INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
KHARAGPUR, WEST BENGAL 721302

TENDER DOCUMENT

for

DESIGN ,SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF VENTILATION SYSTEM FOR KITCHENS AT PATEL, RK, SN/IG, GOKHEL, SAMS & RLHR HALLS AT IIT KHARAGPUR

NIT No: IITKGP/RAC/HALL/2018-19 DATED 08.11.2018

Tender Serial No. IITKGP/RAC/HALL/2018-19 dated 08.11.2018 Issued to:

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Signature and Seal of Contractor_____

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1. NOTICE INVITING TENDER

1.1 INTRODUCTION

Indian Institute of Technology (IIT) Kharagpur, hereinafter called IITKGP, invites sealed item rate tenders from the eligible contractors for Supply, Installation, Testing & commissioning of Ventilation system for Kitchen at Patel, RK, SNIG, SAMS, Gokhel & RLHR halls. The work comprises of ventilation Work. Particulars of the project are following.

1.2 PARTICULARS

1.2.1 **NIT Number**	**IITKGP/RAC/HALL/2018-19 DATED 08.11.18**
1.2.2 **Name of Work**	SUPPLY,INSTALLATION,TESTING AND COMMISSIONING OF VENTILATION SYSTEM FOR KITCHENS AT PATEL, RK, SN/IG, GOKHEL, SAMS & RLHR HALLS AT IIT KHARAGPUR
1.2.3 **Location of Work**	Patel, SN & IG, Gokhel, Sams, RLHR & RK hall at IIT Kharagpur West Bengal 721302.
1.2.4 **Estimated Cost**(including GST)	₹ 68, 63,622.00/-
1.2.5 **Earnest Money Deposit**	₹ 130,000/-
1.2.6 **Time Limit for Completion**	120 days
1.2.7 **Tender Fee**	₹ 1000/- (Non-refundable)
1.2.8 **Tender Basis and Mode**	BOQ Based Two-Bid System
1.2.9 **Mode of Payment to IITKGP**	NTFS/ RTGS/ Demand Draft / Pay order in favour of IIT Kharagpur payable at Kharagpur.
1.2.10 **Date, Time & Venue of Pre-bid Meeting**	15Nov 2018, 1100hrs, E&M Meeting Room, 1st Fl, Old Bldg, IIT Kharagpur. **Site visit shall be done on 15.11.18 after the pre-bid meeting if required.**
1.2.11 **Closing Date & Time for Receipt of bids**	26Nov 2018 up to 1500hrs
1.2.12 **Date & Time for Opening of Technical Bid**	26Nov 2018 up to 1530hrs
1.2.13 **Date & Time for Opening of Price Bid**	30Nov 2018 up to 1530hrs
1.2.14 **Engineer-in-charge and contact details.**	Mr .Soumitra Banerjee, Engineer Tel: 03222-282724, Email: sbanerjee@adm.iitkgp.ac.in
1.2.15 **Address for tender issue, submission and opening**	Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721320
1.2.16 **Website for full and updated information**	https://eprocure.gov.in/cppp/tendersearch; http://www1.iitkgp.ac.in/topfiles/tenders.php

1.3 ELIGIBILITY CRITERIA

1.3.1 The bidder must be registered in appropriate class of works with Government organization like CPWD/ PWD/ MES or PSUs or those having experience in similar nature of works.

1.3.2 The bidder must have done at least ONE similar work of value of 80% of the estimated cost **or** TWO similar works for projects each of value 60% of the estimated cost **or** THREE similar work for projects each of value 40% of the estimated cost; with Government/ Semi-government/ PSU/ Government Funded Autonomous Organization during last **7 (seven) years** preceding last date of the month of tender submission.

a. The estimated cost is mentioned in Para 1.2.4.

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b. The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to the last date of receipt of applications for tender.

c. Similar works shall mean ***Supply installation testing commissioning of Air conditioning system.***

~~1.3.3 The bidders who do not have requisite credential for the specialized services (*Air conditioning working*), must associate with specialized agencies who have done similar specialized work, in accordance with above qualifying criteria for amounts in proportionate to the respective service's amount in the estimated cost.~~

1.3.4 The bidder or the specialized agency the bidder intends to associate with, must be registered with appropriate government authority as a bonafide business entity and must have GST registration certificate and Permanent Account Number of income tax.

1.3.5 The validity of the registrations and licenses should bevalid as on the date of tender submission.

1.3.6 Average annual turnover of the bidder as per ITCC or profit & loss statementshall not be less than 30% of the estimated cost, not having incurred loss in more than two years, during last 5 years ending 31 Mar 2018.

Superintending Engineer (E&M)

On behalf of the Director, Indian Institute of Technology Kharagpur

Copy to:

1) PIC RAC
2) SE(E&M)
3) SE(Civil)
4) HMC Chairman
5) Engineer (RAC)
6) Executive (RAC)
7) Assistant / Junior Engineer (E&M)
8) Notice Board
9) Office file

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INFORMATION TO BIDDER

2.1 DEFINITIONS

2.1.1 The **Contract** means the documents forming the tender and acceptance thereof and the formal agreement executed between the competent authority on behalf of the Director, IIT Kharagpur and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in- Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.

2.1.2 In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them:

(i) The expression **works** or **work** shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.

(ii) The **Site** shall mean the land/or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

(iii) The **Contractor** shall mean the individual, firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm or company.

(iv) The **Engineer-in-charge** means the Engineer Officer who shall supervise and be in charge of the work and who shall sign the contract on behalf of the Director, IITKGP.

(v) **Market Rate** shall be the rate as decided by the Engineer-in-Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Schedule 'F' to cover, all overheads and profits.

(vi) **Department** means CPWD or any department of Government of India which invitestenders on behalf of Director, IITKGP.

(vii) **Tendered value** means the value of the entire work as stipulated in the letter ofaward.

(viii) **Schedule of Quantities** means Bill of Quantities enclosed with the tender document.

2.2 GENERAL INSTRUCTIONS

2.2.1 Bidding Document can be purchased from the office of Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721320 on any working day between 1000hrs to 1700hrs on payment of bidding fee in the prescribed mode upto 1400hrs, 26Nov 2018.

2.2.2 Bidding documents can also be obtained electronically through websites: https://eprocure.gov.in/cppp/tendersearch; http://www1.iitkgp.ac.in/topfiles/tenders.php. The tender documents issued electronically or otherwise must accompany at the time of submission, the tender fee in the prescribed mode or proof thereof if already paid.

2.2.3 This bid document shall form an integral part of the contract agreement.

2.2.4 The bidder shall visit and inspect the site and obtain all information on his own responsibility and at own cost, which may be necessary for the purpose of quoting and submitting the tender. No excuse or ignorance as to site conditions and local information shall be accepted after awarding of the contract. Access to the site will be granted by the Engineer-in-charge on all working days within working hours.

2.2.5 IITKGP shall not provide any space at site for labour hutments.

2.2.6 All clarifications about the tender shall be sought by bidder on or before pre-bid meeting. The bidders may make suggestions which shall be considered during the Pre Bid Meeting. Intending bidder(s) may also send their queries or suggestion, if any, through e-mail to the Engineer-in-charge on *sbanerjee@adm.iitkgp.ac.in* on or before 15Nov 2018. No queries shall be entertained after notification of replies to noteworthy queries received till the date of pre-bid meeting.

2.2.7 Completion certificate issued by Competent Authority will only be considered as credential. If the Completion certificate issued by Competent Authority does not reflect the type of work, then Final bill / Schedule of Quantity of the qualifying works also to be attached along with the Completion certificates. Certificate from private individuals / organizations for whom such works have been executed shall not be accepted.

2.2.8 The tender document (consisting of specifications, the schedule of quantities of various types of items to be executed, the set of terms and conditions of the contract and other documents / drawings, if any), Corrigenda, Clarifications to Pre-bid queries can be downloaded from the websites: https://eprocure.gov.in/cppp/tendersearch; http://www1.iitkgp.ac.in/topfiles/tenders.php. Corrigenda, if any shall be published only on these websites. The institute shall not be responsible for any delay / difficulties / inaccessibility of downloading facility for any reason whatsoever.

2.2.9 All costs, charges & expenses that may be incurred in connection with the preparation of his tender shall be borne by him and the Institute accepts no liability whatsoever therefore.

2.2.10 Rates quoted by the bidders shall be **inclusive of GST** (Goods and Services Tax - Central, State and Interstate) **and allother taxes applicable** if any. Income Tax / GST will be deducted from the Consultant bill as per prevailing rules.

2.2.11 Exemption to IITKGP against any tax/ duty/ fee/ surcharge/ charge/ cost, if any, found applicable or sought later from IITKGP after award shall be passed on to IITKGP by the contractor without dispute.

2.2.12 IITKGP reserves the right to reject any or all of the bids without assigning any reason.

2.2.13 **Bid Validity:** Bid shall remain valid for 90 days from the date of submission.

2.2.14 **Firm Price: Bidder's quoted Rates/Prices for executing the activities under the Contract shall remain firm till completion of the entire work & shall not attract any escalation under any circumstances whatsoever.**

2.2.15 If any information furnished by the bidder is found as false / fabricated, then his bid will be rejected and treated as cancelled. Even if the such manipulation is detected at any stage after signing of the contract, it would lead to termination of the contract besides forfeiture of Earnest Money Deposit and liabilities towards prosecution. In such cases the bidder will be debarred from participation in future tendering process in IITKGP for next 05 (Five) years.

2.2.16 **Earnest Money Deposit(EMD)**of requisite amount and that in prescribed mode or proof of payment thereof, shall be enclosed with the Technical Bid explained in following section.

2.2.17 **Refund / Conversion of Earnest Money Deposit:** The Earnest Money received shall be refunded to the unsuccessful bidders without any interest upon executing the Contract Agreement by successful bidder.The Earnest Money Deposit of successful bidder shall be retained and converted into part of Security Deposit.

2.2.18 **Forfeiture of Earnest Money Deposit:**Earnest Money Deposit will be forfeited in any of the following cases:

a. The bidder withdraws / modifies his tender during the period of Bid Validity.

b. The bidder, in case of tie between lowest bids, refuse to submit revised offer.

c. The bidder does not accept the correction of arithmetical errors of his tender.

d. The bidder fails to deposit Performance Guarantee and information as per ANNEXURE-III within the stipulated time period before award of the work.

~~2.3.1 SPECIAL INSTRUCTIONS FOR NETWORKING SERVICES WORK~~

~~2.3.2 While submitting the technical bid, the vendor must undertake to ensure continued availability of adequate number of service personnel during the period of supply, installation and throughout the warranty period.~~

~~2.3.3 Technical bid should contain all relevant technical details; printed technical leaflet of models quoted and other details, which may be necessary to ensure that offer is complete in all, respect e.g. technical specification, delivery period, guarantee period, validity, etc.~~

~~2.3.4 At least one Customer satisfaction certificates in the name of the vendors and its sub-vendors from any organization is to be attached with the technical bid.~~

~~2.3.5 Materials such as pipe, bricks, sand, stone chips, cement, paint etc. if required for the installation of the above item and other fixation work will have to be supplied by vendor free of cost~~

2.3 SUBMISSION OF TENDER

2.4.1 The sealed tenders shall be received at the Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721320, up to 1500hrs, 26Nov 2018 or Corrigenda otherwise.

2.4.2 Tenders received after the due date and time shall not be considered.

Tenders shall be submitted in a sealed Master envelope super scribed "**TENDER FOR SUPPLY,INSTALLATION,TESTING AND COMMISSIONING OF VENTILATION SYSTEM FOR KITCHENS AT PATEL, RK, SN/IG, GOKHEL, SAMS & RLHR HALLS AT IIT KHARAGPUR**" with the NIT No**. IITKGP/RAC/HALL/2018-19 DATED 08.11.18**, containing three separate sealed covers, each clearly super scribed as "**Tender Fee and EMD", "Technical Bid"** and **"Financial Bid"**respectively, in the following manner:

2.4.3 **Envelope-1 (EMD)** will consist of:

i) **Tender Fee** for ₹ 500/- (Non-refundable), in the prescribed mode or proof of payment thereof.
ii) **Earnest Money Deposit** of requisite amount, in the prescribed mode or proof of payment thereof.

2.4.4 Tender without payment of Earnest Money Deposit would be summarily rejected.

2.4.5 **Envelope-2 (Technical Bid)** will consist of:

i) Covering letter of the offer signed by firm's authorized signatory.
ii) Documents establishing the identity and authenticity of the bidder/ bidding firm
iii) Self-certified copies of all the documents in support of eligibility of bidder.
iv) Self-certified copies of all the documents in support of eligibility of proposed agencies for specialized services.
v) Technical proposal for specialized services, asked for.
vi) Specific proposal or other documents, considered relevant by the bidderfor the work, if any.
vii) Complete tender document, each page duly signed and stamped by the bidder as acceptance of the conditions, Declaration by Bidder.

2.4.6 **Envelope-3 (Financial Bid)** will consist of the **Financial Bid** all duly filled-in, signed by the bidder or his/her authorized signatory and stamped.

2.4.7 **Applicable for Item Rate Tender:**

a. The rate(s) must be quoted in decimal coinage. Amounts must be quoted in full rupees by ignoring fifty paisa and considering more than fifty paisa as rupee one.

b. In case the lowest tendered amount (worked out on the basis of quoted rate of Individual items) of two or more contractors is same, then such lowest contractors may be asked to submit sealed revised offer quoting rate of each item of the schedule of quantity, but the revised quoted rate of each item of schedule of quantity should not be higher than their respective original rate quoted already at the time of submission of tender. The lowest tender shall be decided on the basis of revised offer.

c. Tender must be submitted with the rates for all the items of work involved and any incomplete tender will not be considered. The items for which the rates are not quoted will be considered as 'Zero' & the agency shall complete that item of work without any claim.

d. If the revised tendered amount (worked out on the basis of quoted rate of individual items) of two or more contractors received in revised offer is again found to be equal, then the lowest tender, among such contractors, shall be decided by draw of lots.

List of items to be furnished by the intending bidder within the period of bid submission:

1. All the details of Demand Draft / Pay Order (banker's name, amount, number and date) against cost of bid document.
2. All the details such as Banker's name, Demand Draft / Pay Order / amount and date of each instrument towards EMD.
3. Certificate of registration for GST with acknowledgement of up to date filed return.
4. Attested copies of certificates of work experience (Completion Certificate).
5. Bank solvency certificate, if applicable.
6. Certificate of financial turnover and profit and loss statement from CA for last five financial year.
7. Any other document as specified in the tender notice.
8. Deviation / departure from specification if any.
9. Affidavit that similar work has not been executed through any other contractor on back to back.
10. Profile of Internal Energy Auditor to be submitted alongwith Technical Bid.
11. Tentative Project Schedule in MS project or primavera adhering tender timeline.
12. No Deviation Certificate

~~2.4.8 Applicable for Percentage Rate Tender:~~

~~a. Bidder shall fill up the usual tender form, stating at what percentage below/above (in figures as well as in words) the total estimated cost given in Schedule of Quantities, he will be willing to execute the work.~~

~~b. The tender submitted shall be treated as invalid if the contractor does not quote percentage above/below on the total amount of tender or any section/sub-head of the tender; or, the percentage above/below is not quoted in figures & words both on the total amount of tender or any section/sub head of the tender.~~

~~c. In case the lowest tendered amount (estimated cost + amount worked on the basis of percentage above/below) of two or more contractors is same, such lowest contractors will be asked to submit sealed revised offer in the form of letter mentioning percentage above/ below on estimated cost of tender including all sub sections/sub heads as the case may be, but the revised percentage quoted above/below on tendered cost or on each sub section/ sub head should not be higher than the percentage quoted at the time of submission of tender. The lowest tender shall be decided on the basis of revised offers.~~

~~d. If the revised tendered amount of two more contractors received in revised offer is again found to be equal, the lowest tender, among such contractors, shall be decided by draw of lots.~~

~~2.4.9 In case of discrepancy in the quotes between figures and words, that written in words shall prevail.~~

~~2.4.10 All percentage/rates, Amounts & Sums shall have to be quoted in indelible ink and written both in figures and words. If the rate/percentage quoted in words does not tally with the rate/percentage quoted in figures, then the rate/percentage which corresponds to the lesser amount shall be considered.~~

~~2.4.11 Any overwriting / correction / applying correction fluid shall be avoided and in case any correction is made the same must be initialized and stamped.~~

~~2.4.12 The Bids with conditions or conditional rebates shall be summarily rejected.~~

~~2.4.13 Submission of bids in any mode other than that stipulated above shall not be accepted.~~

2.4 EVALUATION OF BIDS AND AWARD OF WORK

2.5.1 The Bid of bidder will be opened on the specified date and time of opening at the Office of SE(E&M), 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721320 in the presence of willing bidders or their authorized representatives.

2.5.2 Date, time and place of opening of Financial Bid will be informed after evaluation of Technical Bid to the Technically Qualified Bidders.

2.5.3 Bids shall, first, be checked for payment of Tender Fee and Earnest Money Deposit. Only those bids found to have duly paid/ submitted Tender Fee and Earnest Money Deposit shall be considered for evaluation.

2.5.4 Evaluation of Technical Bid: The bids received will then be assessed on the eligibility criteria. Bids found not meeting theeligibility criteria shall be rejected.

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2.5.5 **Financial Bid** of the bidders found qualified as above will be opened on the specified date, time and place in the presence of willing bidders or their authorized representatives.

2.5.6 Financial Bids opened as above will be checked for arithmetical errors. The bid quoting lowest shall be considered accepted.

2.5.7 The successful bidder shall be issued **Letter of Acceptance (LOA)** of the bid, and be required to furnish a **Performance Guarantee**(refer 3.1), **Program Schedule** with specific milestones to be achieved as to complete the work within the stipulated time limit and details of his **Technical Staff** to be deployed as per ANNEXURE-III so, within **10 days** from the issue of the Letter of Acceptance (LOA), failing which offer would stand cancelled and the Earnest Money Deposit shall be forfeited.

2.5.8 **Letter of Award (Work Order)** shall be issued to the successful bidder after receipt of the Performance Guarantee.

2.5.9 **Agreement (Contract)** consisting of complete tender document including conditions, bill of quantities, technical proposal and specialized services, drawings, if any, and acceptance thereof together with any correspondence leading thereto, shall be drawn and signed with the awardee within10 days of the Letter of Award.

2.5.10 **Date of start** of work shall be reckoned from the 7th day of the issue of the Work Order.

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2. GENERAL CONDITIONS OF CONTRACT

3.1 PERFORMANCE GUARANTEE

3.1.1 The contractor shall submit an irrevocable Performance Guarantee of 5% (Five percent) of the tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in para 2.5.7. This guarantee shall be in the form of Cash (in case guarantee amount is less than Rs. 10,000/-) or Deposit at Call receipt of any scheduled bank/Banker's Cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay Order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank in accordance with the ANNEXURE-I. In case a fixed deposit receipt of any Bank is furnished by the contractor to the Government as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit.

3.1.2 The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that. In case the time for completion of work gets enlarged, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest. However, in case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned yearwise proportionately.

3.1.3 The Engineer-in-Charge shall not make a claim under the performance guarantee except for amounts to which the IITKGP is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

a. Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.

b. Failure by the contractor to pay President of India any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-Charge.

3.1.4 In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the President of India.

3.2 SECURITY DEPOSIT

3.2.1 The bidder, whose tender is accepted, will also be required to furnish by way of Security Deposit for fulfillment of his contract, an amount equal to 5% of the tendered value of the work. Earnest Money deposited at the time of tenders will be treated as part of the Security Deposit.

3.2.2 The successful bidder shall permit IITKGP at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 5% of the gross amount of each running bill till the sum along with the sum already deposited as earnest money, will amount to security deposit of 5% of the tendered value of the work. Such deductions will be made and held by IITKGP by way of Security Deposit unless he has / they have deposited the amount of Security at the rate mentioned above in cash or in the form or Fixed Deposit Receipts. In case a fixed deposit receipt of any bank is furnished by the contractor to IITKGP as part of the security deposit and the bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to IITKGP to make good the deficit.

3.2.3 All compensation or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising therefrom, or from any sums which may be due to or may become due to the contractor by IITKGP or any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the State Bank of India or by scheduled banks (if deposited for more than 12 months) endorsed in favour of the Registrar, IITKGP, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof.

3.2.4 Security Deposit as deducted above can be released against Bank Guarantee issued by a Scheduled Bank on its accumulation to a minimum of Rs.5 Lakhs subject to the condition that amount of such Bank Guarantee, except last one, shall not be less than Rs.5 Lakhs. Bank Guarantee should be submitted which will be valid up to the expiry of defect liability period.

3.3 COMPENSATION FOR DELAY

3.3.1 If the contractor fails to maintain the required progress in terms of contract or to complete the work and clear the site on or before the stipulated or extended date of completion, he shall, without prejudice to any other right or remedy available under the Law to the IITKGP on account of such breach, pay as agreed compensation the amount calculated at **1.5% per month of delay to be computed on per day basis** on the amount of tendered value of the work for every completed day / month (as applicable) that the progress remains below that specified or that the work remains incomplete. Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the agreed value of work or of the agreed value of the item or group of items of work for which a separate period of completion is given, over and above the Performance Guarantee and Security Deposit.

3.3.2 In case, the contractor does not achieve a particular milestone mentioned as per ANNEXURE-III, or the re-scheduled milestone(s), 10% the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of Extension of Time. Withholding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor makes up the progress on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. No interest, whatsoever, shall be payable on such withheld amount.

3.4 DETERMINATION OF CONTRACT

3.4.1 Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other right or remedy against the contractor in respect of any delay, inferior workmanship, any claim for damages and /or any other provisions of this contract or otherwise, and whether the date for 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 Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman-like manner shall omit to comply with the requirements of such notice for a period of 7 days thereafter.

ii. if the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer-in-Charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continue to do so after a notice in writing of 7 days from the Engineer-in-Charge.

iii. iii) If the contractor fails to complete the work within the stipulated date or items of work with individual date of completion, if any stipulated, on or before such date(s) of completion and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer-in-Charge.

iv. If the contractor persistently neglects to carry out his obligations under the contract and / or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 7 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge.

v. If the contractor offers or gives or agrees to give to any person in IITKGP or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for IITKGP.

vi. If the contractor obtains a contract elsewhere as a result of wrong tendering or other non-bonafide methods of competitive tendering.

vii. If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.

viii. If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

ix. If the contractor assigns, transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer-in-Charge.

x. If the work is not started by the contractor within l / 8th of the stipulated time.

xi. When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the Director, IITKGP shall have powers:

a. To determine the contract as aforesaid (of which termination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, the Earnest Money Deposit, Security Deposit already recovered and Performance Guarantee under the contract, shall be liable to be forfeited, and shall be absolutely at the disposal of IITKGP.

b. After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be unexecuted out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work.

3.4.2 In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reason of his 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 action is taken under any of the provisions aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

3.4.3 In case, the work cannot be started due to reasons not within the control of the contractor within 1/8th of the stipulated time for completion of work or one month whichever is higher, either party may close the contract. In case contractor wants to close the contract, he shall give notice to the department stating the failure on the part of department. In such eventuality, the Performance Guarantee of the contractor shall be refunded within 30 days from the date of notice from contractor. If Performance Guarantee is not released within prescribed time limit, then a simple interest0.25% per month shall be payable on Performance Guarantee amount to the contractor from the date of expiry of prescribed time limit.A compensation for such eventuality, on account of damages etc. shall be payable @ 0.25% of tendered amount subject to maximum limit of 5 lacs.

3.4.4 **Contractor is liable to pay compensation even if contract is not determined.** In any case in which any of the powers conferred upon the Engineer-in-Charge under the contract, shall have become exercisable and the same are not 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 and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer-in-Charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Engineer-in-Charge which shall be final and binding on the contractor), use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-Charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof, belonging to the contractor, or procured by the contractor 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 these not being applicable, at current market rates to be certified by the Engineer-in-Charge, whose certificate thereof shall be final and binding on the contractor, his clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice); in the event of the contractor failing to comply with any such requisition, the Engineer-in-Charge 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 respects and the certificate of the Engineer-in-Charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

3.5 TIME EXTENSION FOR DELAY

3.5.1 The time allowed for execution of the works as stipulated in the contract or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the works shall commence from such time period as mentioned in contract. If the Contractor commits default in commencing the execution of the work as aforesaid, IITKGP shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the earnest money & performance guarantee absolutely.

3.5.2 As soon as possible after the Contract is signed, the Contractor shall submit a Time and Progress Chart for each mile stone and get it accepted by the Department. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate program has been agreed upon) complete the work as per the mile stones given.

3.5.3 If the work(s) be delayed by:

i. Force majeure, or
ii. Abnormally bad weather, or
iii. Serious loss or damage by fire, or
iv. Civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or
v. Delay on the part of other contractors or tradesmen engaged by Engineer-in-Charge in executing work not forming part of the Contract, or
vi. Non-availability of stores, which are the responsibility of IITKGP to supply or
vii. Non-availability or break down of tools and plant to be supplied or supplied by IITKGP or
viii. Any other cause which, in the absolute discretion of the Engineer-in-Charge is beyond the Contractor`s control,

then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer-in-Charge but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

3.5.4 Request for rescheduling of Mile stones and extension of time, to be eligible for consideration, shall be made by the Contractor in writing within 14 days of the happening of the event causing delay on the prescribed form. The Contractor may also, if practicable, indicate in such a request the period for which extension is desired. In any such case the Engineer-in-Charge may give a fair and reasonable extension of time and reschedule the mile stones for completion of work. Such extension shall be communicated to the Contractor by the Engineer-in- Charge in writing, within 1 months of the date of receipt of such request. Non application by the contractor for extension of time shall not be a bar for giving a fair and reasonable extension by the Engineer-in-Charge and this shall be binding on the contractor.

3.6 MEASUREMENTS OF WORK DONE

3.6.1 Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurement, the value in accordance with the contract of work done. All measurement of all items having financial value shall be entered in Measurement Book and/or level field book so that a complete record is obtained of all works performed under the contract. All measurements and levels shall be taken jointly by the Engineer-in-Charge or his authorised representative and by the contractor or his authorised representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer-in-Charge and the contractor or their representatives in token of their acceptance. If the contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties. If for any reason the contractor or his authorised representative is not available and the work of recording measurements is suspended by the Engineer-in-Charge or his representative, the Engineer-in-Charge and the Department shall not entertain any claim from contractor for any loss or damages on this account. If the contractor or his authorised representative does not remain present at the time of such measurements after the contractor or his authorised representative has been given a notice in writing three (3) days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Engineer-in-Charge or his representative shall be deemed to be accepted by the Contractor.

3.6.2 The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for measurements and recording levels. Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available, then a mutually agreed method shall be followed.

3.6.3 The contractor shall give, not less than 7 days notice to the Engineer-in-Charge or his authorised representative in-charge of the work, before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge or his authorized representative in-charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Engineer-in-Charge's consent being obtained in writing, the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

3.6.4 Engineer-in-Charge or his authorised representative may cause either themselves or through another officer of the department to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels. It is also a term of this contract that recording of measurements of any item of work in the measurement book and/or its payment in the interim, on account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

3.7 PAYMENTS IN COMPOSITE CONTRACTS

3.7.1 In case of composite tenders, running payment for the major component shall be made by Engineer-in-charge of major discipline to the main contractor. Running payment for minor component shall be made by the Engineer-in-Charge of the discipline of minor component directly to the main contractor.

3.7.2 In case main contractor fails to make the payment to the specialized agency associated by him within 15 days of receipt of each running account payment, then on the written complaint of contractor associated for such minor component, Engineer in charge of minor component shall serve the show cause to the main contractor and if reply of main contractor either not received or found unsatisfactory, he may make the payment directly to the contractor associated for minor component as per the terms and conditions of the agreement drawn between main contractor and associate contractor fixed by him. Such payment made to the associate contractor shall be recovered by Engineer-in-charge of major or minor component from the next R/A/ final bill due to main contractor as the case may be.

3.8 COMPLETION CERTIFICATE, CLEANED SITE AND COMPLETION PLANS

3.8.1 Within ten days of the completion of the work, the contractor shall give notice of such completion to the Engineer-in-Charge and within fifteen days of the receipt of such notice, the Engineer-in-Charge shall inspect the work, and if there is no defect in the work, shall furnish the contractor with a certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and / or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed, all scaffolding, surplus materials, debris, rubbish, unserviceable material and all huts and sanitary arrangements, required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floors or other parts the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of the execution thereof, and not until the work shall have been measured by the Engineer-in-Charge.

3.8.2 The contractor shall submit **completion plans** required as per Specifications for Electrical, Networking, Telephone, Water, Sewerage and Drainage works within 30 days of the completion of the work.

3.8.3 In case, the contractor fails to comply as aforesaid,the department will get it done through other agency at his cost and actual expenses incurred plus Rs. 50,000/-for the same shall be recovered from the contractor and the contractor shall have no claim in respect of such cost thereof.

3.9 PAYMENT OF FINAL BILL

The final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within 3 (three) months from the date of receipt of the bill by the Engineer-in-Charge or his authorised representative, complete with account of materials issued by the Department and dismantled materials.

3.10 MATERIALS TO BE PROVIDED BY THE CONTRACTOR

3.10.1 The contractor shall, at his own expense, provide all materials, required for the works other than those specified otherwise. The contractor shall, at his own expense and without delay, supply to the Engineer-in-Charge samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Engineer-in-Charge furnish proof, to the satisfaction of the Engineer-in-Charge that the materials so comply. The Engineer-in-Charge shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Engineer-in-Charge for his approval, fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Engineer-in-Charge shall be issued after the test results are received.

3.10.2 The Contractor shall at his risk and cost submit the samples of materials to be tested or analysed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Engineer-in-Charge. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

3.10.3 The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Engineer-in-Charge may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Engineer-in-Charge and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. The Engineer-in-Charge or his authorized representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

3.10.4 The Engineer-in-Charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

3.10.5 The contractor shall at his own expense, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped at least with the testing equipment as specified in the contract.

3.10.6 **No Price Escalation shall be considered** on the tendered rates for stipulated or extended period of contract.

3.10.7 **Secured advance on non-perishable materials:** The contractor, on signing an indenture in the form to be specified by the Engineer-in-Charge, shall be entitled to be paid during the progress of the execution of the work up to **90**% of the assessed value of any materials which are in the opinion of the Engineer-in-Charge nonperishable, non-fragile and non-combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered / deducted from the next payment made under any of the clause or clauses of this contract.Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of Engineer-in-Charge provided the contractor provides a comprehensive insurance cover for the full cost of such materials. The decision of the Engineer-in-Charge shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on perishable or high risk materials such as ordinary glass, sand, petrol, diesel etc.

3.10.8 **Excavated / dismantled material will be IITKGP's property.**The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work etc. as IITKGP's property and such materials shall be disposed off to the best advantage of IITKGP according to the instructions in writing issued by the Engineer-in-Charge.

3.11 SPECIFICATIONS

3.11.1 The contractor shall execute the whole and every part of the work in the most substantial and workman like manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the designs, drawings and instructions in writing in respect of the work signed by the Engineer-in-Charge. The several documents forming the Contact are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale. The following order of preference shall be observed:

a) Description of Bill of Quantities.
b) Particular Specifications and Special Conditions or Clauses, if any.
c) Drawings.
d) C.P.W.D. Specifications.
e) Indian Standard Specifications of B.I.S.
f) Manufacturer's specifications

3.11.2 The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract.

3.11.3 The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

3.11.4 Contractor shall be required to submit a guarantee bond for all the water proofing works carried out by him as per ANNEXURE-II.

3.11.5 Contractor shall use the items of approved makes as per ANNEXURE-IV.

3.12 DEVIATIONS / VARIATIONS, EXTENT AND PRICING

3.12.1 The Engineer-in-Charge shall have power (i) to make alteration in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) to omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the contractor shall be bound to carry out the works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which the contractor may be directed to do in the manner specified above as part of the works, shall be carried out by the contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.

3.12.2 **Deviation and Time Extension:** The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, will be extended, if requested by the contractor, as follows:

i. In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value, plus

ii. 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

3.12.3 **Extra Items and Pricing**

a. In the case of Extra Item(s) being the schedule items (Delhi Schedule of Rates items), these shall be paid as per the schedule rate plus cost index (at the time of tender) plus/minus percentage above/ below quoted contract amount.

b. In the case of substituted items (items that are taken up with partial substitution or in lieu of items of work in the contract), the rate for the agreement item (to be substituted) and substituted item shall also be determined in the manner as mentioned in the following para:

   I. If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

   II. If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

c. In the case of extra item(s)(items that are completely new, not found in either Delhi Schedule of Rates of CPWD or in tender's schedule of quantities, and are in addition to the items contained in the contract), the contractor may within fifteen days of receipt of order or occurrence of the item(s), claim rates, supported by proper analysis, for the work and the engineer-in-charge shall within one month of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

3.12.4 Deviated Quantities and Pricing

a. In the case of contract items, substituted items, contract cum substituted items, which exceed the limits of 30% for new construction works of plinth and above, 100% for foundation work and 50% for maintenance repairs work, the contractor may within **15 days** of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis, for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities, the Engineer-in-Charge shall within one month of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

b. The provisions of the preceding paragraph shall also apply to the decrease in the rates of items for the work in excess of the aforesaid limits, and the Engineer-in-Charge shall after giving notice to the contractor within one month of occurrence of the excess and after taking into consideration any reply received from him within **15 days** of the receipt of the notice, revise the rates for the work in question within one month of the expiry of the said period of **15 days** having regard to the market rates.

c. The contractor shall send to the Engineer-in-Charge once every **month** an upto date account giving complete details of all claims for additional payments to which the contractor may consider himself entitled and of all additional work ordered by the Engineer-in-Charge, which he has executed during the preceding quarter, failing which the contractor shall be deemed to have waived his right and the rates determined by the Engineer-in-Charge shall be deemed accepted by the contractor.

~~d. For the purpose of operation of this clause the following works shall be treated as works relating to foundation.~~

~~i. For buildings, compound walls: Plinth level or 1.2 metres (4 feet) above ground level, whichever is lower, excluding items of flooring and D.P.C. but including base concrete below the floors.~~
~~ii. For abutments, piers, retaining walls of culverts and bridges, walls of water reservoirs: The bed of floor level.~~
~~iii. For retaining walls where floor level is not determinate: 1.2 metres above the average ground level or bed level.~~
~~iv. For roads: All items of excavations and filling including treatment of sub-base and soling work.~~
~~v. For water supply lines, sewer lines, underground SWD & similar works: All items of work below ground level except items of piping work.~~
~~vi. For open storm water drains: All items of work except lining of drains.~~

e. Any operation incidental to or necessarily has to be in contemplation of tenderer while filing. tender, or necessary for proper execution of the item included in the Schedule of quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations.

3.13 FORECLOSURE OF CONTRACT DUE TO ABANDONMENT OR REDUCTION IN SCOPE OF WORK

3.13.1 If at any time after acceptance of the tender, IITKGP shall decide to abandon or reduce the scope of the works for any reason whatsoever and hence not require the whole or any part of the works to be carried out, the Engineer-incharge shall give notice in writing to that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

3.13.2 The contractor shall be paid at contract rates full amount for works executed at site and in addition, a reasonable amount as certified by the Engineer-in-charge for the items hereunder mentioned which could not be utilised on the work to the full extent in view of the foreclosure.

i. Any expenditure incurred on preliminary site work, e.g temporary access roads, temporary labour huts, staff quarters and site office, storage accommodation and water storage tanks.

ii. IITKGP shall have the option to take over contractor's materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided however, IITKGP shall be bound to take over the materials or such portions thereof as the contractor does not desire to retain. For materials taken over or to be taken over by IITKGP, cost of such materials as detailed by Engineer-in-charge shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the contractor.

iii. If any materials supplied by IITKGP are rendered surplus, the same except normal wastage shall be returned by the contractor to IITKGP at rates not exceeding those at which these were originally issued less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to IITKGP stores, if so required by IITKGP, shall be paid.

iv. Reasonable compensation for transfer of T & P from site to contractor's permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.

v. Reasonable compensation for repatriation of contractor's site staff and imported labour to the extent necessary.

3.13.3 The contractor shall, if required by the Engineer-in-charge furnish to him books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

3.13.4 The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor`s materials at site taken over by IITKGP as per item (ii) above `Provided always that against any payments due to the contractor on this account or otherwise, the Engineer-in-charge shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by IITKGP from the contractor under the terms of the contract.

3.13.5 A compensation for such eventuality, on account of damages etc. shall be payable @ 0.5% of cost of work remaining incomplete on date of closure i.e. total stipulated cost of the work less the cost of work actually executed under the contract shall be payable

3.14 CARRYING OUT PART WORK AT RISK & COST OF CONTRACTOR

3.14.1 If contractor:

(i) At any time makes default during currency of work or does not execute any part of thework with due diligence and continues to do so even after a notice in writing of 7 days inthis respect from the Engineer-in-Charge; or

(ii) Commits default in complying with any of the terms and conditions of the contract anddoes not remedy it or takes effective steps to remedy it within 7 days even after a noticein writing is given in that behalf by the Engineer-in-Charge; orFails to complete the work(s) or items of work with individual dates of completion, on orbefore the date(s) so determined, and does not complete them within the period specifiedin the notice given in writing in that behalf by the Engineer-in-Charge.

3.14.2 The Engineer- in-Charge without invoking action under clause 3 may, without prejudice to anyother right or remedy against the contractor which have either accrued or accrue thereafter toGovernment, by a notice in writing to take the part work / part incomplete work of any item(s)out of his hands and shall have powers to:

(a) Take possession of the site and any materials, constructional plant, implements,stores, etc., thereon; and/or

(b) Carry out the part work / part incomplete work of any item(s) by any means at therisk and cost of the contractor.

3.14.3 The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractorfor completion of the part work/ part incomplete work of any item(s) taken out of his handsand execute at the risk and cost of the contractor, the liability of contractor on account ofloss or damage suffered by IITKGP because of action under this clause shall not exceed10% of the tendered value of the work.

3.14.4 In determining the amount, credit shall be given to the contractor with the value of work donein all respect in the same manner and at the same rate as if it had been carried out by theoriginal contractor under the terms of his contract, the value of contractor's materials takenover and incorporated in the work and use of plant and machinery belonging to the contractor.The certificate of the Engineer-in-Charge as to the value of work done shall be final andconclusive against the contractor provided always that action under this clause shall only betaken after giving notice in writing to the contractor. Provided also that if the expenses incurredby the department are less than the amount payable to the contractor at his agreementrates, the difference shall not be payable to the contractor.

3.14.5 Any excess expenditure incurred or to be incurred by IITKGP in completing the partwork/ part incomplete work of any item(s) or the excess loss of damages suffered or may besuffered by Government as aforesaid after allowing such credit shall without prejudice to anyother right or remedy available to Government in law or per as agreement be recovered fromany money due to the contractor on any account, and if such money is insufficient, thecontractor shall be called upon in writing and shall be liable to pay the same within 30 days.

3.14.6 If the contractor fails to pay the required sum within the aforesaid period of 30 days, theEngineer-in-Charge shall have the right to sell any or all of the contractors' unused materials,constructional plant, implements, temporary building at site etc. and adjust the proceeds ofsale thereof towards the dues recoverable from the contractor under the contract and ifthereafter there remains any balance outstanding, it shall be recovered in accordance withthe provisions of the contract.

3.14.7 In the event of above course being adopted by the Engineer-in-Charge, the contractor shallhave no claim to compensation for any loss sustained by him by reason of his having purchasedor procured any materials or entered into any engagements or made any advance on anyaccount or with a view to the execution of the work or the performance of the contract.

3.15 SUSPENSION OF WORK

3.15.1 The contractor shall, on receipt of the order in writing of the Engineer-in-Charge, (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in- Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

a. on account of any default on the part of the contractor or;

b. for proper execution of the works or part thereof for reasons other than the default of the contractor; or

c. for safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.

3.15.2 If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:

a. the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

b. If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Engineer-in-Charge may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labour at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within fifteen days of the expiry of the period of 30 days.

3.15.3 If the works or part thereof is suspended on the orders of the Engineer-in-Charge for more than three months at a time, except when suspension is ordered for reason (a) in sub-para (i) above, the contractor may after receipt of such order serve a written notice on the Engineer-in-Charge requiring permission within fifteen days from receipt by the Engineer-

in-Charge of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by IITKGP or where it affects whole of the works, as an abandonment of the works by IITKGP, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Engineer-in-Charge. In the event of the contractor treating the suspension as an abandonment of the contract by IITKGP, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Engineer-in-Charge may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labour at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Engineer-in-Charge within 30 days of the expiry of the period of 3 months.

3.16 ACTION IN CASE OF WORK NOT DONE AS PER SPECIFICATIONS

3.16.1 All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the inspection and supervision of the Engineer-in- charge, his authorised subordinates in charge of the work and all the superior officers of the Department or any organization engaged by the Department for Quality Assurance and of the Chief Technical Examiner's Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has 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 that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

3.16.2 If it shall appear to the Engineer-in-charge or his authorised subordinates in-charge of the work or his subordinate officers or the officers of the organization engaged by the Department for Quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within twelve months (six months in the case of work costing Rs. 10 Lakh and below except road work) of the completion of the work from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under para3.3of the contract (for non-completion of the work in time) for this default.

3.16.3 In such case the Engineer-in-Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates he may consider reasonable during the preparation of on account bills or final bill if the items is so acceptable without detriment to the safety and utility of the item and the structure, or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the contractor.Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

3.17 CONTRACTOR LIABLE FOR DAMAGES, DEFECTS DURING MAINTENANCE (DEFECT LIABILITY PERIOD)

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part of it is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within **12 months (6 months** in the case of work costing **Rs. 10,00,000/- and below** except road work**)** after a certificate final or otherwise of its completion shall have been given by the Engineer-in-Charge as aforesaid arising out of defective or improper materials or workmanship, the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense, or in default, the Engineer-in-Charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due, or at any time thereafter may become due to the contractor, or from his security deposit, or the proceed of sale thereof or of a sufficient portion thereof. The security deposit of the contractor shall not be refunded before the expiry of **12 months (6 months** in the case of work costing **Rs. 10,00,000/- and below** except road work**)** after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later. Provided that in the case of road work, if in the opinion of the Engineer-in-Charge, half of the security deposit is

sufficient to meet all the liabilities of the contractor under this contract, half of the security deposit will be refundable after **6 months** and the remaining half after **12 months** of the issue of the said certificate of completion or till the final bill has been prepared and passed whichever is later. Performance Security shall be refunded to the contractor after completion of the work and recording the completion certificate.

3.18 CONTRACTOR TO SUPPLY TOOLS & PLANTS, WORKMEN ETC.

3.18.1 The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-Charge's stores), machinery, tools & plants. in addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffoldings and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specification or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge 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 materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under the contract and/or from his security deposit or the proceeds of sale thereof, or of sufficient portions thereof.

3.18.2 **Recovery of compensation paid to workmen:** In every case in which by virtue of the provisions of section 12 sub-section (1) of the Workmen's Compensation Act. 1923, IITKGP is obliged to pay compensation to a workman employed by the contractor, in execution of the works, IITKGP will recover from the contractor the amount of the compensation so paid; and, without prejudice to the rights of IITKGP under Section 12, sub-section (2) of the said Act, IITKGP shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by IITKGP to the contractor whether under this contract or otherwise. IITKGP shall not be bound to contest any claim made against it under section 12, sub-section (1) of the said Act, except on the written request of the contractor and upon his giving to IITKGP full security for all costs for which IITKGP might become liable in consequence of contesting such claim.

3.18.3 **Ensuring payment and amenities to workers if contractor fails:** In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and of the contract labour (Regulation and Abolition) Central Rules, 1971, IITKGP is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the Rules, under Clause 19 H or under the DAE Contractor's Labour Regulations, or under the rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by Department of Atomic Energy contractors, IITKGP will recover from the contractor the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of IITKGP under Section 20, sub-section (2) and Section 21, sub-section (4) of the contract labour (Regulation and Abolition) Act, 1970, IITKGP shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by IITKGP to the contractor whether under this agreement or otherwise. IITKGP shall not be bound to contest any claim made against it under Section 20, subsection (1) and section 21, sub-section (4) of the said Act, except on the written request of the contractor and upon his giving to IITKGP full security for all costs for which IITKGP might become liable in contesting such claim.

3.19 LABOUR LAWS TO BE COMPLIED BY THE CONTRACTOR

3.19.1 The contractor shall obtain a valid license under the Contract Labour (R & A) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also abide by the provision of the Child Labour Prohibition & Regulation) Act-1998. The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996. Any failure to fulfill these requirements shall attract the penal provisions of this contract arising out of the resultant non execution of the work.

3.19.2 No labour below the age of fourteen years shall be employed on the work.

3.19.3 **Minimum wages act to be compiled with** The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, Contract Labour (Regulation and Abolition) Act, 1970 and rules framed thereunder and other labour laws affecting contract labour that may be brought into force from time to time.

3.20 APPRENTICE ACT PROVISIONS TO BE COMPLIED WITH

The contractor shall comply with the provisions of the Apprentices Act, 1961 and the rules and orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the contract and the Superintending Engineer may, in his discretion, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

3.21 CONFIDENTIAL INFORMATION

The drawings, specifications, proto-type, samples and such other information furnished to the contractor relating to the supply / work, sub-systems / equipment etc. are to be treated as confidential which shall be held by the contractor in confidence and shall not be divulged to any third party without the prior written consent of the Department. The contractor, therefore, binds himself, his successors, heirs, executors, administrators, employees and the permitted assignees or such other persons or agents directly or indirectly concerned with the work / supply to the confidential nature of the drawings, specifications, proto-type samples etc. It is a further condition of the contract that the contractor shall not, without prior written permission from the Department, transmit, transfer, exchange, gift or communicate any such confidential information, and also the component, sub assembly, products, by-products etc. pursuant to the fabrication under taken by the contractor, to any third party.

3.22 SCAFFOLDING, MOBILE ELEVATED PLATFORM AND SAFETY

3.22.1 Every scaffold or mobile elevated platform and its supporting members, railings, Tee-boards, ropes should be designed to support given load, with a safety factor of at least four. No alterations should be made that might impair the strength of such structures, no improvised, make-shift or substandard scaffold should be permitted even for the most temporary use. All work in connection with such structures, including construction, operation, maintenance, alteration and removal should be carefully done under the direction and supervision of persons with specialized experience in such works. A safe and convenient means of access should be provided to the platform or scaffold. Means of access may be a portable ladder, fixed ladder, ramp or it may be a stairway. The use of cross braces or frame work as means of access to the working surface shall not be permitted.

3.22.2 Contractor shall provide safe access to any part of the structure or building for Engineer-in-charge or his/ her representative or officials of the department for inspection of the works at any point of time.

3.22.3 All parts of the construction exposed to fall of a person more than 60cm height shall be kept safe and protected by way guarded railing or barrier.

3.22.4 All parts of the construction shall be kept well lit and ventilated by natural or artificial means.

3.22.5 Every worker shall be made to work wearing safety helmet, florescent shirt, safety harness, and safety shoes.

3.22.6 Construction site shall be kept out of bounds for layman by steel barricades of minimum height 1.8m suitably designed for safety and stability against self-weight, incidental loads and imposed loads.

3.22.7 Contractor shall designate a safety in-charge for the work before start of the work.

3.22.8 Non-compliance to above shall invite a penal recovery of 0.5% of the tendered amount per month without prejudice to any other conditions in the contract.

3.23 WATER

3.23.1 Water if available may be supplied to the contractor by the IITKGP subject to the following conditions:

a) The water charges @ 1 % shall be recovered on gross amount of the work done.

b) The contractor(s) shall make his/their own arrangement of water connection and laying of pipelines from existing main of source of supply.

c)IITKGP do not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor(s) to make alternative arrangements for water at his/ their own cost in the event of any temporary break down in the Department water main so that the progress of his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.

3.23.2 Where there is no piped water supply arrangement and the water is taken by the contractor from the wells or hand pump constructed by IITKGP, no charge shall be recovered from the contractor on that account. The contractor shall, however, draw water at such hours of the day that it does not interfere with the normal use for which the hand pumps

and wells are intended. He will also be responsible for all damage and abnormal repairs arising out of his use, the cost of which shall be recoverable from him. The Engineer-in-Charge shall be the final authority to determine the cost recoverable from the contractor on this account and his decision shall be binding on the contractor.

3.23.3 The contractor shall be allowed to construct temporary wells in IITKGP land for taking water for construction purposes only after he has got permission of the Engineer-in- Charge in writing. No charges shall be recovered from the contractor on this account, but the contractor shall be required to provide necessary safety arrangements to avoid any accidents or damage to adjacent buildings, roads and service lines. He shall be responsible for any accidents or damage caused due to construction and subsequent maintenance of the wells and shall restore the ground to its original condition after the wells are dismantled on completion of the work.

3.24 ELECTRICITY

3.24.1 Electricity may be provided by IITKGP to the contractor on his request.

3.24.2 The charges and tariff for usage shall be refered from the Institute link: http://www.emw.iitkgp.ac.in/menu.php?page=home/news/view&id=4

3.24.3 The connection shall be given against specific work order. The contractor with multiple work orders shall take separate connection for each contract.

3.24.4 Engineer-in-charge, before forwarding any bill of the contractor for payment shall ensure that the latest electricity bill have duly been paid by the contractor and the receipt is enclosed with the bill claimed.

3.25 FORCE MAJEURE

If at any time, during the continuance of this contract, the performance in whole or in part by either party of any obligation under this contract is prevented or delayed by reason of any war, hostility, acts of public enemy, civil commotion, sabotage, serious loss or damage by fire, explosions, epidemics, strikes, lockouts or acts of God (hereinafter, referred to events') provided, notice of the happening of any such event is given by either party to the other within 10 days from the date of occurrence thereof, neither party shall by reason of such event, be entitled to terminate this contract nor shall either party have any claim for damages against the other in respect of such non-performance of delay in performance, and works under the contract shall be resumed as soon as practicable after such event has come to an end or ceased to exist, and the decision of IIT Kharagpur as to whether the works have been so resumed or not shall be final and conclusive, provided further that if the performance in whole or in part of any obligation under this contract is prevented or delayed by reason of any such event for a period exceeding 90 days, either party may at its option terminate the contract by giving notice to the other party.

3.26 ARBITRATION

3.26.1 In the case of dispute arising upon or in relation to or in connection with the contract between the parties, which has not been settled amicably, any party can refer the dispute for Arbitration under (Indian) Arbitration and Conciliation Act, 1996. Such disputes shall be referred to an Arbitral Tribunal consisting of 3 (three) arbitrators, one each to be appointed by IITKGP and PMC, the third arbitrator shall be chosen by the two arbitrators so appointed by the parties and shall act as Presiding Arbitrator. In case of failure of the two arbitrators appointed by the parties to reach a consensus regarding the appointment of the third arbitrator within a period of 30 days from the date of appointment of the two arbitrators, the Presiding arbitrator shall be appointed by the Secretary of the Ministry / Department. The Arbitration and Conciliation Act, 1996 and any statutory modification or re-enactment thereof, shall apply to these arbitration proceedings.

3.26.2 Arbitration proceedings shall be held in Kharagpur and the language of the arbitration proceeding and that of all documents and communications between the parties shall be English.

3.26.3 The decision of the majority of arbitrators shall be final and binding upon both parties. The expenses of the arbitrators as determined by the arbitrators shall be shared equally by the parties. However, the expenses incurred by each party in connection with the preparation, presentation shall be borne by the party itself. All arbitration awards shall be in writing and shall state the reasons for the award.

3. SPECIAL CONDITIONS OF CONTRACT

4.1 Networking Works

~~4.1.1~~ ~~All active networking items required for the networking job will be provided by Computer& Informatics Centre (CIC), IIT Kharagpur.PVC pipe/casing (ISI branded) with accessories for laying the UTP cables and HDPE pipe for laying of OFC and cable trays are to be supplied as per requirement.~~

~~4.1.2~~ ~~Floor to floor vertical connectivity from network/server room rack to rack location of each floor will be through OFC. Horizontal connectivity from rack location to each user points or wireless access points in each floor will be through CAT-6 UTP Cables. Cables shall be installed in unbroken segments from rack location to individual information outlet (I/O) locations maintaining structured cabling standards. The maximum length of UTP cable shall not exceed 90 meters (300 feet) from Jack Panel to the Information Outlet (I/O) point. UTP cable should always be 500 mm apart from electrical cables while laying both the cables side by side. There may be multiple rack locations in a floor.~~

~~4.1.3~~ ~~Wherever cable pathways transition is required from horizontal to vertical, an appropriate 'waterfall' structure must be provided with minimum bend radius. No cable or cable support structure should be installed in any fashion that might prevent maintenance of or access to any utility facility. Selected vendor should maintain the esthetic view of the building/room while doing networking job.~~

~~4.1.4~~ ~~In case of a big room where number of information outlets is more than eight, separate network rack may have to be installed to cater to network outlets locally from this rack. Only one/two UTP uplink will be laid from the floor distribution rack in such cases. The location will be specified by CIC.~~

~~4.1.5~~ ~~At each user location UTP cables shall be terminated in a wall mounted Information outlet compliant with TIA/EIA 568Bstandards.~~

~~4.1.6~~ ~~All UTP cable segments should be marked with the ferrules at both ends. Marking of information outlets corresponding to the jack panel port should also be done properly.~~

~~4.1.7~~ ~~Work has to be completed within 60 days from the date of issue of purchase order by the Institute.~~

~~4.1.8~~ ~~Selected vendor has to submit a project report containing route details, physical connectivity details, link test report of all UTP and OFC cable segments, optical loss details in case of OFC links etc after successful completion of the job.~~

~~4.1.9~~ ~~Physical installation of network switches, UPS(s) and physical connectivity to all links with network switches have to done by the selected vendor.~~

~~4.1.10~~ ~~UPS for network switches has to be fixed beside the network rack by fabricating a wall mount stand (two U shaped brackets) made of galvanized steel to hold one 1 KVA UPS firmly.~~

~~4.1.11~~ ~~Selected vendor has to provide one year comprehensive onsite warranty for all the items supplied and passive work done. Bidder has to deploy onsite technician with necessary tools for maintenance of cable plant and accessories for the entire warranty period.~~

~~4.1.12~~ ~~Vendor may visit the site on any working day in co-ordination with Computer & Informatics Centre before the submission of the tender.~~

~~4.1.13~~ ~~Work should be carried out with the guidance of computer & Informatics Centre (CIC), IIT Kharagpur. For any technical dispute arising at any time during the execution of the work the decision of CIC will be the final.~~

~~4.1.14~~ ~~Service quantities mentioned in the tender are tentative. Payment will be made on the basis of exact quantities installed and certified by the Head, CIC.~~

5.2 HVAC Works

Civil work related to Air conditioning & Ventilation work.

All civil work related to Air Conditioning & Ventilation work such as – Cutting of holes for passage of ducts, Drain Piping, Opening for Fresh Air etc. & making good of same will be done by the Air Conditioning Contractor. The Rates for each item as mentioned in BOQ should include the cost for Civil work related to that item.

Design Validation :

Bidders are requested to re verify the technical parameters highlighted in the scope of the contract based on the Site visit. The system guarantee lies with bidders.

6 UNDERTAKING BY THE BIDDER

U N D E R T A K I N G

I / We have read and examined the Tender document including terms & conditions, specifications, bill of quantities, drawings and designs, general rules & directions, General Conditions of Contract, Special Conditions of Contract and all relevant other documents, publications and rules referred to in the Conditions of Contract and all other contents in the tender documents for the work.

I / We, hereby tender for execution of the work specified for the Indian Institute of Technology Kharagpur within the time specified and in accordance in all respects with the specifications, designs, drawings and instructions in writing.

We agree to keep the tender open for 90 days from the last date of its submission and not to make any modifications in its terms and conditions. A sum of ₹ 130,000/- been deposited in cash / receipt treasury challan / deposit at call receipt of scheduled bank / fixed deposit receipt of scheduled bank / demand draft of a scheduled bank / Bank Guarantee issued by a Scheduled Bank as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said Director, Indian Institute of Technology Kharagpuror his authorized officer shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / we fail to commence work as specified, I / we agree that the Director, Indian Institute of Technology Kharagpurshall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein.

Further, I / We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

I / We hereby declare that I / We shall treat the tender documents, drawings and other records connected with the work as secret / confidential documents and shall not communicate information derived there-from to any person other than a person to whom I / We am / are authorised to communicate the same or use the information in any manner prejudicial to the safety of the State.

Seal & Signature of Contractor
Postal Address

Dated

Witness

Address

Occupation

Signature and Seal of Contractor_____

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Signature and Seal of Contractor_____

29 ANNEXURES

ANNEXURE-I
(Refer para 3.1)

FORM OF PERFORMANCE GUARANTEE (BY BANK GUARANTEE)

In consideration of the Director, IITKGP having agreed under the terms and conditions of Letter of Intene / Agreement No…… dated…….. made between ……..……and ……..…….. (hereinafter called " the said Contractor{s}") .for the work ……..…… (hereinafter called " the said Letter of Intent / Agreement") having agreed to production of a irrevocable bank Guarantee for Rs. …… (Rupees …….. only), as a security / guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement, we ……..(Indicate the name of the Bank) (hereinafter referred to as "the Bank") hereby undertake to pay to IITKGP an amount not exceeding Rs. …….. (Rs……..only) on demand by IITKGP.

We …….. (indicate the name of Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from IITKGP stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs…… (Rupees……..only).

We, the said bank, further undertake to pay to IITKGP any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.

We…….. (indicate the name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of IITKGP under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-charge on behalf of the IITKGP certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.

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

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

We, …… (indicate the name of Bank) lastly undertake not to revoke this guarantee except with the previous consent of IITKGP in writing.

This guarantee shall be valid up to ……, unless extended on demand. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. …… (Rupees …….. only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Signed and sealed
Dated the …… day of …… for ……(indicate the name of Bank)

* * *

(Note: The Letter of Intent shall form part of the Agreement)

Signature and Seal of Contractor_____

ANNEXURE-II
(Refer para 3.11.4)

GUARANTEE TO BE EXECUTED BY CONTRACTORS FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF WATER PROOFING WORKS FOR 10 (TEN) YEARS

The Agreement made this ..... day of ..... two thousand and ..... between ..... son of ..... of ..... (hereinafter called the Guarantor of the one part) and the PRESIDENT OF INDIA (hereinafter called Government of the other part).

WHEREAS this agreement is supplementary to a contract (hereinafter called the Contract) dated ..... and made between the GUARANTOR of the one part and the Government of the other part, whereby the Contractor, inter alia, undertook to render the buildings and structures in the said contract recited completely water and leak-proof.

AND WHEREAS GUARANTOR agreed to give a guarantee to the effect that the said structures will remain water and leak-proof for ten years from the date of giving of water proofing treatment.

NOW THE GUARANTOR hereby guarantees that water proofing treatment given by him will render the structures completely leak-proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date after the maintenance period prescribed in the contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse of roof or alteration and for such purpose: (a) Misuse of roof shall mean any operation which will damage proofing treatment, like chopping of firewood and things of the same nature which might cause damage to the roof; (b) Alteration shall mean construction of an additional storey or a part of the roof or construction adjoining to existing roof whereby proofing treatment is removed in parts; (c) The decision of the Engineer-in-Charge with regard to cause of leakage shall be final.

During this period of guarantee the guarantor shall make good all defects and in case of any defect being found, render the building water-proof to the satisfaction of the Engineer-in-Charge at his cost, and shall commence the work for such rectification within seven days from the date of issue of the notice from the Engineer-in-Charge calling upon him to rectify the defects, failing which the work shall be got done by the Department by some other contractor at the GUARANTOR'S cost and risk. The decision of the Engineer-in-Charge as to the cost, payable by the Guarantor shall be final and binding.

That if GUARANTOR fails to execute the water proofing or commits breach thereunder then the GUARANTOR will indemnify the Principal and his successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Government the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHEREOF these presents have been executed by the Obligor ..... and by ..... and for and on behalf of the PRESIDENT OF INDIA on the day, month and year first above written.

Seal & Signature of Contractor
Postal Address

in the presence of—

1.

2.

Signature and Seal of Contractor_____

ANNEXURE-III
(Refer para 2.5.7 and para 3.3.2)

PROGRESS MILESTONES

Milestones in fractions of the time limit	Days	Work done amount	IndicativePhysical Status
1/5th			
2/5th			
3/5th			
4/5th			
Completion			

TECHNICAL STAFF OF CONTRACTOR

DISCIPLINE	NAME	QUALIFICATION	EXPERIENCE	CONTACT NUMBER
Overall Project In-charge				
Engineer - Building and Civil Works				
Engineer - Electrical Works				
Engineer - Networking Works				
Engineer - Telephone Works				
In-charge - Safety, Health & Environment				

Seal & Signature of Contractor

Signature and Seal of Contractor_____

ANNEXURE-IV
(Refer para 3.11.5)

LIST OF APPROVED MAKES / MANUFACTURERS OF BUILDING MATERIALS

Sr#	Description of materials	List of Manufacturers
Civil Items		
1	Ordinary Portland Cement of Grade 43	ACC, Birla Rajshree, Ultratech, Narmada, Ambuja
2	White Cement	J.K. Cement &Birla White
3	Wall Putty	JK / Birla / Sika
4	Lime	Janatacem, Asian Paint
5	Neeru	More (Peacock), Kamal
6	HYSD Bars (TMT Bars)	TISCO, SAIL, RINL
7	Structural Plates and Steel Sections	TISCO, SAIL, RINL
8	Lighter Structural sections not manufactured by TATA/SAIL/RINL	Shyam Steel / SRMB / Jindal (Hissar)
9	Pressed steel doors & fire resistant steel doors	Godrej, Windoors, Strategic Building Systems &Kutty Flush Doors
10	Mild Steel Rolling Shutters, GI Rolling	SWASTIC, Windoors. Dodia,
11	Shutters, Stainless steel & aluminum rolling shutters	Trupti, Bharath& Larsen Engineering
12	Aluminium Extruded Sections	Jindal, Indal, Hindalco &Bhoruka
13	Aluminium Grills	M/s Alurniprofiles, Decogrills
14	Hardware Fittings & fixtures	M/s Jayant Metal, Shalimar hardware, Everite, Garnish, Diamond, Navbharat, SAIF Enterprises, Hardwin Traders, Godrej, DE Lock Industries, Explore Engineers, Garg Hinges
15	Aluminium Powder Coated Curtain rods	Bilmate, Elite
16	Anodized Aluminium fittings	Allen / Metco / N.L.C.O.
17	SS Railing Sections	Ozone / D-Line / Jindal
18	Stainless steel D-handles	Godrej, Hettich, D-line, Dorma, Dorset, Ozone
19	Door Locks	Godrej, Dorma
20	Door Closer/Floor spring	Godrej, Ozone, Hettich, Dorma, Hardwyn
21	False Ceiling	Gyprock / Armstrong
22	Aluminium Cladding sheets	Alstrong, Alpolic, Alucobond, Alstone International, Aludecor Lamination
23	Asbestos Roofing Sheets	Everest, Charminar & Asbestos Cement Ltd.
24	Colour Coated Steel / Zinc-alu alloy roofing sheets	Kirby, Steelfah&Colour Roof India Ltd.
25	Anti-Termite treatment	M/s PARAGON, PEECOPP , Express Pesticides Corporation, Elite Corporation, Pest Control (I) Ltd. & NOCIL Chemicals,
26	Terrazzo Tiles	M/s NITCO, BHARAT, G.K. BANSAL, Acme Tiles & Super Tiles
27	Ceramic Tiles	H.R. Johnson (I) Ltd., Sornany, Kajaria
28	Glazed Tiles	M/s H.R. Johnson (I) Ltd., Somany, Kajaria
29	Vitrified Floor Tiles	M/s H.R. Johnson, RAK Ceramics, Bell Granito
30	Interlocking Paver Tiles	Hindustan Tiles / Wonder / Ultra Tiles
31	Cement Based Paint	M/s Snowcem India Ltd. (Super snowcem, Sandex Matt), NITCO (Nitcocom) Paints, Hindustan Colour Chemical, Jayant colour, Surfa coat, Terraco, Berger-Rabiacem, ApporvaBuildcare&Decocem
32	Distemper & Paints	Asian Paints, Kansai Nerolac Paints Ltd., ICI Paints, Noble Paints, Berger Paints India Ltd., Jenson Nicholson, Garware Paints & Shalimar Paint

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33	Anti-corrosive water proofing paint with Aluminium finish	SIKA / Shalimar
34	Waterproofing Compound, Sealants	Sunanda Chemicals, Mc-Bauchemie, FOSROC, Pidilite, Roffe, BASF, Sika
35	Adhesive for wood	Fevicol, Vamicol, Dunlop, Araldite
36	Water stops	M/s Omai Plastics, BaseconPask, Asian Engineering Products, Caprihans India Ltd., R.C. Enterprises, Kanta Polymers (Kanta flex) &Fixopan
37	APP Membrane	SIKA / PIDILITE / FOSROC / TIKIDAN
38	Expansion Joint Boards & Tarfelts	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation, Tiki Tar Industries
39	Expansion Joint Filters	M/s Shalitex, S.T.P. Ltd., Lloyd Insulation & BASF Chemicals
40	Concrete Admixtures	Sunanda Chemicals, Mc-Bauchemie, FOSROC, Pidilite, Roffe, BASF
41	Bitumen (grade VG30)	IOCL
42	P V C flooring	M/s Premier Vinyl Flooring Ltd., Royal Cushion Vinyl Product Ltd., Armstrong, Responsive Industries Ltd.
43	P.V.C. Shutters	Sintex / Raunaq / Duroplast
44	P.V.C. Pipes	Oriplast / Supreme / Finolex
45	P.V.C. Cistern	Parryware / Hindware / Cera
46	P.VC. Closet Seat Cover	Parryware / Hindware / Cera / Prayag
47	P.V.C. Connector Pipe	Prayag
48	P.V.C. Ball Cock	Prayag
49	P.V.C. Bib Cock / Stop Cock/ Angular Stop Cock / Pillar Cock	Prayag
50	P.V.C. Waste & Sanitary Fittings	Prayag
51	Polycarbonate Sheets	GE / Macrolux / Polytechno / Danpalon
52	UPVC Doors / Windows	Fenesta, Aluplast, Lingel, Shuco, Winpro, Rehau
53	Factory made panel door shutter	Wooden Design — Bangalore, Shankar Ramchandra& Joinery Manufacturer
54	Masonite Wooden Panel Doors	Kutty flush doors, Sejpal& others
55	FRP Door Shutter	Advance FRP & House of Doors
56	Block Board	Wood India — Calcutta, Sejpal& others Pioneer Timber Products, Chandigarh, Northern Door
57	Ply Wood	Indian Plywood Mfg. Ltd., Kitply, Century Plywood, Nuboard& Nashik Plywood Industries
58	Flush Door	Green Ply, Century Ply
59	Pre Laminated & Plain Particle Boards	NOVAPAN, Anchor
60	Glass for Doors / Windows	Modi Guard, Continental, Emirates, Saint Gobain, Asahi &Sejal
61	Plain Glass Mirror	M/s Modi Float Glass, Eagle, Atul, Saint Gobain, Asahi
62	Sanitary Wares	M/s Parryware, Hindustan, Cera, Neycer
63	C.P. Brass Fittings & Fixtures	GEM, Techno, Lalsons KINGSTON, JAGUAR, Metro, ESSCO, MARC
64	C.P. Brass Coupling and Bottle Trap	ESSCO, GEM, Kingston, Jaguar, Metro, Marc
65	C.I. Flushing Cistern	Mis A-1 (J.S.), HJN, JAMCO, Neco, HIF
66	C.I. Pipe & Fittings	NECO / BIC / D.N.Sinha / AMC / ALC
67	Gun Metal Wheel Valve	Zoloto / Alto / Leader
68	C.P. BRASS Urinal Waste & Flush pipes	Orient, PARKO, Elite, Jaguar &Metro
69	Plastic Sheet & Cover	M/s Commander, Diplomat, Admiral, Patel, Champion, Parryware&Hindvvare
70	S.S. Sink	Diamond, Niraii, Parryware / Cera
71	G.I. Pipes	TATA, Jindal
72	G.I. Finings	PEG, MJM, Sims!, R-Brand, UNIK, Plumb Well, HB / R
73	G.M. Gate / Globe Valves	Nets, SANT, M/s Leader Valves, Zoloto
74	Copper ball Valve	Techno, M/s GEM, ESSCO, Leader, A-1 JS

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75	Air Valve	Leader, Sant, HAWN M/s Kirloskar
76	Water Meter	Capstan, Keycee, Paramount
77	Sluice Valves	Kirloskar, Minoti, ESSCO & Burn, Hawa
78	CI water quality pipes	Deem) steel castings, Jindal, Lanco
79	Cast Iron Valves	Kirloskar, Leader, HAWA
80	C.1. Soil Quality pipes	NECO, BC, $RIFCO_3$ ASP, A-1, PARAS, HIF, Kajeriwal
81	S.W. Pipes & Gully Trap	Perfect, Kashrnira, BURN, RK, ANAND, ISI marked
82	RCC Hume Pipes	Mis Indian Hume Pipes, Pranali, Cement pipe, Ghambir, Kore Cement confirm to ISI
83	HDPE Pipes & HDPE fittings	Prince, Gautam M/s Hastil, Sangir pipes, Supreme
84	RCC frame, covers & SFRC	M/s Pratibha, Bharath, Vikrant
85	PIG LEAD	M/s Hindustan Zinc Ltd.
86	CL frame & covers	RIFCO, NECO, PARAS, A-1, M/s. Ashok Iron, Foundry, HIF
87	CPVC, UPVC, SWR Pipes	Finolex, Prince & Supreme
88	Poly Propylene — R Pipes	Supreme &Sakthi Polymers
89	PVC Plastic High / Low level cistern	Commander, Elite Dual, Champion, Parryware-similine, Hindware
90	PVC Inlet connection & Waste Pipes	Kohinoor, ECCSO, GEM & Elite
91	CP Brass towel rods and accessories	Elite, GEM, Jacquar, ESSCO
Electrical Items		
1	FRLS wire 1.1 KV	Finolex, Havells, RR cable
2	PVC pipe (MMS)	Presto Plast/ Precision/ Polycab
3	Switch/ Socket/ Regulator/ Blanking plate/ Modular box	Legrand (Myrius range)/ Crabtree Thames platinum range/ Wipro (Nowa)
4	3-pole ceiling rose/ holder/ Call bell	Anchor/ SSK
5	GI pipe	TATA (medium)/ Bansal (Medium)/ Jindal
6	Brass Compression Gland	ARUN Make/ Jonson/ 3M
7	All Lug	Dowell's / Jonson/ 3M
Telephone work Items		
1	Perforated powder coated MS cable trays	ISI Approved
2	Metal box with Phenolic Laminated sheet	ISI Approved
3	Multicore Telephone Cable	Finolex/ Havells/ Delton
4	PVC Conduit pipe and PVC pipe	Precision
5	Modular MS Box with front plate outlet No.1 RJ-11	Crapree/ Legrand
Air-conditioning Items		
1	Fans	Kruger / Nicotra/ Greenheck/ Systemair
2	GSS sheet	Sail/ Tata/ Jindal
3	Control Cables	Finolex/ Polycab/ RR Kabel/ Havells /KEI.
4	Power Cables	Finolex/ Polycab/ RR Kabel/ Havells /KEI.
5	Grilles/ Fire dampers/ VCD	Caryaire/ Dynacraft / Systemair/ Air master
6	LT Panel	EAP/ System Syndicate/ Power and Control / RNG / Rayco/System Dynamic/ TTS Systematics
7	Cable Tray	OBO/Profab/Legrand
8	Motor	ABB/SIEMENS/CGL
9	Fire rated Canvass	Cori / Resistoflex/ Easyflex
10	Spring Isolator	Cori / Resistoflex/ Easyflex

Note: For items not covered in the above list or in case of non-availability of preferred make of any item listed above, the make / brand to be used in the work, should have prior approval from the Engineer-In-Charge.

Signature and Seal of Contractor_____

30 PARTICULAR CONDITIONS & TECHNICAL SPECIFICATION

Indian Institute of Technology (IIT) Kharagpur, intends to retrofit exhaust system for kitchen for Patel, RK, SNIG, SAMS, Gokhel & RLHR hall.

Patel Hall of Residence
Radha Krishnan (RK) Hall
Gokhel Hall of Residence
SAMS Hall of Residence
SN/IG Hall of Residence
RLB Hall of Residence
The detailed site report is mentioned as under.

2.0 VENTILATION SYSTEM

2.1 DESIGN PARAMETERS

DESIGN PARAMETER FOR SELECTION OF VENTILATION FAN AND ITS COMPONENTS SHALL BE:

Maximum face velocity across pre filters	:	1.78 m/sec (350 fpm)
Maximum fan outlet velocity	:	9.14 m/sec (1800 fpm)
Maximum fan speed	:	
a. Fan above 450 mm dia	:	1000 RPM
b. Fan up to and including 450 mm dia	:	1450 RPM
Maximum fan motor speed	:	1450 RPM

2.2 DESIGN PARAMETER FOR DUCT DESIGN SHALL BE:

Maximum flow velocity in ducts for air conditioning	:	7.5 m / sec (1500 fpm)
Maximum flow velocity in ducts for ventilation in pump room, boiler room, generator room, toilet exhaust & Kitchen exhaust.	:	7.5 m / sec – 12.5 m / Sec (1500 – 2500 FPM)
Maximum friction	:	0.65 Pa / M run (0.08 inch WG/100 ft run)

2.3 VENTILATION FAN

Max fan outlet velocity for fan upto 450 mm dia	:	9.14 m/sec (1800 fpm)
Max fan outlet velocity for fan above 450 mm dia	:	12 m/sec (2400 fpm)
Maximum fan speed for fans upto 450 mm dia	:	1450 RPM

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3.1 PATEL HALL

1) Type 1 Canopy hood = 3800 CFM
2) Type 1 Double Island hood = 9000 CFM
3) Dish Wash= 550 CFM
4) Chapati station= 4000 CFM

The External static pressure for the Island hood shall be 30 mm.

The following points need to be taken care while retrofitting the said projects-

1) All the fans are to be installed as per the air flow capacity and static pressure required.
2) AMCA certified fan certified on both noise and performance would be recommended.
3) Damper to be installed for balancing in each spigot and at the fan suction.
4) Grease trap to be provided for cleaning.
5) As the Baffle filters have a series of vertical baffles designed to capture grease and drain it into a container. The filters are arranged in a channel or bracket for easy insertion and removal for cleaning. Filters are to be cleaned by running them through a dishwasher or by soaking and rinsing.
6) Any large change in dimension of the duct area to be avoided and re installed.
7) Fan for Chapati Station and Dish wash are to be installed.
8) All the ducting joint shall be sealed using asbestos gasket
9) Ducting are to leak tested as per IS code.
10) Direction and orientation of the fan are to selected considering air flow direction.
11) The motor of the fans shall be outdoor type with IP 65 protection.
12) **Necessary Civil modification works like wall opening/ setting right after work done/ Civil support if any required, painting etc shall be done the HVAC contractor.**

3.2 RK HALL

The capacities of fan shall be - 8000 CFM -1# and 3750CFM- 1#.

The total static pressure for the first canopy hood shall be 30 mm. This indicated static pressure is calculated considering external losses only.

The following points need to be taken care while retrofitting the said projects-

1. All the fans are to be replaced as per the air flow capacity and static pressure required.
2. AMCA certified fan certified on both noise and performance would be recommended.
3. All the filters of hoods to be replaced as the same have been choked.
4. All ducting need to be replaced by new duct work as there is no provision of cleaning in existing ducting.
5. Damper to be installed for balancing in each spigot and at the fan suction.
6. Grease trap to be provided for cleaning.
7. All the ducting joint shall be sealed using asbestos gasket
8. Ducting are to leak tested as per IS code.
9. Direction and orientation of the fan are to selected considering air flow direction.
10. The motor of the fans shall be outdoor type with IP 65 protection.
11. **Necessary Civil modification works like wall opening/ setting right after work done/ Civil support if any required, painting etc shall be done the HVAC contractor.**

3.3 SNIG/SAMS/GOKHEL/RLHR HALL

ANNEXURE – I: Existing Kitchen Hood details
ANNEXURE – II: Analysis & Equipment selection
ANNEXURE – III: Description & Scope of Works

ANNEXURE – I

EXISTING KITCHEN HOOD DETAILS:

Parameters	SNIG	SAMS	Gokhale	RLHR
Kitchen hood	4 Filter set- 3 nos 2 Filter set- 1 no	3 Filter set- 1 no 2 Filter set- 3 nos	4 Filter set- 1 no 3 Filter set- 2nos	4 Filter set- 2nos 2 Filter set- 2nos
Room Size	8400MM x 8400MM	9600MM x 4200MM	13200MM x 3600 MM	12000MM x 15000MM
Duct Size	550MM x 350MM	550MM x 300MM	550MM x 300MM	550MM x 450MM

ANNEXURE – II

ANALYSIS & EQUIPMENT SELECTION:

In reference to the Annexure – I: Existing Kitchen Hood Details, the detailing needs to be done for following points:

1) Existing Kitchen Hood Arrangements at each location remains unaltered.

2) Based on the Kitchen Hood redesigning needs to be done and ducting can be modified accordingly. Fan also shall be selected accordingly.

3) Minimum requirement of Fan shall be as under:
   a) Should be SISW Centrifugal Type
   b) Fan should be AMCA certified for performance
   c) Fan motor should be belt driven 4pole IE3 type.
   d) Fan Air Qty. to be derived with 35 air changes.
   e) Fan Static Pressure to be considered sufficient.

Total Air Flow requirement for each Kitchen:

	SNIG	SAMS	Gokhale	RLHR
Total Hood Area	3 X 2130 X 900 + 1 X 1070 X 900 = 5.75 + 0.96 = 6.71 SqM = 72.226 SqFt.	1 X 1880 X 900 + 3 X 1070 X 900 = 1.69 + 2.89 = 4.58 SqM = 49.299 SqFt.	1 X 2130 X 900 + 2 X 1880 X 900 = 1.92 + 3.38 = 5.3 SqM = 57.049 SqFt.	2 X 2130 X 900 + 2 X 1070 X 900 = 3.83 + 1.93 = 5.76 SqM = 62 SqFt.
Total Appliance	7 X 600 X 600 = 2.52 SqM	4 X 600 X 600 = 1.44 SqM	5 X 600 X 600 = 1.8 SqM	6 X 600 X 600 = 2.16 SqM

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Area	= 27.125 SqFt.	= 15.5 SqFt.	= 19.375 SqFt.	= 23.25 SqFt.
	Considering Burners – Light Duty Section (Gas & Electric Ovens) Thermal Updraft Velocity = 50fpm			
Total Air Qty.	= Total Hood Area X Thermal Updraft Velocity			
	72.226 X 50 = 3611.3 CFM	49.299 X 50 = 2464.95 CFM	57.049 X 50 = 2852.45 CFM	62 X 50 = 3100 CFM
	Considering an overall margin of 15% for Fan losses and 5% Design considerations = 20% Margin			
	4350 CFM	3000 CFM	3500 CFM	3750 CFM
Recommended Duct Size	Considering Duct Velocity as 1200FPM (Approx. 100Ft. length) + 2No.s bends + 2No.s Duct Damper + 1No. Baffle pressure loss			
	1100 X 350	700 X 350	850 X 350	900 X 350
Static Pressure considered	30mm WC	30mm WC	30mm WC	30mm WC

The following points need to be taken care while retrofitting the said projects-

1. All the fans are to be replaced as per the air flow capacity and static pressure required.
2. AMCA certified fan certified on both noise and performance would be recommended.
3. All the filters of hoods to be replaced as the same have been choked.
4. All ducting need to be replaced by new duct work as there is no provision of cleaning in existing ducting.
5. Damper to be installed for balancing in each spigot and at the fan suction.
6. Grease trap to be provided for cleaning.
7. All the ducting joint shall be sealed using asbestos gasket
8. Ducting are to leak tested as per IS code.
9. Direction and orientation of the fan are to selected considering air flow direction.
10. The motor of the fans shall be outdoor type with IP 65 protection.
11. **Necessary Civil modification works like wall opening/ setting right after work done/ Civil support if any required, painting etc shall be done the HVAC contractor.**

1. <u>Scope not considered in AC system:</u>

In reference to the above, the HVAC vendor shall only be responsible for the scope of work considered in BOQ. Remaining items and support services are required from other agencies are listed below (excluded from HVAC vendor's scope):

Any False-ceiling/ Electrical/ Fire-Fighting/Carpentry job not included in the scope of our offer, other than what is mentioned.

Provision of necessary input electrical power supply (415 V +/- 10%, 3 Phase, 4 wire, AC) with necessary proper earthing.

Necessary Civil modification works like wall opening/ setting right after work done/ Civil support if any required, painting etc.

Signature and Seal of Contractor_____

TECHNICAL SPECIFICATIONS

CENTRIFUGAL FAN

1. FANS

1.1 SCOPE

The scope of this section comprises the supply, erection, testing and commissioning of centrifugal, in-line and propeller type fans and roof mounted units conforming to these Specifications and in accordance with the requirement of Drawings and Schedule of Quantities.

TYPE

Centrifugal, in-line propeller fans and roof mounted units shall be of the type as indicated on Drawings and identified in Schedule of Quantities.

CAPACITY

The air-moving capacity of fans shall be as shown on Drawings and in Schedule of Quantities.

FAN WHEEL& MOTOR

The fan wheel shall be of the non-overloading single width backward inclined centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
Fan wheel shall be manufactured with continuously welded steel blades and coated with a minimum of 2-4 mils of (Polyester Urethane), electrostatically applied and baked. Finish color shall be RAL-7023, concrete grey.
The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

The fan and motor assembly must comply with UL/cUL 762, Power Ventilators for Restaurant Exhaust Appliances – All fans not entirely welded shall be UL 762 rated for outdoor use only. Drain connections and access doors shall be provided.

All fans UL 762 listed shall be in the upblast orientation.

Fans shall UL listed as “Power Ventilators for Smoke Control Systems” (by maximum temperature for a minimum number of hours of operation) for 300°C maximum temperature for a minimum of 2 hours of operation

The UL Power Ventilators for Smoke Control sticker shall be fixed to the fan housing.

CENTRIFUGAL FAN

Centrifugal fan shall be DWDI / SWSI Class I construction arrangement 3 (i.e. bearings on both the sides) for DWDI fans complete with access door, squirrel-cage induction motor, Vbelt drive, belt guard and vibration isolators, direction of discharge / rotation, and motor position shall be as per the Approved-for-Construction shop drawings.

a. Housing shall be constructed of 14 gage sheet steel welded construction. It shall be rigidly reinforced and supported by structural angles. Split casing shall be provided on larger sizes of fans, however neoprene / asbestos packing should be provided throughout split joints to make it air-tight. 18 gauge galvanized wire mesh inlet guards of 5 cm sieves shall be provided on both inlets. Housing shall be provided with standard cleanout door with handles and neoprene gasket. Rotation arrow shall be clearly marked on the housing.

b. **Fan Wheel shall be backward-curved non-over loading type. Fan wheel and housing shall be statically and dynamically balanced. For fans upto 450 mm dia, fan outlet velocity shall not exceed 550 meter/minute and maximum fan speed shall not exceed 1450 rpm. For fans above 450 mm dia, the outlet velocity shall be within 700 meter/minute and maximum fan speed shall not exceed 1000 RPM. High static pressure fan speed shall be as per manufacturer.**

c. Shaft shall be constructed of steel, turned, ground and polished.

d. Bearings : shall be of the sleeve / ball-bearing type mounted directly on the fan housing. Bearings shall be designed especially for quiet operation and shall be of the self-aligning, oil / grease pack pillow block type.

e. Motor : Fan motor shall be energy efficient and suitable for 415±10% volts, 50 cycles, 3 phase AC power supply, squirrel-cage, totally enclosed, fan-cooled motor, provided with class F insulation, and of approved make. Motor name plate horsepower shall exceed brake horsepower by a minimum of 20%. Motor shall be designed especially for quiet operation and motor speed shall not exceed 1440 rpm. The fan and motor combination selected for the particular required performance shall be of the most efficient (smallest horse power), so that sound level is lowest.

Motors shall meet or exceed EISA (Energy Independence and Security Act) efficiencies. Motors to be 1500 or 2900 RPM, Open Drip Proof (ODP) with a 1.15 service factor.
Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.
Air Handling Quality bearings to be designed with low swivel torque to allow the outer race of the bearing to pivot or swivel within the cast pillow block. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration.
Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class {Average Life or (L-50) of 400,000 hours} Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
Bearings shall have Zerk fittings to allow for lubrication.

RELATED SECTIONS
All sections, drawing plans, specifications and contract documents

REFERENCES

ANSI/AMCA Standard 99-10, “Standards Handbook”
ANSI/AMCA Standard 204-05, “Balance Quality and Vibration Levels for Fans”
ANSI/AMCA Standard 210-07, “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating”
AMCA Publication 211-05, “Certified Ratings Program – Product Rating Manual for Fan Air Performance”
AMCA Standard 300-08, “Reverberant Room Method for Sound Testing of Fans”
AMCA Publication 311-05, “Certified Ratings Program – Product Rating Manual for Fan Sound Performance”
AMBA - Method of Evaluating Load Ratings of Bearings ANSI-11 (r1999).
AMCA Standard 500-D-12, “Laboratory Methods of Testing Dampers for Rating”
OSHA guideline 1910.212 – General requirements for Machine Guarding. (www.osha.gov)
OSHA guideline 1910.219 – General requirements for guarding safe use of mechanical power transmission apparatus. (www.osha.gov)
OSHA guideline 1926.300 – General requirements for safe operation and maintenance of hand and power tools. (www.osha.gov)
UL/cUL 705, Power Ventilators

HP	POWER FACTOR			EFFICIENCY		
	FL	3/4L	1/2L	FL	3/4L	1/2L
0.50	0.71	0.62	0.50	73.00	73.00	68.00
0.75	0.74	0.64	0.50	78.00	78.00	70.00
1.00	0.76	0.67	0.55	82.50	82.50	77.00
1.50	0.77	0.70	0.57	83.80	83.80	80.00
2.00	0.77	0.70	0.57	85.00	85.00	81.00
3.00	0.82	0.74	0.60	86.40	86.40	84.00
5.00	0.82	0.78	0.63	88.30	88.30	86.00
7.50	0.85	0.80	0.71	89.50	88.50	88.00
10.00	0.86	0.83	0.76	90.30	90.30	89.00
12.50	0.84	0.82	0.73	90.50	90.50	88.00
15.00	0.85	0.83	0.76	91.50	91.50	89.50
20.00	0.85	0.83	0.76	92.20	92.20	91.00
25.00	0.85	0.82	0.76	92.40	92.40	91.00
30.00	0.85	0.80	0.72	92.80	92.80	92.00
40.00	0.86	0.85	0.80	93.20	93.20	91.00
50.00	0.87	0.85	0.77	93.60	93.60	91.60
60.00	0.88	0.86	0.78	93.90	93.90	91.90
75.00	0.87	0.85	0.78	94.20	94.20	92.80

f. Drive to fan shall be provided through belt with adjustable motor sheave and a standard belt guard. Belts shall be of the oil-resistant type.

g. Vibration Isolation: MS base shall be provided for both fan and motor, built as an integral part, and shall be mounted on a concrete foundation through Cori/resistoflex/Easflex vibration isolators. The concrete foundation shall be atleast 15 cm above the finished floor level, or as shown in approved-for-construction shop drawings.
a. Centrifugal fans for smoke extract application shall have external belt drive and motor. Fan & casing shall be internally rated for 300oC for 2 hours.

Signature and Seal of Contractor_____

1.2 AXIAL FLOW FAN

1.2.1 Axial Flow Fan (Standard)

Fan shall be complete with motor, motor mount, belt driven (or direct driven) and vibration isolation type, suspension arrangement as per approved for construction shop drawings.

a. Casing : shall be constructed of heavy gage sheet steel. Fan casing, motor mount and straightening vane shall be of welded steel construction. Motor mounting plate shall be minimum 15 mm thick and machined to receive motor flange. An inspection door with handle and neoprene gasket shall be provided. Casing shall have flanged connection on both ends for ducted applications. Fan casing are with internal punched inlet and outlet flanges to prevent air leakage, for size upto 1600 mm dia and shall be constructed of rolled steel with a continuous seam welded.Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bonderized, primed (minimum 2 coats of rust-proof primer) and finish coated with enamel paint or powder coated after phosphating process.

b. Rotor : hub and blades shall be cast aluminium alloy or cast steel construction. Blades shall be die-formed aerofoil shaped for maximum efficiency and shall vary in twist and width from hub to tip to effect equal air distribution along the blade length. Rotor shall be statically and dynamically balanced. Extended grease leads for external lubrication shall be provided. The fan pitch control may be manually readjusted at site upon installation, for obtaining actual air flow values, as specified and quoted. Taper lock bushing shall be used to mount the propeller to the motor shaft. The impeller and fan casing shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

c. Motor: shall be energy efficient squirrel-cage, totally-enclosed, fan cooled, standard frame, constant speed, continuous duty, single winding, suitable for 415±10% volts, 50 cycles, 3 phase AC power supply, provided with class `F' insulation. Motor shall be specially designed for quiet operation. The speed of the fans shall not exceed 1000 RPM for fans with impeller diameter above 450 mm, and 1440 RPM for fans with impeller diameter 450 mm and less. For lowest sound level, fan shall be selected for maximum efficiency or minimum horsepower. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible metal conduit.

HP	POWER FACTOR			EFFICIENCY		
	FL	3/4L	1/2L	FL	3/4L	1/2L
0.50	0.71	0.62	0.50	73.00	73.00	68.00
0.75	0.74	0.64	0.50	78.00	78.00	70.00
1.00	0.76	0.67	0.55	82.50	82.50	77.00
1.50	0.77	0.70	0.57	83.80	83.80	80.00
2.00	0.77	0.70	0.57	85.00	85.00	81.00
3.00	0.82	0.74	0.60	86.40	86.40	84.00
5.00	0.82	0.78	0.63	88.30	88.30	86.00
7.50	0.85	0.80	0.71	89.50	88.50	88.00
10.00	0.86	0.83	0.76	90.30	90.30	89.00
12.50	0.84	0.82	0.73	90.50	90.50	88.00
15.00	0.85	0.83	0.76	91.50	91.50	89.50
20.00	0.85	0.83	0.76	92.20	92.20	91.00
25.00	0.85	0.82	0.76	92.40	92.40	91.00
30.00	0.85	0.80	0.72	92.80	92.80	92.00
40.00	0.86	0.85	0.80	93.20	93.20	91.00
50.00	0.87	0.85	0.77	93.60	93.60	91.60
60.00	0.88	0.86	0.78	93.90	93.90	91.90
75.00	0.87	0.85	0.78	94.20	94.20	92.80

Drive : to fan shall be provided through belt drive with adjustable motor sheave and standard sheet steel belt guard with vented front for heat dissipation. Belts shall be of oil-resistant type.

e. Vibration Isolation : The assembly of fan and motor shall be suspended from the slab by vibration isolation suspension of heavy duty spring isolators type.

f. Accessories : The following accessories shall be provided with all fans :
i. Outlet cone for static pressure regain.
ii. Inlet cone.

Fan silencers may be provided where specifically called for in Schedule of Quantities. Fans shall be factory assembled and shipped with all accessories factory-mounted.
Axial Flow Fan shall be AMCA certified for Air and Sound performance in accordance to AMCA 210 and AMCA 300. Fan shall be suitable for both indoor and outdoor application with all accessories. Base fan performance shall be at standard conditions (density 1.2 Kg/Cu.mt.)
1.2.2 Axial Flow Fan (UL Listed)

Fan shall be suitable for mounting in duct or wall / floor / slab as required. Fan shall be complete with motor, motor mount, belt driven (or direct driven) and vibration isolation type, suspension arrangement as per approved for construction shop drawings.

a. Casing : shall be constructed of heavy gage sheet steel. Fan casing, motor mount and straightening vane shall be of welded steel construction. Bolt construction is not acceptable. Motor mounting plate shall be of structural steel with minimum 15 mm thick and suitable to handle the weight of the motor and propeller, machined to receive motor flange. An inspection door with handle and neoprene gasket shall be provided. Casing shall have flanged connection on both ends for ducted applications. Fan casing are with internal punched inlet and outlet flanges to prevent air leakage, for size upto 1600 mm dia and shall be constructed of rolled steel with a continuous seam welded confirming to UL standards. Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for

maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bonderized, primed (minimum 2 coats of rust-proof primer) and finish coated with
enamel paint or powder coated after phosphating process as prescribed in UL-705.

b. Rotor : hub and blades shall be cast aluminum alloy or cast steel construction. Blades shall be die-formed aerofoil shaped for maximum efficiency and shall vary in twist and width from hub to tip to effect equal air distribution along the blade length. Rotor shall be statically and dynamically balanced. Extended grease leads
for external lubrication shall be provided. The fan pitch control may be manually readjusted at site upon installation, for obtaining actual air flow values, as specified and quoted. Taper lock bushing shall be used to mount the propeller to the motor shaft. The impeller and fan casing shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

c. Motor: shall be energy efficient squirrel-cage, totally-enclosed, fan cooled, standard frame, constant speed, continuous duty, single winding, suitable for 415±10% volts, 50 cycles, 3 phase AC power supply, provided with class `F' insulation. Motor shall be specially designed for quiet operation. The speed of the fans shall not exceed 1000 RPM for fans with impeller diameter above 450 mm, and 1440 RPM for fans with impeller diameter 450 mm and less. For lowest sound level, fan shall be selected for maximum efficiency or minimum horsepower. Motor shall pass elevated temperature test and other tests as per UL standards and shall be UL listed. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible liquid tight PVC conduit confirming to UL standards.

HP	POWER FACTOR			EFFICIENCY		
	FL	3/4L	1/2L	FL	3/4L	1/2L
0.50	0.71	0.62	0.50	73.00	73.00	68.00
0.75	0.74	0.64	0.50	78.00	78.00	70.00
1.00	0.76	0.67	0.55	82.50	82.50	77.00
1.50	0.77	0.70	0.57	83.80	83.80	80.00
2.00	0.77	0.70	0.57	85.00	85.00	81.00
3.00	0.82	0.74	0.60	86.40	86.40	84.00
5.00	0.82	0.78	0.63	88.30	88.30	86.00
7.50	0.85	0.80	0.71	89.50	88.50	88.00
10.00	0.86	0.83	0.76	90.30	90.30	89.00
12.50	0.84	0.82	0.73	90.50	90.50	88.00
15.00	0.85	0.83	0.76	91.50	91.50	89.50
20.00	0.85	0.83	0.76	92.20	92.20	91.00
25.00	0.85	0.82	0.76	92.40	92.40	91.00
30.00	0.85	0.80	0.72	92.80	92.80	92.00
40.00	0.86	0.85	0.80	93.20	93.20	91.00
HP	POWER FACTOR			EFFICIENCY		
	FL	3/4L	1/2L	FL	3/4L	1/2L
50.00	0.87	0.85	0.77	93.60	93.60	91.60
60.00	0.88	0.86	0.78	93.90	93.90	91.90
75.00	0.87	0.85	0.78	94.20	94.20	92.80

d. Drive : Fan shall be provided through direct / belt drive with adjustable motor sheave and standard sheet steel belt guard with vented front for heat dissipation. Belts shall be of oil-resistant type.
e. Vibration Isolation : The assembly of fan and motor shall be suspended from the slab by vibration isolation suspension of heavy duty spring isolators type.

f. Accessories : The following accessories shall be provided with all fans :
i. Outlet cone for static pressure regain.
ii. Inlet cone.

Fan silencers may be provided where specifically called for in Schedule of Quantities. Fans shall be factory assembled and shipped with all accessories factory-mounted confirming to UL standards. *Complete fan assembly (fan, impeller, fan casing, motor base frame along with motor) shall be ensure mechanical, electrical, water safety as per UL standards. Axial Flow Fan shall be AMCA certified for Air and Sound performance in accordance to AMCA 210 & AMCA 300 and shall be UL listed in accordance with UL 705 for both indoor*
and outdoor application with all accessories. Base fan performance shall be at standard conditions (density 1.2 Kg/Cu.mt.)

Signature and Seal of Contractor_____

1.2.2 Axial Flow Fan (for Fire, Smoke and Heat exhaust)

Fan shall be suitable for mounting in duct or wall / floor / slab as required. Fan shall be complete with motor, motor mount, direct driven and vibration isolation type, suspension arrangement as per approved for construction shop drawings.

a. Casing : shall be constructed of heavy gage sheet steel and shall withstand 300°C for 2 hours. Fan casing, motor mount and straightening vane shall be of welded steel construction. Bolt construction is not acceptable. Motor mounting plate shall be of structural steel with minimum 15 mm thick and suitable to handle the weight of the motor and propeller, machined to receive motor flange. An inspection door with handle and neoprene gasket shall be provided. Casing shall have flanged connection on both ends for ducted applications. Fan casing are with internal punched inlet and outlet flanges to prevent air leakage, for size upto 1600 mm dia and shall be constructed of rolled steel with a continuous seam welded.

Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bonderized, primed (minimum 2 coats of rust-proof primer) and finish with 2 coats of high temperature paint or powder coated after phosphating process.

b. Rotor : hub and blades shall be cast aluminium alloy or cast steel construction and shall withstand 300 °C for 2 hours. Blades shall be die-formed aerofoil shaped for maximum efficiency and shall vary in twist and width from hub to tip to effect equal air distribution along the blade length. Rotor shall be statically and dynamically
balanced. Extended grease leads for external lubrication shall be provided. The fan pitch control may be manually readjusted at site upon installation, for obtaining actual air flow values, as specified and quoted. The impeller and fan casing shall be carefully matched and shall have precise running tolerances for maximum
performance and operating efficiency.

c. Motor: shall be energy efficient squirrel-cage, totally-enclosed, fan cooled, standard frame, constant speed, continuous duty, single winding, suitable for 415±10% volts, 50 cycles, 3 phase AC power supply. Motor shall be specially designed for quiet operation. The speed of the fans shall not exceed 1000 RPM for fans with impeller diameter above 450 mm, and 1440 RPM for fans with impeller diameter 450 mm and less. For lowest sound level, fan shall be selected for maximum efficiency or minimum horsepower. Motor for emergency fire, smoke and heat ventilation shall certified according to standard BS EN 12101-3:2002 for 300 °C for 2 hours. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible liquid tight PVC conduit.

HP	POWER FACTOR			EFFICIENCY		
	FL	3/4L	1/2L	FL	3/4L	1/2L
0.50	0.71	0.62	0.50	73.00	73.00	68.00
0.75	0.74	0.64	0.50	78.00	78.00	70.00
1.00	0.76	0.67	0.55	82.50	82.50	77.00
1.50	0.77	0.70	0.57	83.80	83.80	80.00
2.00	0.77	0.70	0.57	85.00	85.00	81.00
3.00	0.82	0.74	0.60	86.40	86.40	84.00
5.00	0.82	0.78	0.63	88.30	88.30	86.00
7.50	0.85	0.80	0.71	89.50	88.50	88.00
10.00	0.86	0.83	0.76	90.30	90.30	89.00
12.50	0.84	0.82	0.73	90.50	90.50	88.00
15.00	0.85	0.83	0.76	91.50	91.50	89.50
20.00	0.85	0.83	0.76	92.20	92.20	91.00
25.00	0.85	0.82	0.76	92.40	92.40	91.00
30.00	0.85	0.80	0.72	92.80	92.80	92.00
40.00	0.86	0.85	0.80	93.20	93.20	91.00
50.00	0.87	0.85	0.77	93.60	93.60	91.60
60.00	0.88	0.86	0.78	93.90	93.90	91.90
75.00	0.87	0.85	0.78	94.20	94.20	92.80

d. Drive : Fan shall be provided through direct drive.
e. Vibration Isolation : The assembly of fan and motor shall be suspended from the slab by vibration isolation suspension of heavy duty spring isolators type.
f. Accessories : The following accessories shall be provided with all fans :
i. Outlet cone for static pressure regain.
ii. Inlet cone.

Quantities. Fans shall be factory assembled and shipped with all accessories factory-mounted.

Complete fan assembly (fan, impeller, fan casing, motor base frame along with motor) shall be tested and approved by Exova Warringtonfire in accordance BS EN 12101-3:2002 standard for "Powered Smoke & Heat Exhaust Ventilators for Smoke Control Systems" for 300°C temperature for 2 hours of operation. Axial Flow Fan shall be AMCA certified for Air and Sound performance in accordance to AMCA 210 and AMCA 300. Fan shall be suitable for both indoor and outdoor application with all accessories. Base fan performance shall be at standard conditions (density 1.2 Kg/Cu.mt.)

Signature and Seal of Contractor_____

2.IN LINE FAN

IN LINE FAN (RETANGULAR):-

The Rectangular type Inline fan shall be of class-1 construction, complete with motor, motor mount, direct driven (or belt driven) and vibration isolators, inspection/access door, suspension arrangement as per approved for construction shop drawings.

1.The fan section shall be of single skin cabinet type shall be constructed of heavy gauge Galvanized steel sheet with necessary access door and flanged connection on both inlet & outlet for ducted application. The cabinet shall be provided with necessary footings / bracket to support from ceiling or floor mounted.

2. Fan Wheel shall be forward / backward-curved type. Fan wheel and housing shall be statically and dynamically balanced. The fan outlet velocity shall not exceed 10m/sec. For fans up to 450mm dia., maximum fan speed shall not exceed 1500 rpm. For fans above 450mm dia. the maximum fan speed shall not exceed 1000 RPM. High static pressure fan speed shall be as per manufacturer.
3. The fan motor shall be of 230V +/-10% volts, 50hz, 1phase AC power supply for below 1.0kw motor and shall be suitable for 415+/-10% volts, 50 cycles, 3 phase AC power supply for 1.0kw & above capacity, The motor shall be squirrel-cage, totally enclosed, air over motor (or fan- cooled motor if motor is out of air stream), provided with class-F insulation, and of approved make. Motor name plate horsepower shall exceed brake horsepower by a minimum of 15%. The starting torque of the motor also to be taken care while selecting. The fan and motor combination selected for the particular required performance shall be of the most efficient, low energy consumption and low noise level. All the motors should be of IP-55 protections and above as required.

4. The single phase fan shall be of direct driven and the 3phase shall be of belt driven type. The Belt driven fan shall be provided with V-Belts, Pulleys, and Belt Guard. Belts shall be of the Oil- resistant type. The number of groove should be of minimum two (2) numbers to prevent start up failure and pre mature belt failure.

5. The fan inlet and outlet shall be connected to the sheet metal ducting by mean of 100mm length fire retardant, weather proof flexible connections.

6. The fan noise level shall not exceed 65dba at 1m from the equipment of normal application.

IN LINE FAN (CIRCULAR):-

The Circular Inline fan shall complete with casing, impeller, motor, back draft damper etc., The fan casing shall be constructed of pressed heavy gauge Galvanized steel sheet or tough reinforced plastic or equivalent finished with tough epoxy painting. The impeller with motor shall be housed inside the circular casing. The fan motor shall be suitable for 230V +/-10% volts, 50 Hz, 1phase AC power supply with minimum class B insulation & IP 44 / 45 protections. The fan speed shall be of maximum 3000rpm. The fan should be selected for required low pressure class with low noise level. The fan should be provided with necessary supporting brackets.

3. VARIABLE FREQUENCY DRIVES FOR HVAC SYSTEMS

3.1 GENERAL REQUIREMENTS

3.1.1 This specification covers complete variable frequency drives (VFDs) designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD.
3.1.2 The frequency converter shall not be a general purpose product, but a dedicated HVAC engineered product.
3.1.3 The VFD and its options shall be factory mounted and tested as a single unit under full load before dispatch.

3.1.4 The VFD shall be tested to UL 508C. The appropriate UL label shall be applied.
3.1.5 The VFD shall be CE marked and conform to the European Union Electro Magnetic Compatibility directive.
3.1.6 The VFD shall be UL listed for a short circuit current rating of 100 kA and labeled with this rating.

1.2 TECHNICAL REQUIREMENTS

3.2.1 The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate theneed for motor de-rating.

VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
3.2.2 The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.
3.2.3 VFD shall be with chokes / harmonic filters so as to maintain TH id as per (IEEE519, 1992) as indicated in Schedule of Quantity.
3.2.4 IEEE519, 1992 recommendations shall be used for the basis of calculation of total harmonic distortion (THD) at the point of common coupling (PCC). On request VFD manufacturer shall provide THD figures for the total connected load for project electrical single line diagram. Input information like transformer rating, impedance, short circuit current, short circuit impedance, cable sizes and lengths etc. shall be made available to VFD vendor. Cost of such analysis shall be included.
3.2.5 Unless specified otherwise, EMC Filters shall be provided (Integral or externally mounted) for all the Drive Ratings-Category C2 EMC Filters for complete compliance with EN 61800-3 to confirm to both Conducted (minimum 75 metres) and Radiated Emissions (minimum 75 metres).
If asked for in schedule of quantities, VFDs shall contain EMC Filters (Integral or externally mounted) to attenuate Radio Frequency Interference conducted to the AC power line to comply with the emission and immunity requirements of IEC 61800-3: 2004, Category C1 with 50m motor cable (unrestricted distribution).

The suppliers of VFDs shall include additional EMC filters if required to meet compliance to this requirement.

3.2.6 The VFD's full load output current rating shall meet or exceed the normal rated currents of standard IEC induction motors. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 180% of rated torque for up to 0.5 second while starting.
3.2.7 The VFD shall provide full motor torque at any selected frequency from 20 Hz to base speed while providing a variable torque V/Hz output at reduced speed. This is to allow driving direct drive fans without high speed de-rating or low speed excessive magnetization, as would occur if a constant torque V/Hz curve was used at reduced speeds. Breakaway current of 160% shall be available.
3.2.8 A programmable flux optimization / Automatic energy optimization selection feature shall be provided as standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.
3.2.9 The VFD must be able to produce full torque at low speed to operate direct driven fans.
3.2.10 Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.
3.2.11 Motor Identification algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.

3.2.12 Galvanic isolation shall be provided between the VFD's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.

3.2.13 VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. VFDs with fixed carrier frequency are not acceptable.
3.2.14 The VFD shall allow up to at least 100 meters of SWA (Single Wire Armour) cable to be used between the FC and the motor and allow the use of MICS (Mineral Insulated Copper Sheath) cable in the motor circuit for fire locations.

1.3 PROTECTIVE FEATURES

3.3.1 A minimum of Class 20 I2t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.
3.3.2 Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.
3.3.3 Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.
3.3.4 Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.
3.3.5 VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.
3.3.6 If the temperature of the VFD's heat sink rises and approaches safe working temperature limit, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.
3.3.7 In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.
3.3.8 The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.
3.3.9 Protect from output switching : The VFD shall be fully protected from switching a contactor / isolator at the output without causing tripping e.g.: for switching on/off the isolators of the AHU / ventilation fans / pumps near the motor with VFD in ON mode.
3.3.10 The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.
3.3.11 When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.

Air Distribution:

1. SHEET METAL DUCTING

TECHNICAL SPECIFICATIONS FOR SHEET METAL DUCTING WORKS(FABRICATION AS PER LATEST IS-655 STANDARDS)

1.1 Scope

The scope of this section comprises of supply, fabrication, installation and testing of all sheet metal ducts and supply, installation, testing and balancing of grilles and diffusers, in accordance with these specifications and the general arrangement shown in the drawings. The duct work will conform to IS standards/codes and relevant ASHRAE Guidelines. For this purpose it is contractors responsibility to arrange at site all necessary equipments like drilling machine, welding machine, etc. and necessary work force. The duct rates mentioned in the BOQ are inclusive of nuts, bolts, sheets, supports, gaskets etc. complete and duly installed.

1.2 Duct Material
The material for various application of air distribution ducting shall be as follows : -

Application	Material

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1) Air Conditioning.	Cold rolled sheets continuous galvanised with a zinc coating of 120GSM as per IS: 277 – 1977.
2) Supports & Duct Flanges.	Mild Steel Structural Steel Sections.
3) Gasket.	Foamed rubber.
4) Bonding	Mastic Sealant.

1.3 Duct Fabrication.

The ducts shall be fabricated from galvanised steel sheets (GSS) class VIII conforming to ISI:277 – 1962 (revised) or aluminum sheets conforming to IS:737 – 1955 (for aluminum ducts, if any). The thickness of the sheets should be as follows :

Thickness of Sheets for Rectangular Duct Construction.

Maximum Side	*Thickness of Sheets*	*Gauge*
Upto 750 mm.	0.63 mm	24
From 751 to 1500 mm	0.80 mm	22

1.4 All galvanized plain sheets shall be reasonably flat and free from twist. The zinc shall be clean, even and free from galvanised spots. Sheets shall not crack or peel during bending or fabrication. All sheets shall be procured from approved manufactures.

1.5. All ducts for air conditioning and ventilation shall be rectangular in cross section and fabrication in accordance with the following table.

Maximum Size. (mm)	Minimum Thickness (mm)	Transverse Joint.	Bracing.
Upto 300	0.63 (24 SWG).	S-Drive, Pocket or bar Slips on 2.5 m centers.	None.
301 to 600 601 to 750	0.63 (24 SWG)	S-Drive, Pocket or bar Slips on 2.5 m centers. S-drive, 25 mm pocket or 25 mm bar slips on 2.5 m centres.	None. 25X25X3 mm angles, 1.2 mm from joint.
751 to 1000 1001 ot 1500	0.80 (22 SWG)	Drive, 25 mm pocket or 25 mm bar slips on 2.5 m centres. 40X40X mm angle conn--ections, or 40 mm pocket bar slips with 35X3 mm bar reinforcing on 2.5 m centers.	25X25X3 mm angles, 1.2 mm from joint. 40x40X3 mm angles, 1.2 mm from joint.
1501 to 2250	1.00 (20 SWG).	40X40 mm angle connec--tions, or 40 mm pocket or 40 mm bar slips, 1 m maxi--mum center with 35 X 3 mm bar reinforcing.	40x40X3 mm diagonal angles or40X40X3 mm angles, 60 mm From joint.
2251 and above.	1.25 (18 SWG).	40X40 mm angle connec--tions, or 40 mm pocket or 40 mm bar slips, 1 m maxi--mum center with 35 X 3 mm bar reinforcing.	40x40X3 mm diagonal angles, or40X40X3 mm angles, 60 mm From joint.

1.6 All duct shall be fabricated and installed unless otherwise stated as per IS : 655 – 1963 with amendment – 1 (1971 edition.) Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight. The gauges, joints and bracing for sheet metal duct work shall further conform to the provisions as shown on the drawings. The internal ends of slip joints shall be made in the direction of air flow. Ducts larger than 1000 mm shall be cross-broken. Duct sections upto 1200mm length may be used with bracing angles omitted. Tapering angle should not

be more than 30°. Change in dimensions and shape of ducts shall be gradual. Curved elbows shall have a centre line radius equal to one and half of the duct. All Air turns of 45° or more shall be installed in all abrupt elbows and shall consist of curved metal blades or vanes arranged to permit the air to make the turns without appreciable turbulence. Guide vanes shall be fabricated out of 0.63 mm (24 SWG) thick G. S. sheets and equally spaced on side runner to be riveted /bolted to duct sheets. Guide vanes shall be securely fastened to prevent noise or vibration. GI splitter dampers complete with brass metal lever shall be installed at each bifurcation/trifurcation point of duct for proper flow of air quantity in each duct. Joints, seams sleeves, splitters, branches, take-offs and supports are to be as per duct details as specified.

1.7 **Duct Installations**

All ducts shall be installed as per the drawings and in strict accordance with approved for construction drawings prepared by the contractor. During the construction the contractor shall temporarily close duct openings with sheet metal covers / polyethylene sheets to prevent debris-entering ducts and maintains them clean.

All necessary allowances and provisions shall be made by the contractor for beams, pipes or other obstructions in the buildings, whether or not the same are shown on the drawings. Where it becomes necessary to avoid beams or other structural work, plumbing or other pipes and / or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained as approved or directed by the Architect/Consultants.

If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the required points by any path available, subject to the approval of the Architect/Consultants.

All duct work shall be of high quality approved galvanised steel sheet, guaranteed not to crack or peel on bending or fabrication of ducts.

All ducts shall be rigid and shall be supported from the ceiling / slab by means of MS Rods of 8 mm (3/8") dia with MS angles at the bottom as shown in the drawing. The rods shall be anchored to RC slab using Anchor/dash fasteners. A rubber gasket of 5 mm thickness shall be provided between duct and angle to avoid metal-to-metal contact and vibration. Double nuts will be provided under angle supports.

The hanger spacing for duct supporting shall be not more than 2 meter.

Where ducts touches with wall or ceiling or beams or columns or floor, a rubber gasket of 5 mm thickness shall be provided between them.

All flanges, bracing and supports are to be mild steel and are to be essentially given a coat of red oxide primer.

Fire retarding flexible canvas / Rexene connections not less than 100 mm and not more than 200 mm are to be fitted to the delivery of all IDU's.

1.8 Duct Supports.

Duct supports shall be as follows:

Duct Perimeter (mm)	Support.	Location.
Upto 1800	40 X 40 X 3 mm MS angle with 9 mm tie rod.	At Transverse Joints.
Over 1800 to 2500	40 X 40 X 6 mm MS angle with 12.5 mm tie rod.	At Transverse Joints.
Over 2500	50 X 50 X 6 mm MS angle with 15 mm tie rod.	At Transverse Joints.

1.13 Testing and Balancing

After completion of the installation of the complete air distribution system all ducts shall be tested for air leaks. All dampers of supply air diffuser and supply air grille shall be balanced as per user's requirements. The entire air distribution system shall be balanced using approved anemometer.

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1.14 Mode of Measurement.

All sheet metal ducting complete with duct supports, turning vanes, canvas connections erected in position shall be measured externally and paid per unit. All dampers shall be excluded in the duct area.
All manual control/splitter including Fire & Volume control damper sections with operations linkages, locking quadrant, sheet steel enclosure, frame, erection, supporting etc. shall be measured on the basis of quantity as mentioned in BOQ and will be paid as per unit rate.

TECHNICAL SPECIFICATIONS FOR DUCT AIR LEAK TESTING PROCEDURE

Scope: This document describes the Procedure of Duct Air Leak testing.

Apparatus: Duct Air leak tester, Connecting Pipes with Dummies.

Procedure:

1. Leakage testing is based on positive pressure mode.
2. Select a section of duct to go under test.
3. Seal the duct from both the sides & connect the test apparatus.
4. Start the test apparatus and with the variable speed regulator pressurize the duct test section to the required Duct class/ Static Pressure. - "Duct manometer" and Increase the speed with the speed regulator.
5. The Increase in pressure can be seen in the controller, now pressurize the duct test section to the required duct class/Static Pressure.
6. Let the system run for 5-10 minutes to stabilize.
7. Now it can be seen that the controller showing the Differential Pressure across orifice and Actual Leakage in CFM.
8. Calculate the allowable leakage (Lp) using the tables and charts of the specified standard.
   a. (Ref seal class table A--- V/s Pressure class – Derive a factor – Table B)
9. Note the readings "Differential Pressure "from the Orifice Manometers. (MM of WG)
10. Calculate the actual leakage (La) using the orifice table according to the orifice size.
11. Compare the actual leakage versus the allowable leakage. (Lp/La)
12. Actual leakage should be less than or equal to the allowable leakage. (La <Lp)
13. Take a print of the report.

Calculations:

- Allowable Leakage (Lp) (CFM) = Leakage Factor (Lf) *Duct surface area (A).
- For SMACNA Read "LF"- CFM/100 Sq ft from table A: Appendix E.1 in conjunction with table B.
- FOR DW 143 – read Lf- Ltr/Sq mtr- From Table C- UNIT Ltr/Sec/Sq mtr. (Convert unit ltr/Sec/Sq mtr to CFM / Sq Ft by multiplying with factor 0.1968)
- Air Flow Across the orifice---- $Q=21.8*K*(D2)^2* \sqrt{(\Delta P)}$

✓ Q--- Air Volume--- CFM.
✓ K—Coefficient of Air Flow.
✓ D2—Orifice Diameter.
✓ ΔP- pressure Differential – A sum of the total deflection of DP Transmitter.

Important Instructions:
1. The machine has two Air Pumps and Please start an individual Pump, by closing the valve of the other pump.

2. For Quick Pressurization of Duct use both pumps together.

3. Even with both the pumps, if the desired static is not maintained, please check the duct joints for leakage.

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4. Follow the Operating instructions given in the manual carefully to avoid accidents and Faulty operations

2.0 Volume Control Damper (VCD) & Duct damper

The Volume Control dampers & Duct Dampers shall be lever operated and complete with locking devices, which will permit the dampers to be adjusted and locked in any position, and clearly indicating the damper position.
The dampers shall be of splitter, butterfly or louver type. The damper blade thickness shall not be less than 1.25 mm (18 gauge).
Manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings.
Dampers and frames shall be constructed of 1.6 mm thick galvanised steel sheets and blades shall not be more than 225 mm wide.
For air balancing an opposed blade damper with quadrant and thumbscrew lock should be provided.
At the junction of each branch duct with main duct VCD's must be provided. At the delivery of all IDU's VCD's must be provided.
The dampers shall be of Extruded aluminium. Installation of VCD's shall be as per drawings.

3.0 Fire Damper

Dampers should be fusible link type as indicated in BOQ. Fire dampers shall be provided at the delivery of all IDU's.
The dampers shall be of multiple blade type. The blades shall be constructed with minimum 1.8 mm thick aluminium sheets. The frame shall be of 1.6 mm thick. Other materials shall include return spring, locking device and temperature sensor.
Installation of fire damper shall be as per drawings.

4.0 Standard Grilles and diffusers

The supply and return air grille/diffuser shall be fabricated from extruded aluminium sections of thickness not less than 1.5 mm. The supply air grille/diffuser shall have single / double louvers. The front horizontal louvers shall be of adjustable type. The rear vertical louvers shall be of aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers.The damper blades shall also be of extruded aluminium. The grille flange shall be fabricated out of aluminium-extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

The ceiling type square/circular diffusers shall be of aluminium-extruded section with flush or step down face.All supply diffusers shall be provided with extruded aluminium dampers, with arrangement for adjustment from the bottom. (The centre portion should be spring loaded for easy removal and fitting).

All grilles and diffuser shall be epoxy powder coated of 15 Micron in approved colour. Diffuser and grille shall be installed as per drawings. The linear grilles shall be provided with End Pieces at ends.

12. ELECTRICAL

13. Scope.

The scope of this section covers supply, installation & Testing of cables, Control Panel with Voltmeter & Ammeter connecting Indoor Unit & Outdoor Unit as per specification.

14. Electrical.

The supply should be complete with appropriate earthing as per IE Rules.
Each Unit should have a separate control panel. The control panel shall consist of Voltmeter & Ammeter with selector switches.

Depending on the number and capacity of units to be installed, each unit should have separate control through a main incoming switch with adequate capacity of approved makes.

Each ODU should have separate SFU adjacent to the unit / within the unit and visible from the unit.

Electrical cabling should be done with armoured copper cable of approved makes only.
Fuse switches should be HRC cartridge type with visible indication.
The cabling shall be done as per drawings or instruction from Engineer .
The cabling supporting shall be done as per drawing.

LT SWITCHGEAR PANEL

Approvals and Submissions LT Switchgear panel shall be deemed to be approved when a sample has been inspected and when the sample workshop drawings have been approved, by the Owner / Consultant.
Breaker Co-ordination. The contractor shall submit breaker co-ordination details along with selection of breakers during bidding. Selection of all switchgear components – it is intended to achieve total discrimination and coordination, as such vendor shall justify selection of switchgear from upstream to final circuit components. The Vendor/Fabricator shall understand this from switchgear manufacturer before concluding selection.

LT Switchboards

General The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on 415V, 3 phase, 4 wire, 50 Hz system. The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs for use in installations where continuity of operation is of prime importance.

Standards The equipment listed below shall conform to tie requirements shown:

o Moulded Case Circuit Breaker (MCCB) – IS 13937 – 1.2 / IEC 60947 – 1 & 2. Certificate for Test Sequence 1 is mandatory.
O Contactors- IS 13947-1,4
o Miniature Circuit Breaker (MCB) – IS 8828 – 1996/ IEC 898 – 1995 energy limiting class 3.
O Residual Current Circuit Breaker (RCCB) – IS 12640 – 1988 / IEC 1008
o HRC fuse link – IS 9224 and BS 8:8
o Current Transformer – IS 2705 and IEC 185
o Potential Transformer- IS 3156
o Relay – IS 3231 and IS 8686 (For Static Relays)
o Indicating Instrument- IS 1248

2.3 Types and Construction The switchboard shall be of HVAC TECHNICAL SPECIFICATIONS
a. Sheet steel enclosed, indoor floor mounted free standing cubicle type.
b. Made up of the requisite vertical sections modular type which when coupled together shall form continuous dead front switchboards.

c. Dust, vermin and damp proof and enclosure protection of not less than IP 54. D. Each feeder/instrument compartment shall be provided with a hinged door interlocked with MCCB inside the compartment such that door can only be opened when MCCB in off position.
e. Readily extendable as required by the addition of vertical sections after removal of the end covers.

f. The MCCBs shall be lockable. Each vertical section shall comprise:

A front framed structure of rolled/folded CRCA sheet steel angle section of minimum 3 mm thickness rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment such as circuit breaker cassettes, main horizontal bus bars, vertical risers and other front mounted accessories.

B. The structure shall be mounted on a rigid base frame of folded CRCA sheet steel of minimum 6 mm thickness and 75 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

C. A cable chamber housing the cable end connections and power or control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling and adequate safety for working in one vertical or horizontal section without coming into accidental contact with live parts of the adjacent section.

D. A cover plate at the top of the vertical section, provided with a ventilating hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1mm diameter perforations to prevent entry of vermin.

E. Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors generous overlap shall be ensured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust. The height of the panel shall not be more than 2200 mm unless otherwise specified and maximum height of switch operating handle shall not be more than 1800mm from FFL. The total depth of the panel shall be adequate to cater for proper cabling space. Doors shall be of minimum 14 gauge sheet steel and covers and partitions of 16 gauge sheet steel. All sheet steel work forming the exterior of switchboards

15. Civil work related to Air conditioning & Ventilation work.
    All civil work related to Air Conditioning & Ventilation work such as – Cutting of holes for passage of ducts, Drain Piping, Opening for Fresh Air etc. & making good of same will be done by the Air Conditioning Contractor. The Rates for each item as mentioned in BOQ should include the cost for Civil work related to that item.

SECTION-G: TECHNICAL DATA SHEET

Contractor should furnish technical data of the equipment and accessories offered by him as per the scheme and bill of quantities. Some sample technical data sheets are enclosed for the contractor to understand the expected technical data. Similarly the technical data for all other equipment are supposed to be enclosed with offer. Manufacture's printed data sheet for all components should be enclosed along with technical data sheet.

Sl.No.	Description	Unit	Condition of services
	Fan		
1	Unit no./model no.		
2	Manufacturer		
3	Operating weight	KG	
4	Overall dimension	M	
5	Air quantity	M3/hr	
6	Fan outlet velocity	M/s	
7	No. of Blower	Nos.	
8	Dia. Of Blower	MM	
9	Fan speed	RPM	
10	Total static pressure	MM WG	
11	Motor rating	HP	

Sl.No.	Description	Unit	Condition of services
	Type & Make of Electrical items		
1	Electric starters		
2	Electric switches		

Sl.No.	Description	Unit	Condition of services
	Cables		
1	Manufacturer		
2	Type		
3	Conductors		
4	Insulation		
5	Armour		

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31 SCHEDULE OF QUANTITIES

DESCRIPTION AND SCOPE OF WORKS FOR PATEL/RK/SNIG/SAMS/GOKHEL & RLHR HALL:

Item No	Description	Unit	Qty	Rate	Amount
1	SITC With SISW centrifugal fan Backward curved type impeller, AMCA Certified, Motor, Pulleys, Belts & Belt guard, drive sets, base frame, spring mounts etc., Motor shall be of TEFC, IP-55 protection, Class 'F' insulation, suitable for 3phase, 415volts, 50hz power supply. The fan outlet velocity not exceeding 10m/sec. Interlocking of the fan with the hood. Fan shall be with ducted Air in and ducted air out arrangements with a minimum Static Pressure of 30mm WC. Fans should be suitably selected for max. 70dB at 1.5Mtr distance. Capacities as under:				
	Exhaust Air flow- 12800 CFM, ESP 35 mm WC - Type 1 Double Island hood	No	1		
	Exhaust Air flow- 3800 CFM, ESP 30 mm WC -Type 1 Canopy hood	Nos	RO		
	Exhaust Air flow- 3500 CFM, ESP 30 mm WC -Chapati station	Nos	2		
	Exhaust Air flow- 8000CFM, ESP 30 mm WC	No	1		
	Exhaust Air flow- 3750CFM, ESP 30 mm WC	Nos	2		
	Exhaust Air flow- 4350CFM, ESP 30 mm WC	No	1		
	Exhaust Air flow- 3000CFM, ESP 30 mm WC	No	1		
2	SITC of cabinet inline fans				
	550 CFM for Dish wash	Nos	1		
3	Supply, fabrication and installation of GI Duct works site with asbestos gasket with grease trap -fabricated type with 120GSM GI Sheets				
	20G 1MM Thickness	Sq.M	1285		
4.a	Supply and installation of GI 20G Dampers (manual operated)	Sq.M	24		
4.b	Supply and installation of Al powder coated grille with damper	Sq.M	10		
5	Supply and installation of Canvas Connection fire rate	Sq.M	22		
6	Supply and installation of Starter Panel with type 2 co-ordination with Push Button, Indicating Lamps and Starter arrangements complete with VFD space provision	Nos	10		
7.a	Supply and installation of Copper Armored XLPE/PVC multi-stranded Cable 1.1KV Rating Size – 3C X 2.5 Sq.MM	Rmt.	250		
7.b	Supply and installation of Copper Armored XLPE/PVC multi-stranded Cable 1.1KV Rating Size –3C X 4 Sq.MM	Rmt.	30		
8	Supply and installation of GI Earthing Wire 6SWG	Rmt.	420		
9.	IP 20 rated VFD for above mentioned fan with suitable kW rating				
9.a	1.1 kW VFD	No	1		
9.b	2.2 kW VFD	No	1		
9.c	3.7 kW VFD	No	1		
9.d	5.5 kW VFD	No	1		
9.e	7.5 kW VFD	No	1		
10	**Grease Trap Box**: Grease collector box at kitchen exhaust fan discharge made out of 16G CRCA , black iron sheet steel with all seams continuously welded from outside and with smooth ground finish and with easily removeable & cleanable grease trap baffles , grease drain plug, access panel etc. Epoxy painted from outside.	Nos.	12		

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	TOTAL(without GST)				
	GST @ 18%				
	GRAND TOTAL(Including GST)				

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