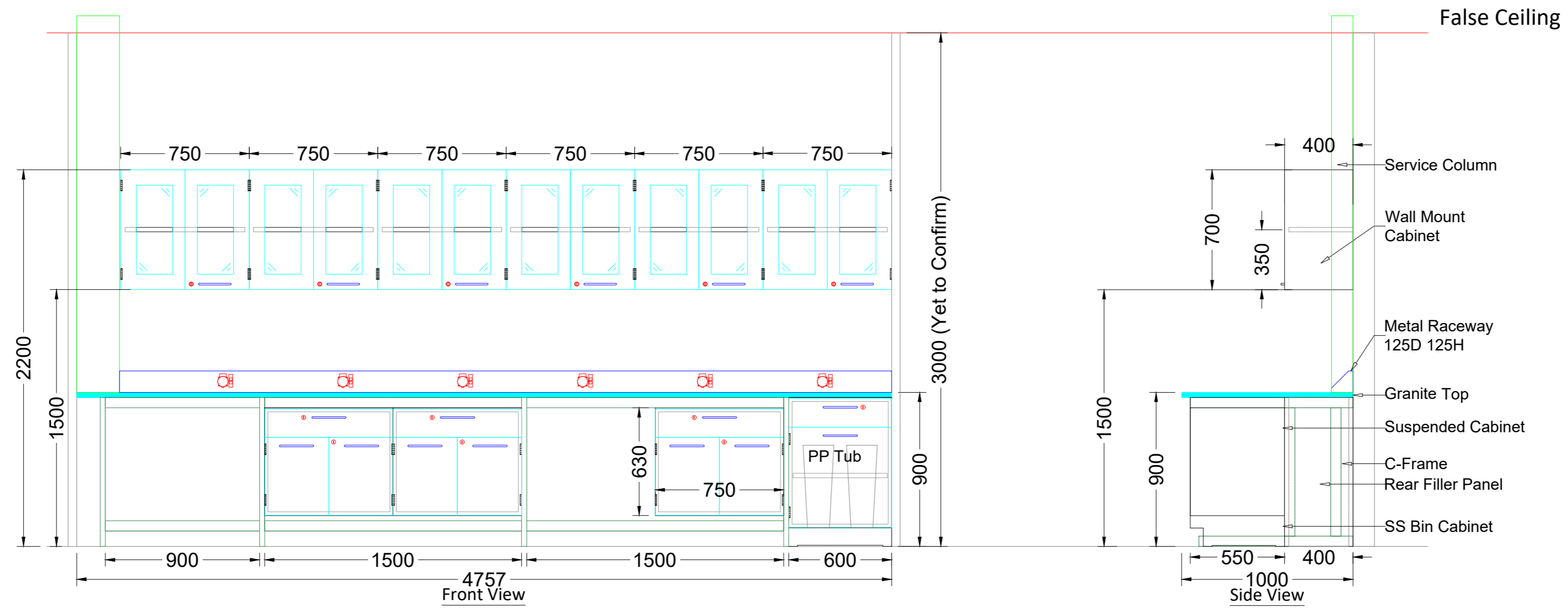
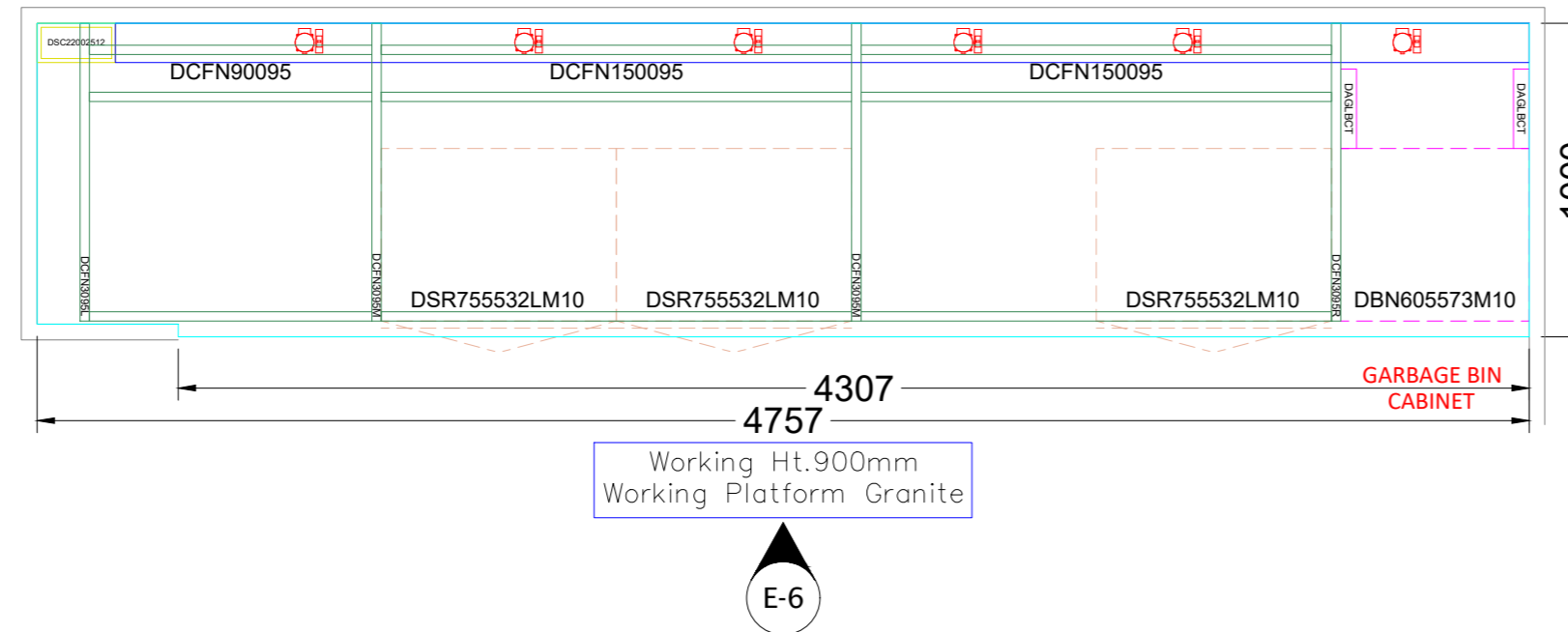
DATE	19.01.2024	
DRAWN	MOTHILAL	
CHECKED	RAGHU	REVISION
APPROVED	DBS	R0
SCALE	NTS	PAGE - A0
PROJECT NO.	CODE	DRAWING NO.
MJ-482	PIPE-DR	2803

C-FRAME ISLAND BENCH

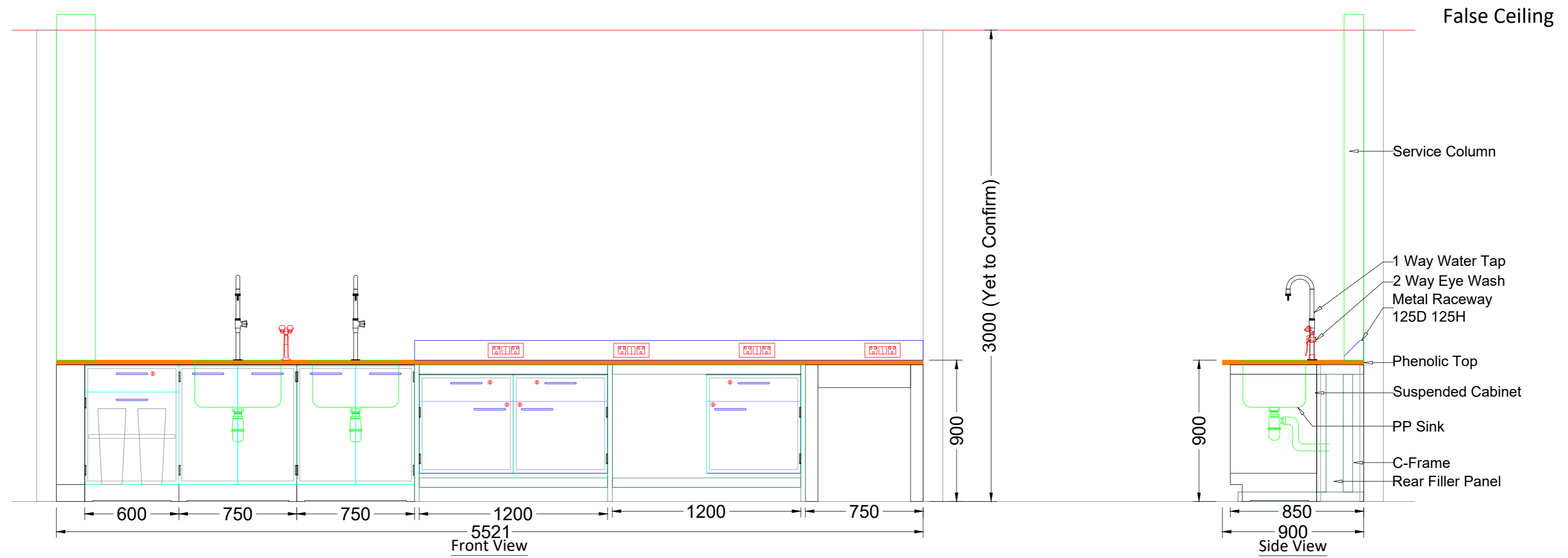
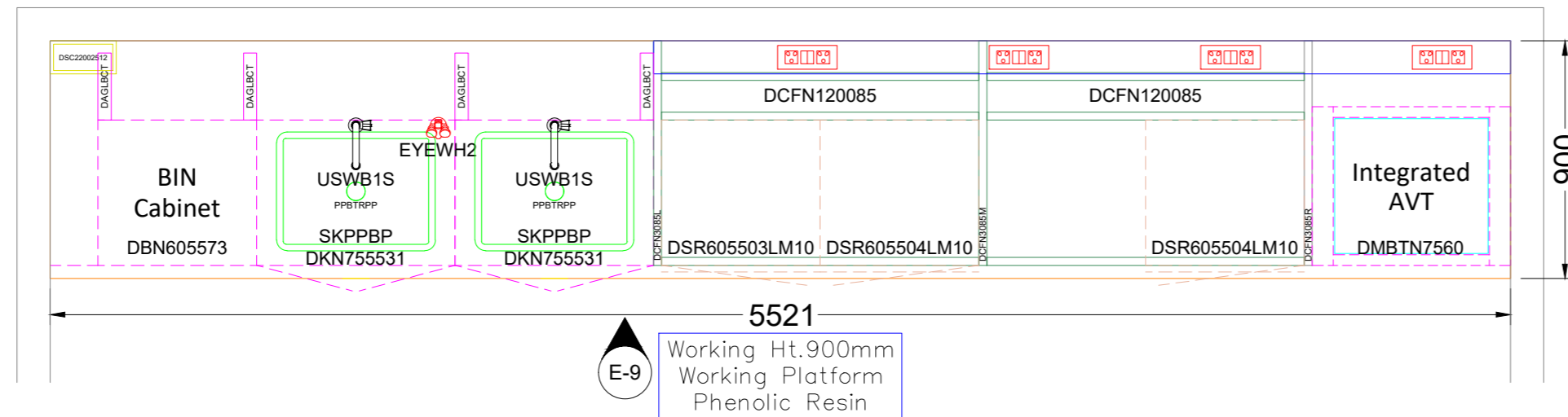
WITH REAGENT RACK



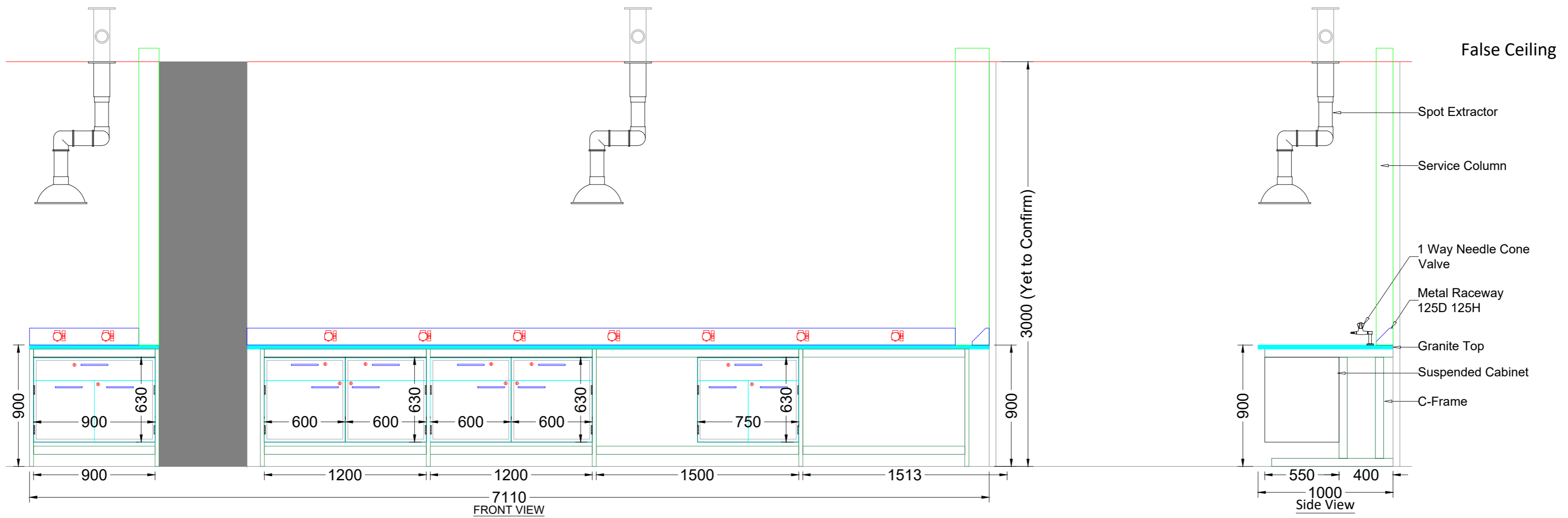
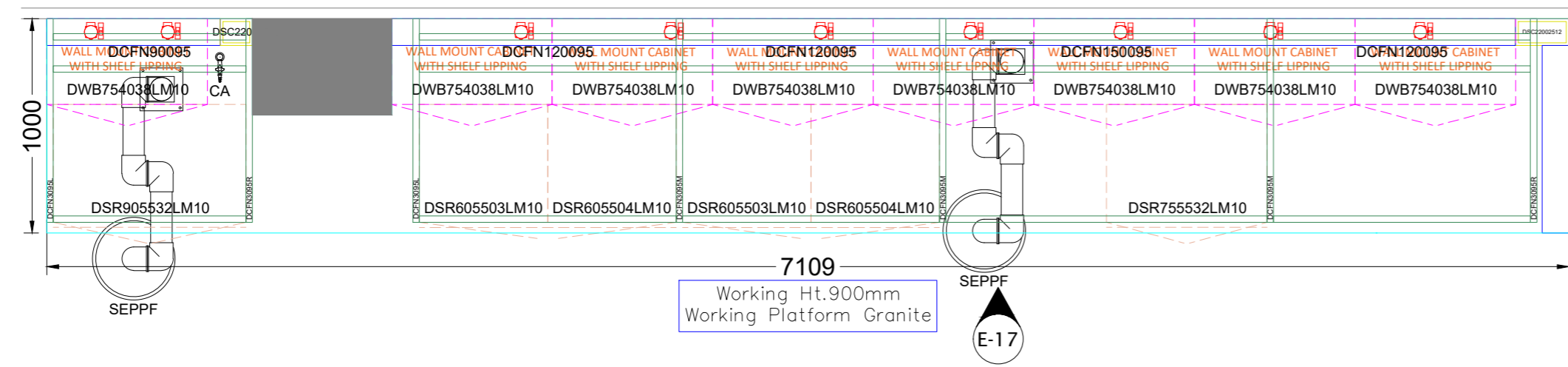
C-FRAME WALL BENCH WITH OVER HEAD CABINETS

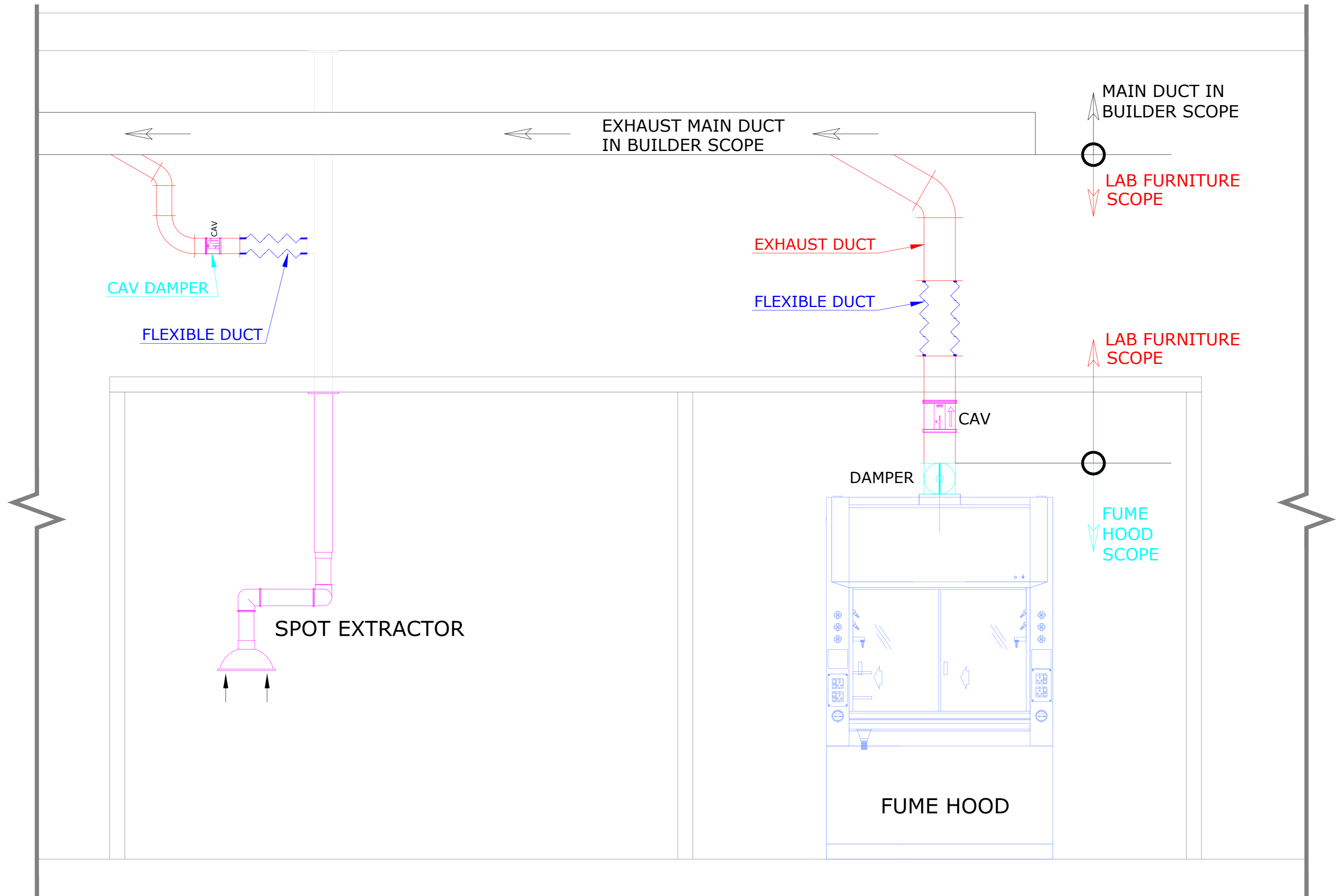


C-FRAME WALL BENCH WITH SINK



C-FRAME WALL BENCH WITH SPOT EXTRACTOR

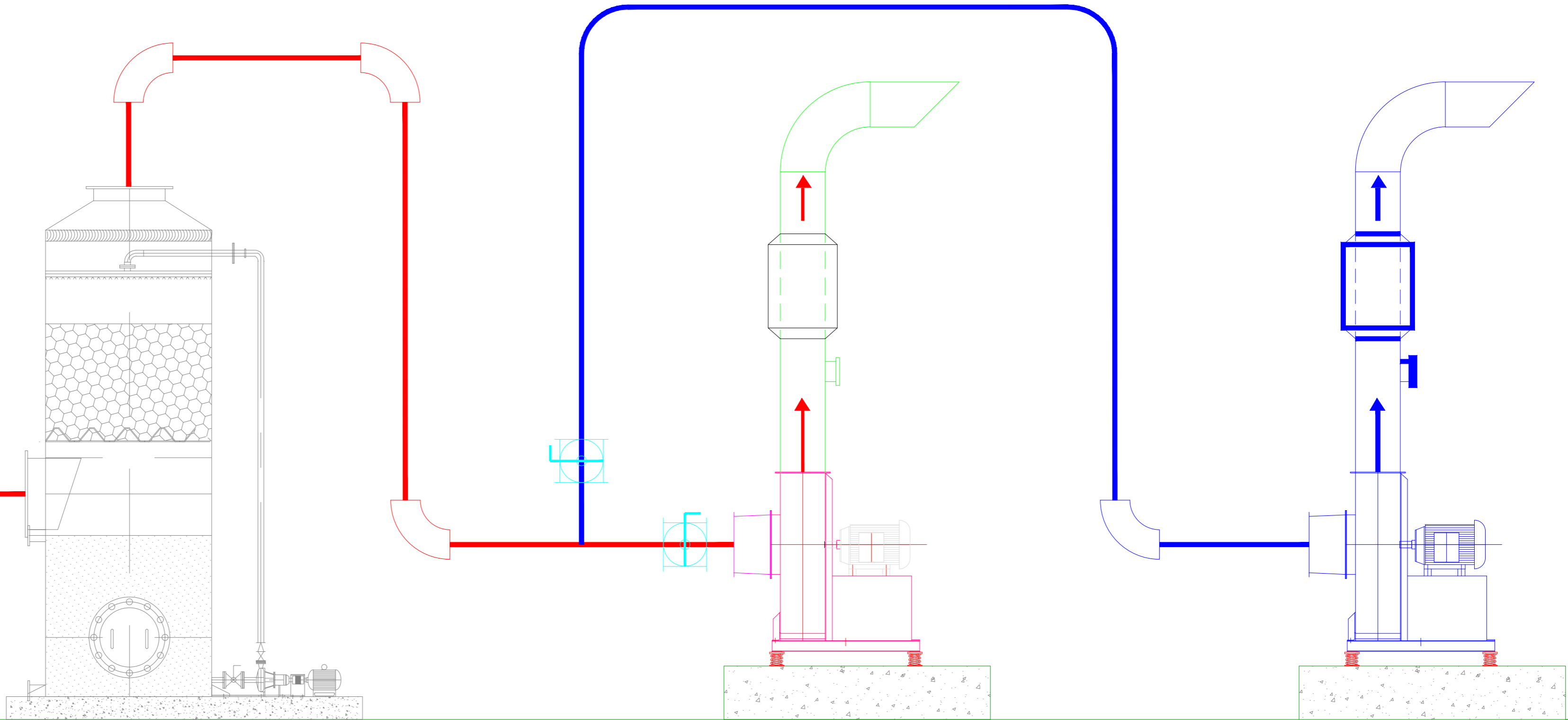




TYPICAL FUME HOOD & SNORKEL CONNECTION DETAILS

TERRACE

EXHAUST AIR





SCRUBBER

EXISTING EXHAUST BLOWER
(ALREADY INSTALLED BY MAIN BUILDER)

EXHAUST BLOWER
(REDUNDANCY)

TYPICAL DETAILS

	EXISTING DUCT
	PROPOSED DUCT