NORTH EASTERN INDIRA GANDHI REGIONAL INSTITUTE OF HEALTH & MEDICAL SCIENCES (NEIGRIHMS), SHILLONG, MEGHALAYA

Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong

VOLUME – I

PREQUALIFICATION DOCUMENT

January, 2009

HSCC (INDIA) LTD.
(CONSULTANTS & ENGINEERS FOR MEGA HOSPITALS & LABORATORIES)
E-6(A), sector-1, NOIDA (U.P) 201301 (India)

Phone: 0120-2542436-40 Fax: 0120-2542447

Tender No. HSCC/NEIGR/VENT/2009

HSCC (India) Limited.

Plot No.6 (A), Block-E, Sector-1, NOIDA - 201301 (U.P.)

No. HSCC/NEIGR/VENT/2009 **Dated: 12.01.2009**

NOTICE INVITING TENDER

1. HSCC (India) Ltd. provides Comprehensive services from concept to commissioning in the Health Care sector ranging from feasibility studies, planning, design and detailed engineering, project management, procurement and commissioning of medical equipments and procurement of drugs.
2. On behalf of NEIGRIHMS, **HSCC (India) Ltd,** invites sealed tenders in two bid system from the Suppliers/contractors/firms for the following works:

Sl. No.	Name of Work	Estimated Cost (Rs.)	Bid Security (Rs).	Cost of document (Rs.)	Period of Completion
1	Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong, Meghalya .	62.5 lakhs	1.25 lakhs	5000.00	3 Months

3. **Eligibility Criteria :**
   (a) Average annual financial turnover during the last three years [2005-2006, 2006-2007 & 2007-2008] should be Rs. 75 Lakhs.
   (b) The experience of having successfully completed similar works during last 7 years ending last day of month previous to the one in which applications are invited should be either of the following: -
      i) Three similar completed works each costing not less than the amount equal to 40% of estimated cost.
      ii) Two similar completed works each costing not less than the amount equal to 50% of estimated cost.
      iii) One similar completed work costing not less than the amount equal to 80% of estimated cost.
   (c) Minimum solvency certificate from banker for the sum of Rs. 62.5 Lakhs.
   (d) The firm should be profit making & have positive net worth in last three financial years.

4 Applicants may obtain the tender documents on any working day between **10.00 AM** and **4.00 PM** from 12.01.2009 to 03.02.2009 on written request from HSCC at the above address against a non refundable fee as specified above for above stated works separately payable in cash or in the form of Demand Draft/ Banker's Cheque in favour of **HSCC (INDIA) Limited** from any nationalised bank/ scheduled bank payable at **NOIDA** / **DELHI.** The applicant may collect the documents in person with authorization letter or on request, HSCC will promptly dispatch the documents by courier on payment of an extra amount of **Rs. 500**/- over & above the said document fee as indicated above, but under no circumstances HSCC will be held responsible for late delivery or loss of the documents so mailed.

5. Pre-bid meeting shall be held on 22.01.09 at 14.00 hrs at **HSCC (INDIA) Limited**, Flat no. B-7D, NEIGRIHMS Hospital Campus, Mawdiangdiang, Shillong-793018 (Ph- 0364-2538038).
6. Tender complete in all respect must be submitted in sealed envelopes, which must be either delivered by hand or by registered mail to **HSCC** at the above address so as to reach not later than **15.00 hours** on **04/02/2009**. (Under no circumstances HSCC will be held responsible for late delivery or loss of the documents so mailed).Tender shall be opened on 04/**02/2009 at 15.30 hours.**
7. HSCC reserves the right to accept or reject any/all bids without assigning any reason.
8. Copy of tender document is available for viewing on our website, www.hsccltd.co.in. Prospective bidders are advised to regularly scan through HSCC website as corrigendum/amendments etc. if any will be notified on the company's website and separate advertisement will not be made for this.

GM (PG-1)

INSTRUCTION TO APPLICANTS

PROJECT NAME	:	Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong
EMPLOYER/ PRINCIPAL EMPLOYER	:	North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS).

1. Scope of Bid :

1.1 For & on behalf of North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS)**,** Shillong, HSCC (I) Ltd (the Consultant) invites tenders for the above works detailed as under:

1.2 Brief Details :

ESTIMATED COST	:	Rs. 62.50 Lakhs
COMPLETION PERIOD	:	03 (THREE) calendar months from the date of Placement of order.

1.3 Tendering is open to all the agencies / firms having sound background and specialization in carrying out similar works.

2.0 PRE-QUALIFICATION CRITERIA:

2.1 Pre-Qualification will be based on meeting all the minimum criteria for pre-qualification and other qualification criteria regarding the Applicant's work experience, personnel and equipment capabilities and financial position as demonstrated by the Applicant's responses in the forms attached to the Letter of Application.

2.2 The Applicant should meet the following minimum criteria for Pre-Qualification :

(i) Average Annual Financial Turnover during the last three financial years i.e. 2005-2006, 2006-2007 & 2007-2008. should be at least Rs 75 lakhs.

(ii) Experience of having successfully completed similar work during last 7 years ending last day of month previous to the one in which tenders are invited should be either of the following :

Three similar completed works costing not less than the amount equal to 40% of the estimated cost.

or

Two similar completed works costing not less than the amount equal to 50% of the estimated cost.

or

One similar completed work costing not less than the amount equal to 80% of the estimated cost.

(iii) Similar nature of works means successful completion of supplying and installation of Ventilation System comprising of Supply and Exhaust Air Equipments, Grilles/Diffusers, Associated Ducting and Electrical Works etc.

3.0 PERSONNEL, EQUIPMENT AND FINANCIAL CAPABILITIES

3.1 **Personnel Capabilities**: The firm should have suitable qualified and experienced personnel for the successful completion of the works. List of employees and bio-data of key officials shall be submitted stating clearly how these would be involved in this work. (Fill enclosed ANNEXURE – I).

3.2 **Equipment Capabilities**: The Applicant should submit the list of equipments for successful completion of project. (Fill enclosed ANNEXURE -II).

3.3 **Financial Capabilities**: The Applicant should submit Audited Balance Sheets for the last three financial years i.e. 2005-2006, 2006-2007 & 2007-2008. These Balance Sheets should demonstrate the soundness of the applicant's financial position, showing positive Net worth and Net Profit in the last three financial years. (Fill enclosed ANNEXURE-III).

3.4 **Minimum Solvency Requirement** :

3.4.1 A solvency certificate shall be submitted from applicant's Bank (Nationalized/ Scheduled) stating that applicant is solvent for a value of 62.5 lakhs. The certificate should be not more than six months old.

4.0 EXPERIENCE OF EXECUTING OF PROJECTS OF SIMILAR NATURE & COMPLEXITY

The applicant shall submit information about their past experience in executing projects of similar nature and complexity with information about magnitude of the Projects, Type of Projects, Completion Certificate from Client, Time Overrun if any, Cost over run if any , (Fill enclosed ANNEXURE-IV).

5.0 OTHER INFORMATION TO BE SUBMITTED ALONGWITH TENDER

5.1 Registration/ Licence: The firm should have Works Contract Tax/VAT Registration with the appropriate Authorities. In case the firm is not registered at the time of submission of bid, a declaration should be submitted by the firm that they will get themselves registered with the concerned authorities in case they are awarded the work

5.2 The firm should submit an affidavit duly notarized that they have not abandoned & blacklisted of any work of Union Government/ State Governments/ PSU's etc. during the last 5 years.

5.3. The applicant should provide information regarding litigation/ Arbitration cases for the last five years as per ANNEXTURE- V

5.4 The applicant shall submit the supporting documents regarding the information given in the ANNEXURE-I to ANNEXURE-V.

6.0 Even though the Applicants meet the above criteria, they are subject to be disqualified, if they have:

- made misleading or false representation in the form, statement and attachments submitted; /or
- record of poor performance such as abandoning the work, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures, etc. /or
- The performance of any agency already worked/ working with HSCC is not found satisfactory./or
- found to have been black listed in any of the works.

7.0 The applicants are advised to visit the site to get first hand information as regards its approach, accessibility, working conditions, site conditions, availability of labour and material etc. and other matters affecting cost and work. All costs incurred in connection

with submission of the tender shall be borne by the applicant irrespective of the outcome.

8.0 If any information furnished by the applicant is found incorrect at a later stage, applicant shall be liable to be debarred from tendering in HSCC. The department reserves the right to verify the particulars furnished by the applicant independently.

9.0 Even though the agency meets all the criteria, the Employer / Consultant reserves the right to accept or reject any applicant/disqualify any agency without assigning any reason whatsoever.

10.0 UPDATING QUALIFICATION INFORMATION

10.1 Applicants shall be required to update the financial information used for Pre-Qualification as and when asked for, to confirm their continued compliance with the pre-qualification criteria and verification of information provided.

11.0 GENERAL

11.1 Only agencies / firms who meet the pre-qualification criteria shall be considered for further evaluation.

11.2 If a firm submit more than one bid all bids of the party will be rejected.

11.3 The Employer / Consultant reserve the right to:

(a) Reject or accept any application without assigning any reason or incurring any liability thereof

(b) Cancel the tendering process and reject all applications/tenders

(c) Split the works into different packages if required

(d) Amend the scope and value of any contract under this project, in such event the bids will only be called from those pre-qualified applicants who meet the requirements of the contract as amended.

11.4 Joint venture companies shall not be allowed to participate in the bid.

11.5 No correspondence either from successful / pre-qualified applicant or unsuccessful applicant will be entertained in this regard.

11.6 Check list format attached at Annexure VI must be filled and enclosed along with the application.

General Manager (PG-I)
For & on behalf of HSCC (I) Ltd.

LETTER OF APPLICATION

[NOTE: On the letterhead paper of the applicant including full postal address, telephone no., fax no., telex no. and cable address]

Date: _____

To,
HSCC (I) Ltd.
Plot No. 6(A), Block (E), Sector-I
NOIDA, U.P.-201301

Sirs,

1. Being duly authorised to represent and act on behalf of …….. (hereinafter referred to as "the Applicant") and having reviewed and fully understood all the pre-qualification information provided, the undersigned hereby apply to be pre-qualified by yourselves as a bidder for the :

   Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong, Meghalya.

Tender Number	Client Name
----------	North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences

2. Attached to this letter are copies of original documents defining:

   (a) the applicants legal status

   (b) the principal place of business

   (c) the place of incorporation (for applicants who are corporations) or the place of registration and the nationality of the owners (for applicants who are partnerships or individually owned firms)

   (d) application form no. 1 to 7 and Annexure VI

3. Your agency and its authorized representatives are hereby authorized to conduct any inquiries or investigations to verify the statements, documents and information submitted in connection with this application, and to seek clarification from our bankers and clients regarding any financial and technical aspects. This letter of application will also serve as authorization or any individual or authorized representative or any institution referred to in the supporting information, to provide such information deemed necessary and requested by yourselves to verify statements and information provided in this application, or with regard to the resources, experience, and competence of the Applicant.

4. Your agency and its authorized representatives may contact the following persons for further information:

General, Personnel, Technical and Financial Enquiries	
Contact 1 :	Telephone 1 :
Contact 2 :	Telephone 2 :

5. This application is made in the full understanding that:

(a) Bids by pre-qualified applicants will be subject to verification of all information submitted for pre-qualification at the time of bidding

(b) Your agency reserves the right to :

- amend the scope and value of the contract / bid under this project ; in such event, bids will only be called from pre-qualified bidders who meet the revised requirements ; and

- reject or accept any application, cancel the pre-qualification process, and reject all applications without assigning reasons or incurring any liability thereof ; and

(c) Your agency shall not be liable for any such actions and shall be under no obligation to inform the Applicant

6. The undersigned declare that statements made and the information provided in the duly completed application are, true and correct in every detail.

Sealed & Signed
Name
For and on behalf of

APPLICATION FORM NO. 1

GENERAL INFORMATION

All individual firms applying for pre- qualification are requested to complete the information in this form. Information to be provided for all owners or APPLICANTS who are partnerships or individually-owned firms.

1.	Name of firm	
2	Head office address	
3	Telephone	Contact
4	Fax	E-mail No.
5	Place of incorporation/ Registration	Year of incorporation/ registration

Authorized Signatory of bidder

APPLICATION FORM NO. 2

STRUCTURE AND ORGANIZATION

1. Name & address of the applicant

2. Telephone No. / Telex No. / Fax No.

3. Legal status of the applicant (attach copies of original document defining the legal status)

   (a) An individual

   (b) A proprietor firm

   (c) A firm in partnership

   (d) A Limited Company or Corporation.

4. Particulars of registration with various Government bodies (attach attested photocopy)

   Organisation /Place of registration Registration No.

5. Name and Titles of Directors & Officers with designation to be concerned with this work.

6. Designation of individuals authorised to act for the organisation

7. Was the applicant ever required to suspend construction for a period of more than six months continuously after you commenced the construction? If so, give the name of the project and reasons of suspension of work.

8. Has the applicant ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.

9. Has the applicant ever been debarred / black listed for tendering in any organisation at any time? If so, give details.

10. Has the applicant ever been convicted by a court of law? If so, give details.

11. Any other information considered necessary but not included above.

Authorized Signatory of bidder

APPLICATION FORM NO. 3

ANNEXURE - I

PERSONNEL CAPABILITIES

Sl. No.	Designation	Total Number	Number available for this work	Name	Qualification	Professional experience	Remarks

Authorized Signatory of bidder

APPLICATION FORM NO. 4

ANNEXURE - II

EQUIPMENT CAPABILITIES

Sl. No.	Name of Equipment	Nos.	Capacity or Type	Age	Condition	Remarks

Authorized Signatory of bidder

APPLICATION FORM NO. 5

ANNEXURE - III

FINANCIAL CAPABILITIES

(Rs. In lacs)

Financial Year	Annual Turn Over in Indian Rupees (or equivalent to Indian Rupees) as per Audited Balance Sheet
2005-2006	Rs.
2006-2007	Rs.
2007-2008	Rs.
Average Annual Turnover over the past three years	Rs.

Financial Information in Rs. Equivalent	For year 2005-2006	For year 2006-2007	For year 2007-2008
1. Total Assets			
2. Current Assets			
3. Total Liabilities			
4. Current Liabilities			
5. Profit before Tax			
6. Profit after Tax			
7. Net Worth			

NOTE : The above data is to be supported by audited balance sheets

1. Attach copies of audited balance sheets for all three years (2005-2006, 2006-2007 & 2007-2008.
2. Attach recent solvency certificate from bankers.
3. Indicate financial arrangements for carrying out the proposed work.

Authorized Signatory of bidder

APPLICATION FORM NO. 6

ANNEXURE - IV

EXPERIENCE OF COMPLETION OF PROJECTS OF SIMILAR NATURE & COMPLEXITY

(During last seven years ending last day of month previous to the one in which applications are invited)

Sl. No.	Name of work / project and location	Owner or sponsoring organization	Cost of work in Lakhs	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Name and address/ telephone number of officer to whom reference may be made	Remarks

NOTE : **Please attach supporting documents (completion certificates along with order copies) for the above information**

Authorized Signatory of bidder

APPLICATION FORM NO. 7

ANNEXURE - V

Litigation Details
Court Cases/arbitration

Name of Bidder

Year	Name of the work	Name of the Client, with Address	Title of the court Case/Arbitration	Detail of the Court/ Arbitrator	Status Pending/ Decided	Disputed Amount (Current Value, the equivalent) in case of Court Cases/arbitration	Actual Awarded Amount (Rs) in decided Court Cases/arbitration

Authorized Signatory of bidder

Check-List

S.No	Criteria	Requirements	Cross Referencing / Page no. at which required information is available (To be mentioned)	Indicate Eligibility Y / N
1	Average Turnover for last three years	Rs 75 lakhs		
2	Experience	During last seven years ▪ Similar work completed, 3 nos. of value not less than 40% of the estimated cost ▪ Similar work completed, 2 Nos. of value not less than 50% of the estimated cost ▪ One Similar work completed of value not less than 80% of the estimated cost		
3	Personnel Capabilities	List of suitable qualified and experienced personnel in relevant field		
4	Equipment Capabilities	List of equipment required and proposed to be deployed & source of such equipments		
5	Financial Capability	▪ Net worth positive for all the three years ▪ Profit earning for all the three years		
6	Solvency Certificate	Solvency certificate from applicant's bank for 62.5 lakhs not older than six months.		
7.	Abandoning / Blacklisting	Information regarding not abandoned /Black listing for any work of Union Govt./State Govt./ PSU's etc. during last 5 years		
8.	Works Contract Tax/VAT Registration with the appropriate Authorities.	In case the firm is not registered at the time of submission of bid, a declaration by the firm that they will get themselves registered with the concerned authorities in case they are awarded the work is submitted.		

Authorized Signature of Bidder with stamp

NORTH EASTERN INDIRA GANDHI REGIONAL INSTITUTE OF HEALTH & MEDICAL SCIENCES (NEIGRIHMS), SHILLONG, MEGHALAYA

Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong

VOLUME – II

GENERAL INSTRUCTION TO BIDDERS

CONDITIONS OF CONTRACT
&
TECHNICAL SPECIFICATION

January, 2009

HSCC (INDIA) LTD.
(CONSULTANTS & ENGINEERS FOR MEGA HOSPITALS & LABORATORIES)
E-6(A), sector-1, NOIDA (U.P) 201301 (India)

Phone: 0120-2542436-40 Fax: 0120-2542447

Tender No. HSCC/NEIGR/VENT/2009

SECTION I : INSTRUCTIONS TO BIDDERS

A. General

1.0 Scope of work :

1.1 **HSCC (India) Ltd. invites bids for the Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong**

1.2 The successful bidder will be expected to complete the works within **3 (Three) calendar Months** from the date of Award of work**.**

2.0 The Employer :

North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences (NEIGRIHMS), Shillong, Meghalya, represented by their consultant M/s HSCC (India) Limited (HSCC), A Government of India Enterprise, having its Corporate office at plot No. 6(A), Block-E, Sector -1, Noida, Distt. Gautam Budh Nagar (UP) will enter into the agreement with the chosen contractor for & on behalf of the Employer.

2.1 In these documents wherever the word tender/ tenderer/tendering has been used, the same shall be considered synonymous with bid/bidder/bidding.

3.0 Informations to be submitted :

3.1 All bidders shall include the following information and documents with their bids :

1. Power of attorney of the signatory of the bid to commit the bidder.
2. A Work plan clearly bringing out how the bidder proposes to carry out the work to achieve the time schedule.

4.0 Cost of bidding :

The bidder shall bear all costs associated with the preparation and submission of his bid, and the Employer will in no case be responsible or liable for those costs.

5.0 Site visit :

The bidder is advised to visit and examine the Site of Works and its surroundings and obtain for himself on his own responsibility and at his own risk all information that may be necessary for preparing the bid and entering into a contract for supplying laboratory furniture. The cost of visiting the Site shall be at the bidder's own expense.

B. Bidding Documents

6.0 Content of bidding documents :

The set of bidding documents comprises the documents listed below :

Volume-I : Pre-Qualification Criteria
Volume-II : Conditions of contract & Technical specifications
Volume-III : Bill of Quantities

7.0 Clarification of bidding documents :

A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter, "cable" includes facsimile) at the Engineer's address indicated in the Invitation to Bid. The Engineer will respond to any request for clarification which he received earlier than 7 days prior to the submission of bid. Copies of the Engineer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.

8.0 Amendment of bidding Documents :

8.1 Before the deadline for submission of bids, the Engineer may modify the bidding documents by issuing addenda.

8.2 Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing or by cable to all purchasers of the bidding documents.

8.3 To give prospective bidders reasonable time to take an addendum into account in preparing their bids, the Engineer shall extend as necessary, the deadline for submission of bids in accordance with Sub-Clause 16.2.

C. Preparation of Bids

9.0 Language of bid :

All documents relating to the bid shall be in English Language only.

10.0 Documents comprising the bid :

The bid submitted by the bidder shall comprise the following :

(a) Bid Security
(b) All information and document regarding the pre-qualification
(c) Conditions of Contract
(d) Specifications
(e) Bill of Quantities
(f) Tender drawings, if any
(g) Documents mentioned in 3.1 above.

and any other documents required to be completed and submitted by bidders in accordance with these instructions.

11.0 Bid prices :

11.1 The bidder shall fill the rates against each item of BOQ both in words and figures.

11.2.1 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause shall be included in the rates, prices, and total amount of bid submitted by the bidder. The evaluation and comparison of bids by the Employer shall be made accordingly.

11.3 The rates and prices quoted by the bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account.

12.0 Currencies of bid and payment :

The rate to be quoted by the bidder shall be in Indian Rupees.

13.0 Bid validity :

13.1 Bids shall remain valid for a period of 120 days after the deadline for bid submission specified in Clause 16.

13.2 In exceptional circumstances, the bidders may be requested to extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by cable. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his bid security for the period of the extension, and in compliance with Clause 14 in all respects.

14.0 Bid security:

14.1 The bidder shall furnish, as part of his bid, a security amount of Rs. 1,25,000/-.

14.2 The bid security shall be in the form of a Pay order/ Demand Draft from a Nationalised/Scheduled bank in favour of HSCC (I) Ltd., payable at Delhi/Noida.

14.3 Any bid not accompanied by an acceptable bid security shall be rejected.

14.4 The bid security of unsuccessful bidders will be returned within 28 days of the end of the bid validity period specified in Sub-Clause 13.1.

14.5 The bid security of the successful bidder will be discharged when the bidder has signed the Agreement and furnished the required performance security.

14.6 The bid security will be forfeited :

(a) if the bidder withdraws his bid during the period of bid validity;
(b) if the bidder does not accept the correction of his bid price, pursuant to Clause 23; or
(c) in the case of a successful bidder, if he fails within the specified time limit to :
(i) sign the Agreement ; or
(ii) furnish the required performance security.

14.7 No interest will be payable on the bid security amount cited above.

15.0 Sealing, marking and submission of bid :

15.1 The bid shall be submitted in accordance with the procedure detailed herein. Documents shall be enclosed in separate envelopes of appropriate size each of which shall be sealed.

(i) **Envelope No. 1** shall contain the bid security as indicated in clause 14 of these instructions to bidders.

(ii) **Envelope No. 2** shall contain the bidder's application for pre-qualification, original bid document comprising of Volume-I and all the asked information and documents in support of pre-qualification.

(iii) **Envelope No. 3** shall contain the covering letter and original bid document comprising of Volume-II, duly signed and stamped and the other documents as indicated at Clause 3.1, duly signed and stamped, without any conditions or reservation.

(iv) **Envelope No. 4** shall contain only the bill of quantities (Vol III)and rates/prices duly filled in and signed and stamped without any conditions whatsoever. Bids containing any conditions in Envelope no. 4 are liable to be summarily rejected. Any variation between the rates mentioned in figures and words, the rates in words shall prevail.

The contractor must fill up the prices both in words and figures.

Please note that the price should not be indicated in any of the documents enclosed in envelope 1 , 2 & 3

All bidders are required to submit unconditional bids. Conditional bids if submitted shall be liable to be rejected and no correspondence in this regard shall be entertained.

15.2 The bidder shall seal the bid.

15.3 All the four envelopes shall be sealed and enclosed in an envelope and addressed to the General Manager (PG-I), HSCC (India) Ltd, Plot No. 6(A), Block-E, Sector 1, Noida, Distt. Gautam Budh Nagar, Uttar Pradesh, Pin – 201 301.

15.4 All the above envelope shall bear the following identification.

Name of work: - Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry & CSSD at NEIGRIHMS, Shillong, Meghalya.

15.5 All the envelopes shall indicate the name and address of the bidder to enable the bid to be returned unopened, if required.

15.6 All recipients for the purpose of submitting a bid, shall treat the contents of the documents as private and confidential.

16.0 Deadline for submission of bids :

16.1 Bids must be received by the Engineer at the address specified above not later than the designated date and time.

16.2 The Engineer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 8, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

17.0 Late bids :

Any bid received by the Engineer after the deadline prescribed in Clause 16.0 will be returned unopened to the bidder.

18.0 Modification and withdrawal of bids :

18.1 The bidder may modify or withdraw his bid by giving notice in writing before the deadline prescribed in Clause 16.

18.2 The bidder's modification or withdrawal notice shall be prepared, sealed, marked, and delivered in accordance with Clause 15, with the outer and inner envelopes additionally marked "MODIFICATION" or "WITHDRAWAL", as appropriate.

18.3 No bid may be modified after the deadline for submission of bids.

18.4 Withdrawal of bid between the deadline for submission of bids and the expiration of the original period of bid validity specified in the Form of Bid may result in the forfeiture of the bid security pursuant to Clause 14.

D. Tender Opening and Evaluation

19.0 Bid opening :

19.1 Bids shall be opened in the office of H SCC (India) Ltd, Plot No. 6(A), Block-E, Sector 1, Noida, Distt. Gautam Budh Nagar, Uttar Pradesh, Pin - 201301, half an hour after the prescribed time for tender submission in presence of the bidders representatives who may wish to be present.

Envelope No.1: Shall be opened first. If the bid Security is not found as prescribed the bid shall be summarily rejected.

Envelope No.2: Shall then be opened. The applications of bidders for pre-qualifications and the information and documents submitted shall be evaluated.

Envelope No.3: Shall be opened for only those parties who meet the pre-qualification criteria and are pre-qualified, on the same day or at a subsequent date to be intimated in advance to such eligible bidders. Bids of parties who do not accept the conditions laid down in the bid documents may be rejected.

Envelope No. 4 : Containing the sealed price bid of only for those parties whose bid is found to be generally in order and substantially responsive shall be opened either at the bid opening or at a subsequent date to be intimated in advance to such eligible bidders.

19.2 The Engineer will examine the bids to determine whether they are complete, whether the requisite bid securities have been furnished, whether the bids have been properly signed and whether the bids are generally in order.

19.3 Telegraphic/ fax offer will be treated as defective/ invalid and rejected. Only detailed complete bids received prior to the closing time and date will be taken as valid.

19.4 The bidders names, general technical details, the presence of the requisite bid security and such other details as the Engineer, at his discretion may consider appropriate will be announced at the bid opening.

19.5 The bid of any bidder who has not complied with any of the instructions contained herein may not be considered.

20.0 Process to be confidential :

20.1 Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful bidder has been announced. Any effort by a bidder to influence the Engineer's processing of bids or award decisions may result in the rejection of his bid**.**

21.1 Clarification of bids :

21.1 To assist in the examination, evaluation, and comparison of bids, the Engineer may, at his discretion, ask any bidder for clarification of his bid, including break down of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Engineer in the evaluation of the bids in accordance with Clause 23.

22.0 Examination of bids and determination of responsiveness :

22.1 Prior to the detailed evaluation of bids, the Engineer will determine whether each bid (a) meets the eligibility criteria; (b) has been properly signed; (c) is accompanied by the required securities; (d) is substantially responsive to the requirements of the bidding documents; and (e) provides any clarification and/or substantiation that the Engineer may require.

22.2 A substantially responsive bid is one which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the bidding documents, the Engineer's right or the bidder's obligations under the contract or (c) whose

rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

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

23.0 Correction of errors :

23.1 Bids determined to be substantially responsive will be checked by the Engineer for any arithmetic errors. Errors will be corrected by the Engineer as follows :

(a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; and

(b) If the bidder does not accept the corrected amount of bid, his bid will be rejected, and the bid security may be forfeited in accordance with Sub-Clause 14. 6(b).

24.0 Currency for bid evaluation :

Bids shall be evaluated as quoted in Indian Rupees in accordance with Clause 12.

25.0 Evaluation and comparison of bids :

25.1 The Engineer will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause 22.

25.2 In evaluating the bids, the Engineer will determine for each bid the Evaluated Bid Price by adjusting the Bid Price after making any correction for errors pursuant to Clause 23.

E. Award of Contract

26.0 Award Criteria :

26.1 Subject to Clause 27, the Engineer on behalf of the Employer intends to award the Contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the Lowest Evaluated Bid Price.

27.0 Employer's right to accept any bid and to reject any or all bids :

27.1 Notwithstanding Clause 26, the Engineer on behalf of the Employer reserves the right to accept or reject any bid, and to cancel the bidding process and reject all bids, at any time prior to the award of contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders of the ground for the Employer's action.

28.0 Notification of award :

28.1 Prior to expiration of the period of bid validity prescribed, the Engineer on behalf of the Employer will notify the successful bidder by cable confirmed by registered post /courier letter that his bid has been accepted. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") shall name the estimated sum which the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provision of Clause 29.

28.3 Upon furnishing by the successful bidder of a performance security, the Engineer on behalf of the Employer will promptly notify the other bidders that their bids have been unsuccessful.

29.0 Performance Security :

29.1 Within 15 days of receipt of the notification of award from the Engineer on behalf of the Employer, the successful bidder shall furnish to the Employer a performance security in the form of a bank guarantee for an amount equivalent to 5% of the Contract Price. The performance security shall be valid till the successful completion of the Defect Liability Period by the Contractor.

29.2 Failure of the successful bidder to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the bid security.

A. General

1.0 Definitions :

1.1 Terms which are defined in the Contract Data are not defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

Acceptance is the date when the Contract came into existence upon receipt by the Contractor of the Letter of Acceptance issued by the Engineer on behalf of the Employer.

The Activity Schedule is a schedule of the activities comprising the construction, installation, testing, and commissioning of the Works.

The Completion Date is the date when the Engineer notifies that the works can be used by the Employer.

The Consultant is M/s. HSCC (I) Ltd. (HSCC).

The Contract is the contract between the Employer of the one part and the Contractor of the other.

The Contract Data defines the documents and other information which comprise the Contract.

The Contractor is a person or corporate body whose bid to carry out the Works has been accepted by the Employer.

The Contractor's Bid is the completed bidding document submitted by the Contractor to the Employer.

The Contract Price is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; months are calendar months.

A Defect is any part of the Works not completed in accordance with the Contract.

The Engineer is the person named in the Contract Data who is responsible for supervising the Contractor, administering the Contract, certifying payments due to the Contractor, issuing and valuing Variations to the Contract, awarding extensions of time etc.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

The Initial Contract Price is the Contract Price at the date of the Employer's written acceptance of the Contractor's Bid.

The Intended Completion Date is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer by issuing an Extension of time.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical function.

The Site is the area defined as such in the Contract Data.

The Start Date is given in the Contract Data. It is the date when the Contractor can commence work on the Contract.

It does not necessarily coincide with any of the Site Possession Dates.

A Subcontractor is person or corporate body who has a contract with the Contractor to carry out a part of the work in the Contract.

Temporary Works are works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

A Variation is an instruction given by the Engineer which varies the Works.

The Works are what the Contract requires the Contractor to construct, install, and hand over to the Employer.

2.0 Interpretation :

In interpreting these Conditions of Contract, singular also means plural, male also means female, and vice versa. Headings and cross-references between clauses have no significance. Words have their normal meaning under the language of the Contract unless specifically defined.

3.0 Language and law :

The language of the Contract and the law governing the Contract are stated in the Contract Data**.**

4.0 Engineer's decisions :

The Engineer is to decide contractual matters between the Employer and the Contractor fairly and impartially.

5.0 Delegation :

The Engineer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6.0 Communications :

Communications between parties which are referred to in the conditions are effective only when in writing**.**

7.0 Sub-Contracting : Deleted

8.0 Other Contractors :

Deleted.

9.0 Personnel :

Deleted

10.0 Removal of personnel

If the Engineer asks the Contractor to remove a person who is a member of his staff or his work force and states his reasons the Contractor is to ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

11.0 Contractor's risks :

11.1 All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

Excepted Risks are :

a. (i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
(ii) rebellion, revolution, insurrection, or military or usurped power, or civil war,
(iii) ionising radiations, or contamination by radio - activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio - active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,
(iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speed,

b. loss or damage due to the use or occupation by the Employer of any section or part of the Permanent Works, except as may be provided for in the Contract.

c. loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible.

12.0 Insurance :

12.1 The following insurance cover is to be provided by the Contractor in the joint names of the Employer and the Contractor for the period from the Start Date to the end of the Defects Notice Period or of the last Defects Correction Period whichever is later :

(a) cover against damage to other people's property caused by the Contractor's acts or omissions;
(b) cover against death or injury caused by the Contractor's acts or omissions to
(i) anyone authorised to be on the Site ;
(ii) third parties who are not on the Site ;
(c) cover against damage to the Works and materials during construction.

12.2 Policies and certificates for insurance are to be produced by the Contractor to the Engineer for approval before the Start Date given in the Contract Data and subsequently as the Engineer may require.

12.3 If the Contractor does not produce any of the policies and certificates required, the Employer may effect the insurance for which the Contractor should have produced the policies and certificates and recover the premiums it has paid from payments due to the Contractor.

12.4 Alterations to the terms of an insurance may be made either with the approval of the Engineer or as a result of general changes imposed by the insurance company with which the insurance policy is effected.

12.5 Both parties are to comply with conditions of the insurance policies.

13.0 Indemnities :

13.1 The Contractor is liable for and indemnifies the Employer against losses, expenses and claims for loss or damage to physical property, personal injury, and death caused by his own acts or omissions.

13.2 The Contractor idemnifies the Employer against claims for damage caused by the movement of his Equipment or Temporary Works outside the Site.

14.0 Site Investigation report :

Deleted

15.0 Queries about the contract data :

The Engineer is to give instructions clarifying queries about the Contract Data.

16.0 Contractor to execute the works :

The Contractor is to execute the work of supply, installation, testing & commissioning of ventilation system for Kitchen, Laundry & CSSD at NEIGRIHMS, Shillong in accordance with the Specification and contract.

17.0 The works to be completed by the intended completion date :

The Contractor may begin the Works on the Start Date and is to carry out the Works in accordance with the program submitted by him, as updated with the approval of the Engineer, and complete them by the Intended Completion Date.

18.0 Approval of samples shall be taken by the contractor prior to their delivery at site.

19.0 Safety :

The Contractor is responsible for the safety of all activities on the Site.

20.0 Discoveries :

Deleted.

21.0 Possession of the site :

The Employer is to give possession of all parts of the Site to the Contractor, where the work is required to be executed. If possession of a part is not given by the date stated in the Contract Data, the Employer is deemed to have delayed the start of the relevant activities.

22.0 Access to the site :

The Contractor is to allow the Engineer and any person authorized by the Engineer access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

23.0 Instructions :

The Contractor shall carry out all instructions of the Engineer.

24.0 Procedure for disputes :

If any dispute or difference of any kind what so ever shall arise between the Employer and the contractor or the Engineer and the contractor in connection with or arising out of the Contract, or the execution of the works, whether during the progress of the works or after their completion and whether before or after the termination, abandonment or breach of the contract, it shall, in the first place, be referred to and settled by the Engineer who shall, within a period of ninety days after being requested by either party to do so, give written notice of his decision to the Employer and the Contractor. Subject to arbitration, as hereinafter provided, such decision in respect of every matter so referred shall be final and binding upon the Employer and the Contractor and shall forthwith be given effect to by the Employer and by the Contractor, who shall proceed with the execution of the works with due diligence whether he or the Employer requires arbitration or not. If the Engineer has given written notice of his decision to the Employer and the Contractor and no claim to arbitration has been communicated to him by either the Employer or the Contractor within a period of ninety days from receipt of such notice, the said decision shall remain final and binding upon the Employer and the Contractor. If the Engineer shall fail to give notice of his decision, as aforesaid within a period of ninety days after being requested, or if either the Employer or the Contractor be dissatisfied with any such decision, then and in any such case either the Employer or the Contractor may within ninety days after receiving notice of such decision or within ninety days after the expiration of the first named period of ninety days as the

case may be require that the matter or matters in dispute be referred to arbitration as hereinafter provided. All disputes or differences in respect of which the decision if any of the Engineer has not become final and binding as aforesaid, shall be finally settled under the Indian Arbitration and Conciliation Act,1996 or any statutory modification or re - enactment thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. Such arbitration shall be settled by Sole arbitrator who shall be appointed by Chairman cum Managing Director, HSCC. The arbitration shall take place in New Delhi unless both parties agree otherwise. Neither party shall be limited in the proceedings before the arbitrator to the evidence or arguments put before the Engineer for the purpose of obtaining his said decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the arbitrator on any matter whatsoever relevant to the dispute or difference referred to the arbitrator as aforesaid. The reference to arbitration may proceed notwithstanding that the works shall not then be or be alleged to be complete provided always that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the works.

B. Time Control

25.0 Program :

25.1 Within the time stated in the Contract Data, the Contractor shall submit to the Engineer for his approval a program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Contractor is to submit to the Engineer an updated program as required by the Engineer.

25.3 The Engineer's approval of the program does not alter the Contractor's obligations. The Contractor may revise the program and submit it to the Engineer again at any time. A revised program is to show the effect of Variations.

26.0 Extension of the intended completion date :

26.1 The Engineer is to extend the Intended Completion Date if an event not attributable to the contractor causing delay occurs or a Variation is issued which makes it impossible for completion to be achieved by the Intended Completion Date.

26.2 The Engineer is to decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking him to decide upon the effect of a event causing delay or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by his failure is not considered in assessing the new Intended Completion Date.

27.0 Acceleration :

Deleted

28.0 Delays ordered by the Engineer :

The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.

29.0 Management meetings :

29.1 The Engineer and/ the Contractor may be required the other to attend a management meeting. The business of a management meeting is to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

C. Quality Control

30.0 Identifying defects :

The Engineer is to check the Contractor's work and to notify the Contractor of any Defects which he finds. Such checking does not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work which he considers may have a Defect.

31 & 32.0 Tests :

Tests of all materials will be carried out as per the relevant BIS. Incase it is not available in BIS the same shall be carried out as per decision given by engineer based on existing general practice which will be binding to the agency. The material which is not passing to BIS or any other test will be rejected or may be accepted with reduced rates as per decision taken by engineer.

33.0 Guarantee, Defects Liability and Correction of defects :

33.1 All the equipments, components and the complete Ventilation System as a whole shall be guaranteed for its performance and against any manufacturing defect. The defect liability shall be valid for a period of **5 years** from the date of satisfactory completion of works and issue of completion certificate. The contractor shall guarantee that all equipments shall be free from any defect due to the defective materials and bad workmanship or any other cause and that the equipment shall work satisfactorily and that the performance and efficiencies of the equipment shall be not less than the guaranteed values. Any parts found defective during the defect liability period shall be replaced by the contractor at his own expense. The services of the contractor's personnel, during this period for such work, shall be made available free of any cost to the Employer.

33.2 The Engineer/Employer is to give notice to the Contractor of any Defects of which he is aware before the end of the Defects Liability Period.

33.3 Every time notice of a Defect is given, a Defects Correction Period for the notified defect beings. The Contractor is to correct the notified defect within the Defects Correction Period. The length of the Defects Correction Period is stated in the Contract Data.

33.4 The Contractor is to correct defects which he notices himself before the end of the Defects Liability Period.

33.5 The Engineer is to certify that all Defects have been corrected when all known Defects have been corrected. If the Engineer considers that correction of a Defect is not essential he can request the Contractor to submit a quotation for the corresponding reduction in the Contract Price or an earlier Intended Completion Date or both. If the Engineer accepts the quotation, the corresponding change in the Contract Data is a Variation.

34.0 Uncorrected defects after completion date :

34.1 After completion the Engineer may arrange for a third party to correct a Defect if the contractor has not corrected it within the Defects Correction Period.

34.2 The Engineer is to give the Contractor at least 28 days notice of his intention to use a third party to correct a Defect. If the Contractor does not correct the Defects himself within this notice period, the Engineer may have the Defect corrected by the third party. The cost of the correction will be deducted from the Contract Price.

D. Cost Control

35.0 Bill of quantities :

35.1 The Bill of Quantities is to contain items for the work to be done by the Contractor.

35.2 The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

36.0 Changes in the quantities :

36.1 Final work done may exceed to any extent itemwise as well as total work value wise, as per the requirement of the works to be executed under the contract.

36.2 If requested by the Engineer, the Contractor is to provide the Engineer with a detailed cost breakdown of any rate in the Bill of Quantities.

37.0 Variations :

37.1 All Variations are to be included in updated programs produced by the Contractor.

38.0 Payments for variations :

If the contract does not contain any rates or prices applicable to the varied work, the rates and prices in the contract shall be used as basis for valuation so far as may be reasonable, failing which , after due consultation by the engineer with the contractor, suitable rates or prices shall be agreed upon between the engineer and the contractor. In the event of disagreement, the engineer shall fix such rates or prices as are, in his opinion, appropriate based on CPWD norms and shall notify the contractor accordingly.

39.0 Cash flow forecasts :

39.1 The contractor shall provide cash flow forecast at the start of work to the Engineer. When the program is updated, the Contractor is to provide the Engineer with an updated cash flow forecast**.**

40.0 Payment certificates :

40.1 The contractor shall submit to the Engineer monthly statements of the value of the work completed less the cumulative amount certified previously on a printed proforma (prepared at the cost of Contractor).

40.2 The Engineer shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.

40.3 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

41.0 Payments :

The payment terms would be as follows;

(i) 90% payment shall be realeased against completion of supply, testing, installation and satisfactorily commissioning at site.

(ii) Balance 10% within 30 days of complete handing over of the functionally operating ventilation system.

42.0 Taxes:

Taxes shall be deducted as applicable.

43.0 Cost of Labour :

The Contractor shall be deemed to have allowed in his Tender Price for the full cost of labour having due regard to the provision of all labour legislation of the Central and State Government which are in force on the date of the tender and which are applicable to labour engaged for the Contract.

44.0 Retention Amount :

44.1 The Employer is to retain from each payment due to the contractor the proportion stated in the Contract Data until Completion of the whole of the Works.

44.2 On Completion of the whole of the Works, half the total amount retained is repaid to the Contractor and balance half when the Defects Notice Period has passed and the Engineer has certified that all Defects notified by him to the Contractor before the end of this period have been corrected. The second half of the retention may be paid against submission of Bank Guarantee approved by the Engineer from any nationalized bank if applicable.

45.0 Liquidated damages :

45.1 If the contractor fails to complete execution of works within the relevant time as specified in the Contract Data / Extended date, the contractor shall pay the employer the relevant sum as stated in the Contract Data as liquidated damages for every day or part of a day which shall elapse between the relevant time of completion and the date stated in Taking over certificate

46.0 Advance payment :

46.1 Deleted.

47.0 Securities :

47.1 The performance payment securities are to be provided to the Employer by the Start Date and are to be issued in a form and by a bank acceptable to the Employer. payable.

47.2 If there is no reason to call the performance security, the performance security is to be returned by the Employer within 14 days of the last Defects Correction Period.

47.3 The Employer is to notify the Contractor of any claim made against the institution issuing the security.

47.4 The Employer may claim against the surety if any of the following occurs for 42 days or more

(a) the Contractor is in breach of the Contract and the Employer has notified him that he is
(b) the Contractor has not paid an amount due to the Employer.

48.0 Day works :

48.1 Deleted

49.0 Cost of repairs :

Loss or damage to the Works or materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods is to be mended by the Contractor at the Contractor's cost if the loss of damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

50.0 Completion :

The Engineer shall issue a certificate certifying Completion to the Contractor and the Employer when he decides that the work is completed.

51.0 Taking over :

The Employer shall take over the Works within seven days of the Engineer issuing a certificate of Completion.

52.0 Final account :

52.1 The Contractor shall furnish to the Engineer a detailed account of the total amount which he considers is payable to him under the Contract before the end of the Defects Notice Period. The Engineer is to certify any final payment which is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer is to issue a schedule which states the scope of the corrections or additions which are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer is to decide on the amount payable to the Contractor.

53.0 Operating and maintenance manuals :

The contractor shall submit operation and maintenance manual for the complete ventilation system clearly indicating the trouble shooting, the preventive maintenance to be carried out and maintenance schedule, in three sets in hard binding.

54. Remedies and Powers due to Default of Contractor :

54.1 If the contractor shall become bankrupt or if the Engineer shall certify in writing to the Employer that in his opinion the contractor :

a) has abandoned the contract, or

b) without reasonable excuse has failed to commence the work or has suspended the progress of the works for twenty eight(28) days after receiving from the Engineer written notice to proceed, or

c) has failed to remove materials from the Site or to pull down and replace work twenty eight(28) days after receiving from the Engineer written notice that the said materials or work had been condemned and rejected by the Engineer under these conditions, or

d) despite previous warnings by the Engineer, in writing, is not executing the works in accordance with the contract, or is persistently or flagrantly neglecting to carry out his obligations under the Contract, or

e) has to the detriment of good workmanship, or in defiance of the Engineer's instructions to the contrary, sublet any part of the contract, then all the events mentioned in this clause 54.1 shall for the avoidance of doubt be a breach of this contract and the Employer may, after giving fourteen(14) days notice to the contractor, enter upon the site and the works and expel the contractor there from without thereby voiding the contract, or releasing the Contractor from any of his obligations or liabilities under the contract, or affecting the rights and powers conferred on the Employer or the Engineer by the contract, and may himself complete the works or may employ any other contractor to complete the works. The Employer or such other contractor may use for such completion so much of the constructional plant, Temporary works and materials, which have been or are deemed to be reserved exclusively for the execution of works under the provisions of the contract, as he or they may think proper, and the Employer may, at any time sell any of the said constructional plant, Temporary works and unused materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the contractor under contract.

54.2 Valuation at date of forfeiture :

The Engineer shall as soon as may be practicable after any such entry and expulsion by the Employer, fix and determine ex-parte, or by or after reference to the parties, or such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accrue to the contractor in respect of work then actually done by him under the contract and the value of any of the said unused or partially used materials, any constructional plant and any Temporary works.

54.3 Payment after forfeiture :

If the Employer shall enter and expel the contractor under this clause, he shall not be liable to pay to the contractor any money on account of the contract until the expiration of the Defects Notice period and thereafter until the costs of execution and maintenance, damages for delay in completion, if any, and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer. The contractor shall then be entitled to receive only such sum or sums, if any as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the contractor on due completion by him then the Contractor shall, upon demand pay to the Employer the amount of such excess and it shall be deemed a debt due by the contractor to the Employer and shall be recoverable accordingly.

55.0 Property :

55.1 All materials on the Site, Plant, Equipment owned by the Contractor, Temporary Works and Works are deemed to be the Property of Employer and are at his disposal if the Contract is terminated because of a fundamental breach of Contract by the Contractor.

56.0 Frustration :

56.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor the Engineer is to certify that the Contract has been frustrated. The Contractor is to make the Site safe and stop work as quickly as possible

after receiving this certificate and is to be paid for all work carried out before receiving it and for any work carried out after wards to which he was committed.

57.0 Comprehensive All Inclusive Operation & Maintenance Services

57.1 The Employer shall have the right to operate all equipments, if in operating condition, whether or not such equipments, have been accepted as complete and satisfactory. Repairs and alterations shall be made at such time as directed by the Engineer. In special circumstances user may have to use a part of the System/ equipments even before the completion of whole work. The contractor shall Co-operate fully under such circumstances.

57.2 After completing the works, **during the Defect Liability Period**, the contractor shall provide Comprehensive all Inclusive Operation and Maintenance services for the complete Ventilation System installed. The cost for providing Comprehensive All Inclusive Operation and Maintenance services during the defect liability period shall be included in the item wise unit quoted rates of the contractor and nothing extra shall be payable to the contractor on this account. The contractor shall carry out all the routine and preventive maintenance of the system and shall maintain adequate trained and skilled staff, necessary spares and tools & tackles etc. at site to ensure smooth operation and maintenance of the Ventilation System. The Comprehensive all Inclusive Operation and Maintenance Services during the defect liability period shall include all the required servicing and maintenance, spares, tolls and tackles, accessories and the manpower etc. complete in all respect.

57.3 After successful completion of defects liability period, the contractor may be further required to provide Comprehensive Operation and Maintenance services for the complete system and equipments. Availing of Comprehensive Operation and Maintenance services of the system and equipments shall be at the sole discretion of the Employer and can be for 1, 2, 3, 4 or 5 years. The unit rates quoted for providing Comprehensive Operation and Maintenance services of the Complete Ventilation System and equipments for 1^{st}, 2^{nd}, 3^{rd}, 4^{th} & 5^{th} year (after completion of defect liability period) shall be binding on the contractor and the quoted rates of same shall be considered for the purpose of evaluation of the bids.

57.4 During providing comprehensive operation and maintenance services, the contractor shall deploy adequate skilled manpower and tools and tackles for smooth operation and maintenance of the complete Ventilation system. The Engineer/Employer shall have the right to ask for more manpower or ask for the replacement of existing manpower in case it is found that the operation and maintenance services provided by the contractor is not satisfactory. The decision of Engineer/Employer in this regard shall be final and binding on the contractor.

57.5 The rates quoted for comprehensive maintenance services for 1^{st}, 2^{nd}, 3^{rd}, 4^{th} & 5^{th} year (after defect liability period) shall be inclusive of all spares, accessories, manpower, tools and tackle, replacement of parts, routine and preventive servicing and maintenance of equipments/system etc. complete in all respect. Nothing extra over and above the quoted rates shall be payable on any account for providing comprehensive operation and maintenance services.

Section 3. Contract Data

Items marked "N/A" do not apply in this Contract

The following documents are also part of the Contract :

	Clause Reference (Conditions of contract)
*The Contractor's Bid and Letter of Acceptance	[1]
*The Conditions of Contract	[1]
*The Technical Specifications	
*The Program	[25]
*The Priced Bill of Quantities	[35]

The Engineer is : General Manger (PG I) or any other officer nominated from time to time by CMD of HSCC (I) Ltd. Plot 6(A),Block-E, Sector-1,Noida, Distt. Gautam Budh Nagar, Uttar Pradesh-201301.

*The Start Date is as notified in the letter of Acceptance	
*The Intended Completion Date for the whole work is three month from Date of Award.	[17]
*The Contractor is to submit the program for the works within 7 days of being notified of the acceptance of his bid.	[25]
*The contractor is to submit the updated program at the interval of 15 days	[25.3]
*The Site is located at NEIGRIHMS, Shillong, Meghalya	[1]
*The Defects Liability Period is FIVE YEAR	[33]
*The Defects Correction Period is 30 days.	[33,34]
*The language of the Contract is English	[3]
*The law which applies to the Contract is the law of the Union of India, Jurisdiction is High Court of Delhi only	[3]
*Arbitration procedure to be used shall be Arbitration and Conciliation Act 1996 or the latest amended.	[24]
*Appointing Authority for the arbitrator	[24]
*Place where arbitration will take place : New Delhi.	[24]
*The currency of the contract is the Indian Rupees.	
*The proportion of payments retained is 5%. Limited to 5% of contract value.	[44]

*The liquidated damages for the whole of the work are Rs. 5,000/- per day. [45]

*Maximum liquidated damages shall be 10% of the Contract price. [45]

*The amounts and currencies of the performance guarantee are [47]

Amount : 5% of Contract price
Currency : Indian Rupees

ANNEXURE - A

FORM OF AGREEMENT

1. This Agreement made the _____ day of _____ 2008 between North Eastern Indira Gandhi Regional Institute of Medical & Health Sciences (NEIGRIHMS, Shillong, Meghalya) (hereinafter called "The Employer") represented by M/s HSCC (India) Limited, E-6(A), Sector - 1, Noida (UP) - 201301 who enters into this Agreement of the one part and M/s _____ (hereinafter called "the Contractor") of the other part.

1.1 Whereas the Employer is desirous that certain Works should be executed by the Contractor, viz supply, installation, testing and commissioning of ventilation system for Kitchen , Laundry & CSD and has accepted a bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

Now this Agreement witnesseth of follows :

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz :

   (a) The Letter of Acceptance ;

   (b) The said bid ;

   (c) The Conditions of Contract ;

   (d) The Specification ;

   (e) The Drawings ;

   (f) The Priced Bill of Quantities ;

   (g) Any other relevant documents referred to this Agreement or in the aforementioned documents

3. In consideration of the payments to be made by the Employer to the Contractor as herein after mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein the Contract Price or only such sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

In Witness whereof, the parties hereto have caused this Agreement to be executed the day and year first before written.

Signed, Sealed, and Delivered by the Said _____

Binding Signature of [HSCC] on behalf of NEIGRIHMS, Shillong

_____

Binding Signature of Contractor _____

in the presence of

Witness (1) :

Witness (2) :

ANNEXURE - B

PROFORMA FOR PERFORMANCE BANK GUARANTEE
(On a stamp paper of appropriate value from any Nationalised Bank or Scheduled Bank)

To,

M/s HSCC (India) Ltd.,
Plot No. 6(A), Block E, Sector 1,
NOIDA - 201 301.

Dear Sir,

In consideration of the North Eastern Indira Gandhi Regional Institute of Health & Medical Sciences, Shillong, Meghalya (hereinafter called Employer) which expression shall include his successor and assigns represented by his Consultant M/s. HSCC (I) Ltd., Plot - 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201301 (hereinafter called HSCC) having awarded to M/s _____ (hereinafter referred to as the said Contractor or `Contractor' which expression shall whenever the subject to context so permits include its successors and assigns) a contract No._____ in terms inter alia, of the HSCC Letter No._____ dated_____ and the General Conditions of Contract and upon the condition of the contractor's furnishing security for the performance of the contractor's obligations and discharge of the contractor's liability under and in connection with the said contract upto a sum of Rs. _____ (Rupees _____only) amounting to _____ percent of the total contract value.

1. We,_____(hereinafter called `The Bank' which expression shall include its successors and assigns) having our branch office at _____ and Registered/Head Office at _____ a company registered under the Companies Act, 1956) hereby jointly and severally undertake to guarantee the payment to the Employer in rupees forthwith on demand in writing and without protest or demur or any and all moneys any wise payable by the contractor to the Employer under in respect of or in connection with the said contract inclusive of all the Employer's losses and damages and costs, (inclusive between attorney and client) charges and expenses and other moneys any wise payable in respect of the above as specified in any notice of demand made by the Employer to the Bank with reference to this guarantee upto an aggregate limit of Rs._____(Rupees _____ only).

2. We_____Bank Ltd. further agree that The Employer shall be sole judge of and as to whether the said contractor has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by The Employer/ HSCC on account thereof and the decision of The Employer that the said Contractor has committed such breach or breaches and as to the amount or amounts of loss, damage, costs, charges and expenses caused to or suffered by The Employer from time to time shall be final and binding on us.

3. The Employer shall be at liberty without reference to the Bank and without affecting the full liability of the Bank hereunder to take any other security in respect of the Contractor's obligations and liabilities hereunder or to vary the contract or the work to be done thereunder vis-a-vis the Contractor or to grant time or indulgence to the Contractor or to reduce or to increase or otherwise vary the prices of the total contract value or to release or to forbear from enforcement of all or any of the security and/or any other security(ies) now or hereafter held by The Employer and no such dealing(s) reduction(s) increase(s) or other indulgence(s) or arrangements with the Contractor or release or forbearance whatsoever shall absolve the bank of the full liability to The Employer hereunder or prejudice the rights of The Employer against the bank.

4. This guarantee shall not be determined or affected by the liquidation or winding up, dissolution, or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all monies payable to The Employer in terms thereof.

5. The bank hereby waives all rights at any time inconsistent with the terms of this guarantee and the obligations of the Bank in terms hereof shall not be any wise affected or suspended by reason of any dispute or disputes having been raised by the Contractor stopping or preventing or purporting to stop or prevent any payment by the Bank to The Employer in terms hereof.

6. The amount stated in any notice of demand addressed by The Employer to the Bank as liable to be paid to The Employer by the Contractor or as suffered or incurred by The Employer on account of any losses or damages or costs, charges and/or expenses shall be conclusive evidence of the amount so liable to be paid to The Employer or suffered or incurred by The Employer as the case may be and shall be payable by the Bank to The Employer in terms hereof.

7. This guarantee shall be a continuing guarantee and shall remain valid and irrevocable for all claims of The Employer and liabilities of the contractor arising up to and until midnight of_____.

8. This guarantee shall be in addition to any other guarantee or security whatsoever that The Employer may now or at any time any wise may have in relation to the Contractor's obligations/or liabilities under and/or in connection with the said contract, and The Employer shall have full authority to have recourse to or enforce this security in preference to any other guarantee or security which The Employer may have or obtain and no forbearance on the part of The Employer in enforcing or requiring enforcement of any other security shall have the effect of releasing the Bank from its full liability hereunder.

9. It shall not be necessary for The Employer to proceed against the said Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding that any security which The Employer may have obtained or obtain from the contractor shall at the time when proceedings are taken against the said bank hereunder be outstanding or unrealised.

10. We, the said Bank undertake not to revoke this guarantee during its currency except with the consent of The Employer in writing and agree that any change in the constitution of the said contractor or the said bank shall not discharge our liability hereunder.

11. We_____the said Bank further that we shall pay forthwith the amount stated in the notice of demand notwithstanding any dispute/difference pending between the parties before the arbitrator and/or that any dispute is being referred to arbitration.

12. Notwithstanding anything contained herein above, our liability under this guarantee shall be restricted to Rs._____(Rupees_____) and this guarantee shall remain in force till_____ and unless a claim is made on us within 3 months from that date, that is before_____all the claims under this guarantee shall be forfeited and we shall be relieved of and discharged from our liabilities thereunder.

Dated_____day of_____2008

For and on behalf of Bank.

Issued
under
seal :

ANNEXURE -C

PROFORMA FOR BID SECURITY BANK GUARANTEE

(To cover payment of Bid Security and Conditions of Contract)

(On a stamp paper of appropriate value from any Nationalised Bank or Scheduled Bank)

To

M/s HSCC (India) Ltd.,
Plot No. 6(A), Block E, Sector 1,
NOIDA - 201 301.

Dear Sir,

In consideration of your agreeing to accept Bank Guarantee for Rs. .....
(Rupees .....) in lieu of payment from
M/s ..... having its /their registered office at
.....
(hereinafter called the Bidder) towards Bid Security in respect of your Tender no. .....
..... calling for Tender for .....
at ..... and for due fulfilment of the terms and conditions of the said Tender, we hereby undertake and agree to indemnify and keep you indemnified to the extent of Rs ..... (Rupees .....
.....).

In the event of any loss or damages, costs, charges or expenses caused to or suffered by you by reason of any breach or non observance on the part of the Bidder of any terms and conditions of the said Tender, we shall on demand and without cavil or argument, and without reference to the Bidder, irrevocably and unconditionally pay you in full satisfaction of your demand the amounts claimed by you, provided that our liability under this guarantee shall not at any time exceed Rs .....
(Rupees .....).

This guarantee herein contained shall remain in full force and till you finalise the Tender and select the Tender as per your choice and it shall in the event of the said Bidder being selected and entrusted with the said work, continue to be enforceable till the said Bidder executes the Agreement with you and commences the work as stipulated under the terms and conditions of the said Tender have been fully and properly carried out by the said Bidder and accordingly discharges the guarantee.

We also agree that your decision as to whether the Bidder has committed any breach or non observance of the terms and conditions of the said Tender shall be final and binding on us.

We under take to pay the Consultant any money so demanded by the Consultant notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceedings pending before any Court or Tribunal relating thereto, our liability under this present being absolute and equivocal.

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

This guarantee shall continue to be in full force and effect for a period of 120 days from the date of submission of Bid. Notwithstanding the above limitations, we shall honour and discharge the claims preferred by you within thirty days of expiry of this guarantee.

We shall not revoke this guarantee during its currency except with your previous consent in writing. This guarantee shall not be affected by any change in Constitution of our bank or of the Bidder firm. Your neglect or forbearance in the enforcement of the payment of any money, the payment whereof is intended to be hereby secured or the giving of time for the payment hereto shall in no way relieve us our liability under this guarantee.

Dated this ..... day of .....

Yours faithfully,

For

Signature & seal of the Bank (Authorised Signatory)

SPECIFICATIONS

SYSTEM DESIGN DATA

1.0 General

The system design, basis of design, estimated requirements and other relevant data are outlined in this section. The specifications and specific requirements are outlined in the subsequent sections.

2.0 Location:

North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS) is located at Shillong

3.0 Scope of Work:

The work proposed under this tender includes providing, fixing, testing commissioning and handing over to client the ventilation system for Kitchen, Laundry and C.S.S.D.

Civil works such as trenches for piping, cables and making foundations of equipments.

Main 3 ph, 415 v, 50 hz, A.C. power supply up to main Electrical Starter Panels of Kitchen, Laundry, CSSD of the ventilation system.

Water supply up to each Air Washer and sump. Make up water tanks.

Any kind of false ceiling, boxing etc. Making frames for fixing grilles & diffusers in false ceiling, boxing or in walls.

4.0 Special Considerations in Design:

The ventilation system design shall take into consideration the following aspects:

Specific requirements for ventilation and air filtration to dilute and remove contamination.

The need to provide controls for maintaining accurate control of environment conditions.

The need to design systems which should be easily maintained by the hospital staff.

The need to maintain relative pressure differentials with respect to adjoining areas and the outside.

FIRE SAFETY

For fire safety fire dampers shall be provided in supply and return air ducts, which shall automatically shut off in case of detection of fire. Also the Ventilation system shall be electrically interlocked with the central fire alarm system of the building.

5.0 Design Considerations :

5.1 The amount of fresh air intake has been optimised to provide a suitable environment for specific areas of the buildings depending upon the function of the area, the number of people involved and the degree of hazard.

5.2	**Ventilation :**	**:**	
	Kitchen	:	12-15 air change per hour during normal Condition and 30 air changes per hour during fire condition.
	Laundry	:	12-15 Air changes per hour in normal condition 30 air change per hour during fire.
	C.S.S.D.		20-25 Air changes per hour.
6.0	**Electric Power supply**	:	415 V/3ph/50Hz/AC

7.0 System Design

7.1 For fire safety, fire dampers interlocked with the air blowers shall be provided in supply air ducts and return air passage. All materials used for insulation shall be fire retardant type. The ventilation system's motors shall also be interlocked with the central fire alarm system of the building such that in case of detection of smoke or fire by the fire alarm system, the ventilation system units shall automatically work.

9.0 Drawings:

The drawings forming part of these specifications provide a feasible scheme for locating the equipment. the contractor may re-arrange the equipment for improving the layout and meeting the site conditions. All such changes shall however be subject to the Engineer In-Charge approval. Contractor shall submit the detail working drawings based on tender drawing/ site condition and get these approved from HSCC before starting the work.

10.0 TEST DATA:

The complete HVAC system shall be tested as per the specifications given elsewhere and complete test data shall be furnished on prescribed data sheets:

11.0 TECHNICAL DATA :

The contractor shall furnish complete technical data, on the equipment offered as required under the heading `Technical data'. In this specifications every effort has been taken to put forth only general specifications of various equipments/ material **.**If inadvertently, any of the specification drawn happens to match with the specifications of any one particular make/manufacturer only, in respect of critical parameters, than

it will not automatically mean that this particular make/manufacturer is only technically suitable. In general, the specifications offered of other approved makes/manufacturers will be assessed in their own entirety to ascertain whether or not the broad functions in general expected of the requirements are available with reasonable tolerance on the desired requirements of the client and accordingly the equipments/material would be considered based on prudent assessment and sole discretion of the Engineer.

12.0 PERFORMANCE GUARANTEE :

12.1 The contractor shall guarantee that the ventilation system shall maintain the inside conditions as per the designed inside conditions.

12.2 The contractor shall guarantee that the capacity of various equipments / components as well as the whole system shall not be less than specified.

12.3 The contractor shall ensure , that the system shall be free of vibrations and disturbing sounds.

VENTILATION SYSTEMS

The kitchen, Laundry & CSSD shall be mechanically ventilated by centrifugal exhaust fans In normal operation, fans shall exhaust 12-15 air changes/hr and during fire condition, the fans shall exhaust @ minimum 30 air changes/ hr as per the fire regulations. All the fans shall have provision of emergency power supply & shall be interlocked with the fire panel.

Drawings:

The drawings forming part of these specifications provide a feasible scheme for locating the equipment. the contractor may re-arrange the equipment for improving the layout and meeting the site conditions. All such changes shall however be subject to the Engineer In-Charge approval. Contractor shall submit the detail working drawings based on tender drawing/ site condition and get these approved from HSCC before starting the work.

1. VENTILATION FANS

General :

The ventilation fans shall be complete in all respects and shall generally comply with the following specifications given below:

1 **Exhaust Fans:**

1.1 The exhaust fans shall be propeller type with steel hub and blades, mounted directly on the shaft of a totally enclosed motor.

1.2 The fan blades shall be of pressed steel of aerofoil design for high efficiency and static pressure.

1.3 The mounting frame shall be of cast/sheet steel with steel brackets to connect the frame, with the fan/motor assembly. Rubber mounts shall be provided between the mounting frame and the mounting brackets.

1.4 The fan motor shall be to totally enclosed squirrel cage type.

2 **Centrifugal Blowers:**

2.1 The centrifugal blowers shall be double/single inlet, double/single width, non-overloading type, of suitable construction. The blower performance must be rated in accordance with approved test codes and procedures.

2.2 The blower housing comprising of scroll & side plates shall be accurately cut, heavy gauge all welded sectional construction and reinforced with angle bracings. Outlets shall be flanged to assure proper duct connections. Inlet cones shall be spun venturi

type or curved vane type to ensure smooth air entry. The base frame shall be of angle iron in bolted/welded construction.

2.3 Impeller shall be fabricated from sheet steel with backward curved, properly designed. blades, heavy c.i. hub and shall be both dynamically and statically balanced, to a close tolerance for quiet and vibration free performance.

2.4 Shaft shall be of hot rolled steel or forged steel, sized adequately, but in no case less than 40 mm dia-meter and shall be accurately ground and polished to a close tolerance.

2.5 Bearings shall be self aligning, heavy duty ball or tapered roller type with integral dust and grease seals.

2.6 After assembly, the complete fan shall be painted with rust proof primer and two coats of synthetic enamel paint.

2.7 Fan having wheel diameter of 1220 mm or more, shall be supplied with split, bolted housing for convenience of handling and installation.

3 **Blower Drive Assembly:**

3.1 Drive assembly for each blower shall consist of blower pulley, motor pulley, a set of `V' belts, belt guards, and belt tension adjusting device.

3.2 Pulleys shall be selected to provide the required speed. They shall be multi-grove type, with section and grooves selected to transmit 33% more load than the required power and shall be statically balanced.

3.3 The belt guards shall be of m.s. sheet with angle iron reinforcement and expanded metal screen.

4. **Motors and Starters :**

4.1 The motor for each blower, shall be squirrel cage induction type and conform to specifications as given under section on control panel, motors and switchgear. The motor h.p. shall be at lease 20% more than the limit load of fan and of minimum rating as given under `Schedule of Equipments'.

4.2 **Limitation :**

The air velocity limits are as follows :

Velocity at blower outlet shall not exceed 12.5 mps.

2.0 **Package Type Air Washers:**

2.1 The Packaged type Air Washer shall be complete in all respect and shall generally comply with the following specifications given below:

2.2 Air Wahers

The packaged air washers shall be of G.I sheet metal sectionalized construction and shall include fan section, cooling pad section, motor drive, eliminators etc.

2.2.1 Fan Section:

The impellers of the fan or fans shall be of G.I sheets, double inlet forward curved centrifugal design, both statically and dynamically balanced. The fan housing shall be of sturdy construction made from 16 G(1.6 mm) G.I sheet with smooth air inlets. The fan shall be mounted on properly aligned shaft and mounted on self aligning bearing blocks. The casing of the cab section shall be made of 16 G(1.6 mm) G.I sheets suitably reinforced to provide rigidity. The frame work shall be either be folded G.I sheets or of hot dipped galvanized iron.

The fan section shall be complete with multi V belt drive, belt guard and adjustable motor mounting base.

2.2.2 Cooling Pad

The Cooling pads shall be of honey comb design to provide extended and sufficient wetted surface to give a water absorbing efficiency of at least 90% at an air efficiency velocity of 500 FPM (2.5 m/sec)

The cooling pads shall be made of either acetate paper or high impact PVC. The cross section and depth shall be sufficient for specified efficiency. The cooling pad section shall be of 16 G (1.6 mm) G.I sheets similar to fan section. It shall be complete with galvanized supports for mounting the pads and a water distribution through the uniform supply of water over the entire surface.

2.2.3 Water Sump

The water sump below the pad section shall be of 3 mm M.S plate with welded jounts and stiffness. The tank shall be complete with makeup, overflow and drain connections. A float valve shall be provided for makeup water line. The tank shall be given 2 coats of corrosion resistance paint and final coat of black anamel paint.

The pump set shall be of monoblock construction, with end suction and top discharge with flanged connections, cast iron impeller and casing all mounted directly on a squirrel cage, drip proof induction motor of suitable capacity.

2.3 Motors and Starter

2.3.1 The motor for each blower shall be totally enclosed, fan cooled, squirrel cage induction type and conform to specifications as given under section 9.

2.3.2 The starters shall be “Direct on Line” type upto 7.5 H.P and all larger starters shall be fully automatic Star Delta Type. The starters shall conform to the IS specifications.

2.4 Miscellaneous:

Necessary accessories shall be provided wherever necessarily required for proper operation and shall also include:

Necessary

Vibration isolators for the Blowers

Canvass connections at the outlet of each fan

Nuts, bolts, shims etc as required for the grouting of the equipments

Float valves in the air washer tank, along with quick fill connection

Gate valves in drain, make up, quick fill lines etc. as required.

2.5 Limitations

The air velocity limits are a follows:

Velocity across air washer shall not exceed 2.5 m/sec (500 FPM)

Velocity at blower outlet shall not exceed 8m/sec (1500 FPM)

3.0 AXIAL FLOW FANS

Casing shall be constructed of heavy gauge sheet steel. Casing shall be provided with hinged door enabling easy replacement of wheel, shaft and bearings. A small inspection door with handle and neoprene gasket shall also be provided. Casing shall have flanged connection on both ends for ducted applications. 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 de-rusted, cleaned, primed and finish coated with enamel paint.

ii) Rotor hub and blades shall be of cast aluminium, 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. Fan blade mounting on the hub shall be statically and

dynamically balanced. Extended grease leads for external lubrication shall be provided. The fan pitch control maybe manually readjustable at site, upon installation, for obtaining actual airflow values, as specified.

iii) Motor shall be of 3 phase squirrel-cage totally enclosed, fan cooled type. Motor and starter shall be in accordance with para 6.6. (V) and 13.9. The speed of fan shall not exceed 1000 RPM for fans with impeller diameter above 450 mm, and 1450 RPM for fans with impeller diameter of 450 mm and less.

iv) Drive to fan shall be provided through belt drive with adjustable motor sheaves and belt guard or direct driven. Belt shall be oil resistant type.

DUCT WORK AND OUTLETS

1.0 **General:**

1.1 The work under this part shall consist of furnishing labour materials, equipment and appliances as specified necessary and required to install all sheet metal and other allied work to make the air conditioning supply, ventilating, exhaust system ready for operation as per drawings.

1.2 Except as otherwise specified all duct work and related items shall be in accordance with these specifications.

1.3 Duct work shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

2.0 Duct materials

2.1 The ducts shall be fabricated from galvanized steel sheets class VIII GSS sheets conforming to IS: 277-1962 (revised) or aluminium sheets conforming to IS: 737-1955 (wherever aluminium ducts are specified) as manufactured by TATA/SAIL/HSL/ JINDAL/ BHUSAN

2.2 All duct work, sheet metal thickness and fabrication unless otherwise directed, shall strictly meet requirements, as described in is: 655-1963 with amendment-i (1971 edition)

The thickness of the sheet shall be as follows: -

	Size of duct	**Sheet thickness**		**type of joints**	**bracing if any**
		GI	**Aluminium**		
2.2.1	Upto 750mm	0.63 mm	0.80 mm	GI flange	
2.2.2	751 mm to 1000 mm	0.80 mm	1.00 mm	25x25x3 mm Angle iron Frame With 8 mm dia. nuts & bolts.	25x25x3 mm at the rate of 1
2.2.3	1001 mm to 1500 mm	0.80 mm	1.00 mm	40x40x5 mm angle iron frame with 8 mm dia. Nuts & bolts.	40x40x3mm at the rate of 1
2.2.4	1501 mm to 2250 mm	1.00 mm	1.50 mm	50x50x5 mm angle iron to be cross braced diagonally with 10 mm dia nuts & bolts at 125 mm center.	40x40x3mm at the rate of 1.2

2.2.5	2251 mm and above	1.25 mm	1.80 mm	50x50x6 mm angle iron frame with 10mm nuts & bolts at 125 mm centre.	40x40x3 mm at the rate of 1.6

2.3 The gauges, joints and bracings for sheet metal duct work shall further conform with the provisions as shown on the drawings.

2.4 Ducts larger than 450 mm shall be cross broken, duct sections upto 12 00 mm length may be used with bracing angles omitted.

2.5 Changes in section of duct work shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 deg. Angle from the axis of the main duct unless otherwise approved by the engineer-in-charge.

2.6 All ducts shall be supported from the ceiling/slab by means of M.S. rods of 9 mm (3/8") dia with M.S. angle at the bottom.

3.0 **Installations**

3.1 During the construction, the contractor shall temporarily close duct openings with sheet metal covers to prevent debris entering ducts and to maintain opening straight and square, as per direction of engineer-in-charge.

3.2 Great care should be taken ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.

3.3 All duct work shall be of high quality approved galvanized sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. all joints shall be tight and shall be made in the direction of air flow.

The ducts shall be re-inforced where necessary, and must be secured in place so as to avoid vibration of the duct on its support.

3.4 All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. turning vanes shall be securely fastened to prevent noise or vibration. All ducts shall be fabricated and installed in accordance with modern design practice. The sheet metal gauges and fabrication procedures as given in IS specifications shall be adhered to and shall be considered as an integral part of these specifications.

3.5 The duct work shall be varied in shape and position to fit actual conditions at building. All changes shall be in accordance with accepted airconditioning duct design and subject to the approval of the engineer-in-charge. The contractor shall verify all measurements at building and shall notify the engineer-in-charge of any difficulty in carrying out his work before fabrication.

3.6 Sponge rubber of approved equal gaskets shall be installed between duct flanges as well as between all connections of sheet metal ducts to walls, floor columns, heater casings and filter casings. Sheet metal connections shall be made to walls and floors by means of galvanized steel angles anchored to the building structure with anchor bolts and with the sheet bolted to the angles. sheet metal connections shall be as shown in the drawings or as directed by engineer-in-charge.

3.7 The ducts shall be supported from the structure by means of suitable supports grouted in the R.C.C. work. The type of support should meet the approval of the engineer-in-charge and should involve minimum damage or breakage. In no case the duct will be rested upon the false ceiling/boxing or on supports grouted in the wall.

3.8 Flanges and supports are to be black, mild steel and are to be primer coated on all surfaces before erection and painted with aluminium thereafter. accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.

3.9 Joints, seams, sleeves, splitters, branches/ takeoffs and supports are to be as per duct details as specified, or as decided by engineer-in-charge.

3.10 Joints requiring bolting or riveting may be fixed by hexagon nuts and bolts, stove bolts or buck bolts, rivets or closed centre top rivets or spot welding. Self tapping screws must not be used. all fixing must have a permanently non-corrosive finish such as cadmium plating or galvanizing as appropriate. Spot welds and bronze welds are to be coated on all surfaces with zinc rich paint, as approved by engineer-in-charge.

3.11 The flexible joints are to be fitted to the suction and delivery of all fans. The material is to be normally double heavy canvass or as directed by engineer-in- charge. On all circular spigots the flexible materials are to be screwed or clipband with adjustable screws or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat.

3.12 The flexible joints are to be not less than 75 mm and not more than 250 mm between faces.

3.13 The duct work should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling contractors.

4.0 **Dampers**

4.1 At the junction of each branch duct with main duct and split of main duct, volume dampers must be provided. Dampers shall be two gauges heavier than gauge of the large duct, and shall be rigid in construction to the passage of air.

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

4.3 The dampers shall be of splitter, butterfly or louver type. The damper blade shall not be less than 1.25 mm (18) gauge, reinforced with 25 mm angles 3 mm thick along any unsupported side longer than 250 mm angles shall not interface with the operation of dampers, nor cause any turbulence.

4.4 Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.5 mm steel and blades shall not be over 225 mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8 mm thickness with fine mesh packing.

4.5 Wherever required for system balancing, provide a volume balancing opposed blade damper with quadrant and thumb screw lock. Provide damper rod and damper block with upset screws.

4.6 After completion of the duct work, dampers are to be adjusted and set to deliver the required amounts of air as specified on the drawings.

4.7 The fire dampers shall be provided wherever shown on the drawings. The damper shall be multi blade type as per drawings. The blades shall be minimum 1.6 mm thick mild steel. The frame shall be of 1.6 mm thickness. Other materials shall be as per the drawings attached and shall include return spring, locking device, fusible link etc.

5.0 **Access panel**

5.1 A hinged and gasketed access panel shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

6.0 **Miscellaneous**

6.1 All ducts above 450 mm are to be cross broken to provide rigidity to the ducts.

6.2 All duct work joints are to be true right angle or approaching with all sharp edges removed.

6.3 Sponge rubber gaskets also to be provided behind the flange of all grilles.

6.4 Each shoot from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the shoot.

6.5 Inspection doors measuring at least 450 mm x 450 mm are to be provided in each system at an appropriate location, as directed by engineer-in-charge.

6.6 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.

6.7 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations additional supports are to be provided where required for rigidity or as directed by engineer-in-charge.

6.8 The ducts should be routed directly with a minimum of directional change.

6.9 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the engineer-in-charge, at no extra cost.

6.10 All duct supports, flanges, hangers and damper boxes etc. shall be given 2 coats of red oxide paint before installation and one coat of aluminium paint after the erection, at no extra cost.

6.11 All angle iron flanges to be welded electrically and holes to be drilled.

6.12 All the angle iron flanges to be connected to the GSS ducts by rivets at 100 mm centres.

6.13 All the flanged joints, to have a 4 mm thick felt packing stack to the flanges with shellac varnish. The holes in the felt packing are to be burnt through.

6.14 The GSS ducts should be lapped 6 mm across the flanges.

6.15 The ducts should be supported by approved type supports at a distance not exceeding 2.4 metres.

6.16 Sheet metal connection pieces, partitions and plenums required shall be constructed of 1.25 (18 gauge) sheet thoroughly stiffened with 25 mm x 25 mm angle iron braces and fitted with access doors.

8.0 GRILLES DIFFUSERS

8.1 The supply and return air grills and ceiling diffusers

The supply and return air grills and ceiling diffusers shall be made of powder coated extruded aluminium sections. The supply air grills/diffusers shall be provided with screws operated opposed blade volume control device made of extruded aluminium in black anodized finish.

All grills/diffusers shall have soft continuous rubber/foam gasket between the peripheries of the grills/diffusers and surface on which it has to be mounted. The colour of grills/diffuser shall be as per the approval of the Engineer-in-Charge.

8.2 Linear supply and return grills

The linear continuous supply/return air grills shall be made of powder coated extruded aluminium construction with fixed horizontal bars. The thickness of fixed bar louvers shall be 5mm in front and the flange shall be 20mm wide with round edges. The register shall be suitable for concealed fixing and horizontal bars of the grills shall mechanically crimped from the back to hold them.

The colour of grills shall be as per the approval of the Engineer-in-Charge. The volume control device made of extruded aluminium construction in black anodized finish shall be provided in supply air duct collars only.

8.3 Front fixed bar rear adjustable louvered grills

The grills shall be made of powder coated extruded aluminium construction with front fixed horizontal bar at 0 degree inclination with one way or two way deflection with rear vertical individually adjustable louvers in black shade mounted on Nylon bushes to hold deflection setting under all conditions of velocity and pressure.

The colour of grills shall be as per the approval of the Engineer-in-Charge. The volume control device of extruded aluminium construction in black anodized finish shall be provided in supply air duct collars.

8.4 Square/rectangular ceiling diffusers

The square/rectangular ceiling diffusers shall be made of powder coated extruded aluminium construction with flush fixed pattern. The diffusers shall have Anti-Smudge ring and spring loaded removable control core in various pattern for air flow direction. The diffusers shall be mounted by concealed screw fixing arrangement. The volume control device of extruded aluminium construction in black anodized finish shall be provided in supply air diffusers. The colour of diffuser shall be as per the approval of the Engineer-in-Charge.

8.5 Volume control device

The opposed blade volume control device shall be made of Powder Coated extruded aluminium construction in black anodised finish. Opposed blades shall be pivoted to extruded aluminium frame with Nylon bushes. Specially designed blade shall have an overlapping lip which shall ensure a tight closure.

8.6 Fresh air intake louvers with bird screen

The fresh air intake louvers at least 50mm deep will be made of powder coated extruded aluminium construction. Bird/insect screen will be provided with the intake louvers. The blades shall be inclined at 45 degree on a 40mm blade pitch to minimize water ingress. The lowest blade of the assembly shall be extended out slightly to facilitate disposal of rain water without falling on door/wall on which it is mounted.

The intake louvers shall be provided with factory fitted aluminium construction volume control dampers in black anodised finish.

9.0 SMOKE AND FIRE DAMPERS – SPRING RETURN TYPE

The smoke and fire damper shall be opposed blade type made of 1.5 mm GSS sheet having multiblade construction. The blades shall be fitted with chrome plated and self lubricated phosphorus bronze bushes. The damper shaft shall be provided with jam seal (compression type) on sides, to prevent spread of smoke and fire. The blades of damper shall be held in open position by a high tensile spring and fusible link. The fusible link shall be UL stamped and shall operate at 74 degree C, causing the damper to close in case of fire. The dampers shall be installed with GI sheets of minimum 400 mm long as an integral part. The damper shall be provided with a suitable hand operated lever for opening the damper blades manually.

10.0 ACCESS PANEL

10.1 Hinged access doors of suitable size complete with air tight gaskets shall be provided in all fire dampers and plenums.

11.0 Painting

11.1 All grilles, and diffusers shall be anodised or powder coated, as required, before installation.

11.2 All ducts immediately behind the grilles/diffusers etc. are to be given two coats of black paint in matt finish.

11.3 All grilles, diffusers & registers shall be provided with rubber gasket between flanges and the wall or ceiling.

12.0 Testing

12.1 After completion, all duct system shall be tested for air leakage by injecting smoke with the smoke with the help of smoke generating machine.

12.2 The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final balance of air quantity through each outlet shall be submitted to the engineer-in-charge for approval.

PIPE WORK

1. **General:**

All piping work shall conform to quality standards and shall be carried out as per specifications and details given hereunder :-

2. **Pipes :**

2.1 All pipes in sizes upto 50 mm dia shall be m.s. e.r.w tube (black steel) heavy class as per I.S. 1239-79, part-i with amendment-i of january `81.

2.2 All pipes in sizes 65 mm to 150 mm dia shall be m.s. e.r.w. tube (black steel) heavy class, as per I.S. 1239/79 part-i with amendment i of january 1981.

2.3 All pipes in sizes above 150 mm dia shall be m.s. e.r.w. tube (black steel) of minimum 6 mm thickness as per I.S. 3589 with amendment (latest).

3. **Fittings :**

3.1 The dimensions of the fittings shall conform to I.S. 1239/69 part-ii unless otherwise indicated, in the specifications.

3.2 All bends in sizes upto and including 150 mm dia, shall be ready, made of heavy duty, wrought steel of appropriate class.

3.3 All bends in sizes 200 mm and larger dia, shall be fabricated from pipes of the same dia and thickness, with a minimum of 4 sections, and having a minimum centre line radius of 1.5 diameter of pipes.

3.4 All fittings such as branches reducers etc. in all sizes shall be fabricated from pipes of the same dia and thickness, and its length should be at least twice the dia of the pipe.

3.5 The branches may be welded straight to the main line, without making a separate fitting, where specified on drawings or required by engineer-in-charge.

3.6 Blank ends are to be formed with flanged joints and 6 mm thick blank between flange pair for 150 mm and over, in case where, a future extension is to be made otherwise blank end discs of 6 mm thickness are to be welded on, with additional cross stiffeners from 50 mm x 50 mm m.s. heavy angles, for sizes upto 350 mm. All ends larger than 400 mm dia shall have dished ends.

3.7 Air valves (included in piping) shall be provided at all high points in the piping system for venting with a size of 25mm for pipes up to 100 mm and 40mm for larger pipes

4. **Flanges :**

4.1 All flanges shall be of mild steel as per i.s. 6392/71 and shall be steel slip-on-type, welded to the pipes, flange thickness shall be to suit class-ii pressures.

4.2 Flanges may be tack welded into position, but all final welding shall be done with joints dismounted 3 mm thick gaskets shall be used with all flanged joints. The gaskets shall be fibre re-inforced rubber as approved by the engineer-in-charge. special adhesive compound shall be used between flanges of steam, air and gas

lines.

4.3 Flanges shall be used as follows :-

4.3.1 Counter flanges for equipment having flanged connections.

4.3.2 Flanged pairs shall be used on all such equipment, which may require to be isolated or removed for service e.g. pumps, refrigeration machines, air handling units etc.

4.3.3 All threaded valves shall be provided with nipples and flanged pairs on both sides to permit flange connections, for removal of valves from main lines for repair/replacement.

5. **Valves:**

5.1 **Butterfly Valves**

5.1.1 The butterfly valve shall consist of cast iron body preferably in two piece construction.

5.1.2 The disc shall consist of disc pivot and driving stem shall be in one piece centrally located.

5.1.3 The valve seat shall be synthetic material suitable for water duty it shall line the whole body.

5.1.4 The disc should move in slide bearings on both ends with `O' ring to prevent leakage.

5.1.5 The handle should have arrangement for locking in any set position.

5.1.6 The valve should be suitable for 12 kg/sq.cm working pressure.

5.2 The check valves shall be wafer type. The body shall be of cast iron and the plate of aluminium bronze. The valve shall have plain face and shall have a synthetic seal. The valve shall be suitable for 12 kg /cm^2 pressure.

5.3 All gauge cocks shall be of gunmetal plug type, complete with siphon (brass chrome plated).

5.4 All drain valves shall be of gunmetal with a hose union connection of one hand.

5.5 All valves on the return line of fan coil units shall be as in 5.6 but without integral water strainer.

6. **Balancing Valves :**

6.1 The balancing valves upto 80 mm dia shall be of gunmental screwed type confirming to b.s. 5154 or equivalent specifications.

6.2 The valve shall be cast gunmetal astm b-62 and complete with non rising spindle. ptfe disc seal cast metal hand wheel.

6.3 The port opening shall permit precise regulation of flow rate, by accurately measuring the pressure drop across the port.

6.4 The valve shall be complete with two ports for connections to a mercury manometer

to measure the pressure drop, as well as a drain port.

6.5 The spindle shall have a shielded screw to set the flow at the desired level.

6.6 This valve shall be used wherever specified.

7. **Strainers:**

7.1 The strainers shall either be pot type or `y' type with cast iron or fabricated steel body tested upto pressure applicable for the valves as shown on the drawings.

7.2 The strainers shall have a perforated bronze sheet screen with 3 mm perforation and with a permanent magnet to catch iron fillings.

7.3 Pot strainers shall be provided with flanged connections and `y' strainers shall be provided with flanged ends.

7.4 The strainers shall be designed to facilitate easy removal of filter screen for cleaning, without disconnection of pipe line.

8. **Jointing:**

8.1 All pipe lines shall be welded type.

8.2 Square cut plain ends will be welded for pipes upto and including 100 mm dia.

8.3 All pipes 125 mm dia or larger will be beveled by 35 deg before welding.

9. **Miscellaneous**:

9.1 Provide all pipe work as required to make the apparatus connected complete and ready for regular and safe operation. Unless otherwise noted connect all apparatus and equipment in accordance with manufacturer's standard details, as approved by engineer-in-charge.

9.2 Unless otherwise specified, pitch the lines of piping as follows: -

All condensation drainage, including air handling unit and fan coil unit shall be pitched in the direction of flow to ensure adequate drainage, with an adequate trap seal to prevent leakage of air due to static pressure developed by air conditioning units. Pitch, 20 mm per metre wherever possible, but not less than 10 mm per metre.

Drains from other equipment shall be pitched similarly without trap seal.

9.3 Provide necessary valves (included in piping) and capped connections for all low points in piping system, where necessary or required for draining systems. Provide isolating valves & drain valves in all risers to permit repairs without interfering with the rest of the system.

9.4 During construction, temporarily close, open ends of pipes with sheet metal caps, where necessary, or required to prevent debris from entering the piping system.

9.5 Support piping independently of all equipment so that the equipment is not stressed by the piping weight or expansion.

9.6 To facilitate the maintenance, repair and replacement:

9.6.1 Provide shut-off valves where indicated and for individual equipment, units at inlet and outlet, to permit unit removal for repairs, without interfering with the remainder of the system. Additional shut-off valves shall be provided as required to enable all systems to be fully sectionalized. By-pass and stop valves shall be provided for all automatic control valves as specified.

9.6.2 Arrange piping for maximum accessibility for maintenance and repair, locate valves for easy access and operation. No valves shall be installed with handles pointing down, unless unavoidable.

9.6.3 Cut the pipes accurately according to measurements, established at building site & work into place without springing or forging.

9.6.4 Pipe supports shall be adjustable for height and prime coated with rust preventive paint & finish coated with grey paint, both as approved by engineer-in-charge. The spacing of pipe supports shall not be more than that specified below :-

Nominal pipe size mm			Spacing (metres)
15	...	...	1.25
20 & 25	...	...	2.00
32, 30, 50 & 65	...	...	2.50
80,100 & 125	...	...	2.50
150 & above	...	...	3.00

9.6.6. Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stresses on the pipes. Pipe hangers shall be fixed on walls and ceiling by means of metallic approved dash fasteners.

9.6.7 Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation.

9.6.8 Where pipes are to be buried under ground, they should be coated with one coat of bituminous paint. The top of the pipes shall not be less than 75 cms. from the ground level. Where this is not practical permission of engineer-in-charge shall be obtained for burying the pipes at lesser depth. The pipes shall be surrounded on all sides by sand cushions of not less than 15 cms. after the pipes have been laid and top sand cushions provided, the trench shall be refilled with the excavated soil, excess soil shall be removed from the site of work by the contractor.

10. **Hangers & Supports:**

10.1 Hangers and supports shall be provided and installed for all piping and tubing wherever indicated, required or otherwise specified. Wherever necessary, additional hangers and supports shall be provided to prevent vibration or excessive deflection of piping and tubing.

10.2 All hangers and supports shall be made of steel or other durable and

non-combustible materials, galvanized or plated. Wood wire or perforated strap iron shall not be used as permanent hangers or supports.

10.3 Hangers shall be supported from structural steel, concrete inserts & pipe racks, as specifically approved.

10.4 No hangers shall be secured to underside of light weight roof decking and light weight floor glass.

10.5 Mechanical equipment shall be suspended midway between steel joists and panel points.

10.6 Drilling or punching of holes in steel joist members will not be permitted.

11. **Sleeves:**

11.1 Where pipes pass through floors, walls, etc provide galvanized steel pipe sleeves 50 mm larger than outside diameter of pipe. Where pipes are insulated, sleeves shall be large enough to ample clearance for insulation.

11.2 Where pipes pass through outside walls or foundations, the space between pipe and sleeve shall be caulked with lead wool and oakum.

11.3 The centre of pipes shall be in the centre of sleeves, and sleeves shall be flush with the finished surface.

12. **Expansion or Contraction:**

12.1 The contractor shall provide for expansion and contraction of all piping installed by the use of swing connections and expansion loops.

13. **Arrangement and Alignment of Piping:**

13.1 All piping shall be arranged and aligned in accordance with the drawings as specified. Where special conditions are encountered in the field, the arrangement and alignment of piping shall be as directed by the engineer-in-charge.

13.2 The piping shall be installed in a uniform manner, parallel to or perpendicular to walls or ceilings, and all changes in directions shall be made with fittings. The horizontal piping shall be run at right angles and shall not run diagonally across rooms or other piping. Wherever possible all piping shall be arranged to provide maximum head room.

13.3 All piping shall be installed as directly as possible between connecting points in so far as the work of other trades permits. Where interference occurs with another trade whose work is more difficult to route this contractor shall reroute his pipes as required to avoid interference, at the discretion of the engineer-in-charge.

13.4 All piping shall be carefully installed to provide for proper alignment, slope and expansion.

13.5 The stresses in pipe lines shall be guided and pipes shall be supported in such a manner that pipe lines shall not creep, sag or buckle.

13.6 Anchors and supports shall be provided wherever necessary to prevent any

misalignment of piping.

13.7 Small tubing gauges, controls or other equipment installed on any apparatus, shall not be coiled nor excessive in length, but shall be installed neatly, carefully bent at all changes in direction, secured in place and properly fastened to equipment at intervals to prevent sagging.

13.8 The piping shall be grouped wherever practical and shall be installed uniformly in straight parallel lines in either vertical or horizontal positions.

14. **Testing:**

14.1 In general, tests shall be applied to piping before connection of equipment and appliances. In no case shall the piping, equipment or appliances be subjected to pressures exceeding their test ratings.

14.2 The tests shall be completed and approved before any insulation is applied. Testing of segments of pipe work will be permitted, provided all open ends are first closed, by blank-offs or flanges.

14.3 After tests have been completed the system shall be drained and flushed 3 to 4 times and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fillings and debris.

14.4 All piping shall be tested to hydraulic test pressure of at least one and half times the maximum operating pressure but not less than 10 kg/sq.cm for a period of not less than 8 hours. All leaks and defects in the joints revealed during the testing shall be rectified to the satisfaction of the engineer-in-charge, without any extra cost.

14.5 All the piping systems shall be tested in the presence of the engineer-in-charge or their authorised representative. Advance notice of test dates shall be given and all equipments, labour, materials required for inspection, and repairs during the test shall be provided by the contractor. A test shall be repeated till the entire systems are found to be satisfactory to the above authority. The tests shall be carried out for a part of work if required by engineer-in-charge in order to avoid hindrance in the work of the insulation contractor.

14.6 All steam and condensate pipes shall be tested and proven tight under hydrostatic pressure of 20 kg/sq.cm, unless otherwise stated, for a minimum period of 4 hours without drop in pressure.

14.7 Miscellaneous piping, tests with air at 10.5 kg/sq.cm for a minimum of 24 hours without drop in pressure.

14.8 The contractor shall make sure that proper noiseless circulation is achieved through all piping systems. If due to poor bond, proper circulation is not achieved, the contractor shall bear all expenses for carrying out the rectification work including finishing of floors, walls and ceiling damaged in the process of rectifications.

14.9 The contractor shall provide all labours and materials to make provision for removing water and throwing it at the proper place, during the testing or/and after the testing to avoid damages to employer or other contractors ' properties. Any damages caused by the contractor to the employer or other contractors' properties, shall be borne by the contractor.

15. Drain Piping:

15.1 The drain piping shall be medium class galvanized steel as per is 1239/1979.

15.2 The fittings shall be of `R' brand or equal forged with screwed connections.

15.3 The gate valves (included in piping) shall be of gun metal as described earlier.

15.4 Pipe crosses shall be provided at bends, to permit easy cleaning of drain line.

15.5 The drain line shall be provided upto the nearest drain trap and pitched towards the trap.

15.6 Drain lines shall be provided at all the lowest points in the system, as well as at equipments, where leakage of water is likely to occur, or to remove condensate and water from pump glands.

16. **Painting:**

16.1 All MS pipes , supports, hangers, etc., shall be given two coats of red oxide primer.

16.2 All pipes, which are not to be insulated, shall then be given two coat of finish paint, of colour as approved by the engineer-in-charge/ as per norms of local inspection.

MOTOR STARTERS CONTROL PANELS

1.0 **General:**

The motors and switchgears required for various items shall generally be as per specifications given below. All electric motors shall be suitable for 3 phase, 50 cycles 415 volts a.c. supply.

2.0 **Control Panel:**

2.1 These panels should be floor/wall mounted, sheet steel clad, modular construction, cubicle design, compartmentalised .These panels shall comprise of incoming & outgoing feeders (circuit breakers, fuse switch units/switch fuse units, contactor starters with overload relays, single phasing preventor etc. as indicated in the drawings.

2.2 The panels shall be provided wherever necessary with necessary interlocks designed to prevent incorrect operation and to ensure safety of operating personnel and equipment.

2.3 All feeders are to be operated from the front and they shall be interlocked suitably. Padlocking arrangement and interlock defeating device shall also be provided. Each module shall have separate door and partition plate. The feeder incomer switches shall be interlocking with the door so that the door can only by opened when switch is in `off' position. The doors and covers shall be provided with thick gaskets to make it dust tight. All the door covers shall be provided with synthetic rubber gaskets to make it dust tight. Feeder name tags shall be provided.

2.4 **Air Circuit Breaker and Fuse Switch Units**

The circuit breaker shall be air break fully draw out type equipped with arc chutes and their face barriers of proper design. The continuous current rating of the circuit breakers shall be as given in the detailed technical specifications. The circuit breakers shall have a breaking capacity of 31 mva at 415 volts, 50 hz ac & they shall be able to withstand full fault current for one second.

2.5 The circuit breaker shall be provided with manually operated spring closing mechanism. The operating mechanism shall be trip-free throughout the breaker travel. The breaker shall be equipped with inside `on' & `off' position indicator mechanism and so located that the position of the circuit breaker i.e. whether closed or open, is indicated on the front door of the compartment. The `on' & `off' trip indicating lights shall also be provided for each breaker feeder.

2.6 The moving portion of the circuit breaker shall be so interlocked that it is not possible to isolate it and draw out from the service position or to plug it in from the isolated position when the circuit breaker is closed. The interlock being provided shall be such as to prevent operation of a circuit breaker unless it is fully plugged in or fully isolated and is locked correctly in either of the two positions.

2.7 The circuit breaker compartment doors shall be so interlocked as to prevent access to the breaker while in the plugged in position. However special means shall be provided for undoing this interlocked in an emergency.

2.8 The draw out feature shall clearly provided three distinct positions of the circuit breaker viz., `service', `test' & isolated. Inadvertent withdrawal of a circuit breaker removable unit too for beyond its supports shall be prevented by a suitably interlock, the design shall provide for the testing of breaker in the test positions i.e. when the breaker's moving unit is in fully disconnected position and the secondary circuit remains connected or energized. The secondary connections between the fixed and removable units shall be provided with means of spring loaded sliding type contacts to make the breaker fully draw out type.

2.9 The circuit breaker unit shall be provided with complete range of releases including the overload releases and release for short circuit protection.

2.10 The circuit breaker shall be provided with necessary auxiliary contacts with 2 No. spare contacts. All contacts shall be wires upto the terminal board.

2.11 The fuse switch unit shall be of load break heavy duty, industrial design and of double break pattern with quick make and quick break mechanism, however, the design shall be such that it shall ensure positive opening even if quick break action is lost due to spring stretchening or breaking.

2.12 The `on' and `off' position of the switch handle shall be distinctly indicated and inter locks shall be provided to ensure that switch cover can not be opened unless the switch is in the `off' position.

2.13 The fuse switch units shall be provided with non-deteriorating type of HRC cartridge fuse link and having rupturing capacity not less than 31 mva at 415 volts.

2.14 All alive parts inside switch shall be properly shrouded and interphase barriers shall be provided. Design of the switch handles shall be such that they do not protrude out of the panel in the manner so as to prevent free passage of operating personnel. Design with normal conventional position of switch handle up in `on' position & down in `off' position shall be preferred.

2.15 **415 Volts Bus Bars**

2.15.1 The 415 volts main bus-bar shall have continuous current rating as indicated in the specification or equivalent standard rating of at least 50 percent of these of the phase bus bars. The bar and its connections shall be so arranged and supported as to withstand without any damage or deformation, the specific short circuit current. The bus bars shall be braced and supported on reinforced fiber glass support and shall be of electrolytic grade type E 91e of IS: 5082. These bus bars shall withstand 43.12 ka for one second during short circuit conditions. The bus bars shall be colour coded with PVC tapes or insulating painting for identification purposes. The bus bars shall be sleeved with special type heat shrinkable PVC sleeving.

2.15.2 Bus supports shall be resistant low absorption type moulded insulation of high impact strength and high creepage surface.

2.15.3 All bus work shall be braced to withstand without damage a short circuit current of 43.12 ka symmetrical for one second.

2.16 **Instruments and Meters**

2.16.1 Current transformer shall comply with the requirements of IS:2705. They shall have ratio outputs and accuracies as specified or required as shown in single line diagram.

2.16.2 All indicating instruments shall be of industrial pattern and should be provided as shown in the single line diagram.

2.16.3 All instruments shall be switch board type flush mounted with proper scale dimensions so as to be clearly visible to the operators standing on the floor. The instruments shall be provided with front of board zero adjuster shall be not preferably be mounted at heights lower than one meter and higher than two meters above the floor level.

2.16.4 The operating handles, meters, instruments etc. shall be mounted at the front of the switch board. Approved means shall be provided for locking the control switch/operating handles in the open position. For fuse switch gear section of the switch board, meters where specifications shall be mounted in such a manner that it is possible to readily identify the meters for individual units and the arrangements does not create hindrance to maintenance of individual units without having to shut down the bus.

2.16.5 All wires carried within the switch gear enclosure shall be PVC insulated and shall be neatly arranged to be readily accessible and to facilitate easy replacement. Only PVC copper cables shall be used for all power and control inter connections. The cables of 660 volts shall be used. Trained copper cables lugs shall be used. All small wires shall be colour coded and provided with numbered ferrules for easy identification of circuits. As for as possible, each essential circuit shall be connected within the respective switch gear unit. Control wiring terminal shall preferably be near the panel.

3.0 **Cable Termination:**

3.1 The cables entries and terminals shall be provided in the switch board to suit the number, type and size of aluminium conductor cables as given in the line diagram. Cable entries shall be so designed as to avoid damage to cables and there shall be sufficient space to avoid short bending of cables. The positions of the cable lugs and terminals shall be such that the cable could be neatly drawn and connected through one meter deep trench below the switch gear and the jointing carried out in a convenient and satisfactory manner. The cable entry, design panel, cable boxes and terminals and their locations will have to be approved by the engineer/owner. However the access for cabling shall preferably be from the back of the switch board. The panels shall be provided with control transformers of suitable va rating along with control bus and hr fuses from control supply to contractors.

3.2 The cables socket shall be of copper and of crimping type. Cables risers shall be adequately supported to withstand the effects of rated short circuit current without damage.

3.3 Cable glands of sizes as required shall be provided at all cable entry paints in the bottom plate. The glands shall form part of switch board.

4.0 **Indication:**

Each incoming and outgoing feeder units shall be provided with `on' `off' indicating lamps of standard conventional colour coding.

5.0 **Subsidiary Panels:**

Subsidiary panels shall be provided wherever required such as AHU room, air washer room. The construction of these panels should be similar to the main panel and shall have all related accessories.

6.0 **Contactor Starters:**

6.1 **Star Delta Starter**

The star delta starter shall be air break automatic contactor starter provided with main contactor, star contactor, delta contactor, timer and automatic change over from start to delta, bimetallic over load relay, operating coil, start/stop push button, single phasing preventor, auxiliary make and break contacts, indicating lamps etc. The contactor shall quick make, quick break, double break consisting of robust silver contacts. The coil voltage shall be 415 volts ac at 50 hz. The starter shall be provided with trip indication light and overload reset push button for overload relay.

6.2 **DOL Contactor Starter**

The contactor shall be air break type coil operate, DOL contractor starter, provides with cables entries, ambient temperature compensated bimetallic over load relay, single phasing preventor, solenoid coil, start and stop push buttons, 8 auxiliary make and break contacts, indicating lamps etc. The contactors shall be quick make quick make and quick break, double break type consisting of robust silver contacts. The coil voltage shall be 440 volts at 50 c/s. The starter shall be provide with trip indication light and over load reset bush button for overload relay.

7.0 **Squirrel Cage Induction Motors:**

7.1 The motor shall be of well tried out and design and of reputed make. The motors provided on the equipment shall conform to IS:325 in general. The motors shall be squirrel cage indication motors rates for operation at 415 volts, 3 phase, 50 hz a.c. supply. The motor for various equipments shall have the following enclosure level.

(a) Air washer and exhaust blower motor – IP: 55 (TEFC)

7.2 The horse power and speed of the motor shall match that of driven equipment and the motor shall be suitable for star delta starting or direct on line starting with class `3' insulation. The motors upto 7.5 HP and above 7.5 HP shall be suitable for star delta starting and below 7.5 HP suitable for DOL starting.

ELECTRIC WIRING

1. **General:**

All electrical works includes power supply ,panels cables, clamps etc. complete with all accessories as per specifications given hereunder:

2. **Power Cabling for Motors, Heaters etc:**

2.1 Unless otherwise specified, the power cables shall be PVC insulated, and PVC sheathed aluminium conductor, armoured cables to 1100 V grade conforming to IS 1554. The power cables shall be of 2 core for single phase, 4 core for sizes upto and including 25 sq.mm, 3-1/2 core for sizes higher than 25 sq.mm for 3 phase. Where high voltage equipments are to be fed, the cables shall be rated for continuous operation at the voltages to suit the same.

2.2 Power cables shall be of sizes as indicated in the tender specifications. In all other cases, the sizes shall be as approved by the Engineer-in-Charge, after taking into consideration the load, the length of cabling and the type of load.

2.3 Cables shall be laid in suitable metallic trays suspended from ceiling, or mounted on walls, or laid directly in ground or clamped on structures, as may be required. Cable ducts shall not be provided in plant rooms. Cable trays shall be fabricated from slotted angle/solid angles to make ladder type cable tray, designed with adequate dimensions for proper heat dissipation and also access to the cables. Alternatively, cable trays may be of steel sheet with adequate structural strength and rigidity, with necessary ventilation holes therein. In both the cases, necessary supports and suspenders shall be provided by the Air-conditioning Contractor as required.

2.4 Cable laying work shall be carried out in accordance with IS 1255/1967, Indian standard code of practice. The scope of work for the Air-conditioning Contractor shall include making trenches in ground and refilling as required, but excludes any masonry trenches for the cable work.

3.0 CONTROL WIRING

3.1 Control wiring in the ventilation system /rooms shall be done using control wire as per IS 1554 PVC insulated and PVC sheathed, 2.5 sq.mm. copper conductor, 1100 V grade, cables drawn in ISI marked steel or PVC conduits. The control cables interconnecting the ventilation system shall be of multi-core armoured type only, and suitable for laying direct in ground.

3.2 The number and size of the control cables shall be such as to suit the control system design adopted by the Contractor.

3.3 ISI marked steel conduit pipes, wherever used, shall be of gauge not less than 1.6 mm thick for conduits upto 32 mm dia and not less than 2.0 mm thick for higher sizes. All conduit accessories shall be threaded type with substantial wall thickness.

3.4 Control cables shall be of adequate cross section to restrict the voltage drop.

3.5 Runs of control wires within the switchboard shall be neatly bunched and suitably supported/clamped. Means shall be provided for easy identification of the control wires.

3.6 Control wiring shall correspond to the circuitry/sequence of operations and interlocks approved by Engineer-in-Charge.

3.7 In cold storage involving temperatures below zero deg. C, polythene cables shall be used instead of PVC cables.

4.0 **Laying**

4.1 The cables shall be laid, as per drawings or along a short and convenient route between switch board and the equipment, either in trenches, on wall or on trays. Hangers, supported from the slab. Cable routing shall be checked on the site to avoid interference with structure, equipment etc. Where more than one cable are running close to each other, proper spacing should be provided between them

4.2 The radius of bends of the cable should not be less than 12 times the radius of cable to prevent undue stress and damage at the bends, the cables should be supported and fixed on M.S. supports, when running in trenches, wall or ceiling suspended hangers when laid under ground the cables should be covered with sand and protected with cement concrete covering. suitable G.I. pipe shall be used wherever cable is laid across road, crossing of other services and when passing through R.C.C.

4.3 Wooden bushes shall be provided at the ends of pipes through which cables are taken.

5.0 **Earthing:**

5.1 **Pipe Earth Electrode**

G.I. pipe shall be of medium class 40 mm dia 4.5 mtr long in length. Galvanising of the pipe shall conform to relevant is. G.I. pipe electrode shall be cut tapered at the bottom and provided with holes of 12 mm dia drilled not less than 7.5 cm from each other upto 2m of length from bottom. The electrode shall be buried in the ground vertically with its top not less than 20 cms below ground level.

5.2 **Plate Earth Electrode**

For plate electrode minimum dimensions of the electrode shall be as under:

i. G.I. plate electrode : 60cm x 60cm x 6mm thick.

ii. Copper plate electrode : 60cm x 60cm x 3mm thick.

The electrode shall be buried in ground with its faces vertical and top not less than 3 m below ground level.

In case of plate earth electrode a watering pipe of 20 mm dia of medium class gi pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on top of this pipe for watering the earth. In case of pipe electrode a 40mm x 20mm reducer shall be used for fixing the funnel. The watering funnel attachment shall be housed in masonry enclosure of not less than 30cm x 30cm x 30cm. A cast iron/ms frame with cover having locking arrangement shall be suitable embedded in the masonary enclosure.

5.3 **Loop Earthing**

Loop earthing shall be providing for all mountings of main board and other metal clad switches and DB's with G.I. strip of size specified but not less than 14 swg copper or 12 swg G.I. or 4 sq mm aluminium wire. The earthing lead from electrode owner's shall be suitably protected from mechanical injury by a 15 mm dia G.I. pipe in case of wire and 40 mm dia medium class G.I. pipe in case of strip. Metallic covers or supports of all medium pressure or ht apparatus or conductor shall in all cases be connected to not less than two separate and distinct earths.

5.3.1 All equipment connected with electric supply shall also be provided with double earthing continuity conductors. The size of G.I. earthing conductors shall be: -

Earthing should be carried out as per is-3043

Size of phase wire sq.mm aluminium tape/wire (swg)	Size of G.I. conductor
185	25 mm x 4 mm (strip)
150	25 mm x 4 mm (strip)
120	20 mm x 3 mm (strip)

Size of phase wire sq.mm	Size of G.I. conductor aluminium tape/wire (swg)
95	20 mm x 3 mm (strip)
70	4 swg
50	4 swg
35	6 swg
25-6	6 swg
4	8 swg

6.0 **Miscellaneous:**

6.1 The final connections to the equipment shall be through flexible connections where the equipment is likely to be moved back and forth, such as on slide rails.

6.2 An isolator switch shall be provided at any motor which is separated from the main switch panel by a wall or partition or other barrier or is more than 15 metres away from the main panel.

6.3 Two separate and distinct earthing conduits shall be connected from the equipment upto the main switch board panel.

6.4 The entire installation shall be tested as per electricity rules and I.S. 732-1973/ I.S. 3043 with amendments 1,2&3 prior to the commissioning of the plant and a suitable test report furnished by competent local authorities. The test report will be obtained by contractor himself at his own expenses.

6.6 All exposed hangers etc. shall be given 2 coats of suitable paint of approved colour, when all work has been completed.

INSULATION

1. **General:**

The insulation of water piping, air handling units, ducting, chillers etc., shall be carried out as per specifications given below :

2. **Materials:**

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere.

2.1 **Pipe Insulation:**

a. In locations susceptible to physical damages and all exposed piping the insulation for chilled water and drain piping pump etc. shall be carried out from `TF' quality expanded polystyrene having a `K' value of 0.014 kcal/hr/^{o}c. at mean temperature of 10^{o}c. and a density of 24 to 28 kgs/cub.m.

2.2 **Ducting Insulation:**

a. The materials for duct insulation shall be resin bonded glass wool, as described earlier but conforming to I.S. 8183 of 1976. The density of insulation shall not be less than 24 kg/cub/m. and material shall be in the foam of blankets/rolls of uniform thickness. The `K' value at 10^{o}c. shall not be less than 0.03 kcal/mhr/deg.c.

2.3 **Other Insulation:**

The material for acoustic treatment of ducts, rooms, roofs etc. shall be resin bonded fibre glass, as described earlier, conforming to I.S. 8183 of 1976. The density of fibre glass shall be 32 kg/cub.m and the material shall be in the form of slabs of uniform density. The `K' value at 10^{o}c. shall not be less than 0.028 kcal/mhr/^{o}c. Facing shall be provided with 0.5 mm perforated aluminium sheet held with G.I. nuts bolts or nailed to the batten work as required.

3.0 **Chilled Water Piping/Drain Piping Insulation with TF quality Polystyrene:**

3.1 The chilled water and drain pipes shall be insulated with `TF' quality expanded polystyrene. The thickness of the insulation for chilled water pipes will be 50 mm and for drain pipes will be 25 mm.

3.2 Preformed pipe sections shall be used for pipes upto and including 350 mm dia.

3.3 Pipes above 350 mm dia. shall be insulated with insulation slabs cut in mitred sections.

3.4 **Installation**

Chilled Water and Drain Piping

3.4.1 The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.

3.4.2 The pipes shall be treated with a coat of cold setting compound.

3.4.3 The insulation preformed section shall be fixed tightly to the surface taking care to seal all joints.

3.4.4 All joints along the circumference of the pipe sections shall be sealed with adhesive.

3.4.5 The insulation than shall be covered with 0.63 mm x 19 mm mesh wire netting than finally finished with 12 mm sand cement plaster in two layers of 6 mm each and troulled to a smooth round finish.

3.4.6 Insulation on pipes in areas exposed to weather or underground shall additionally be covered with tar-felt sheets manufactured by Shalimar tar products (1935) ltd. and fixed with G.I. wires of 1.0 mm. The tar felt sheet shall be stuck with bitumen r 85/25.

4. **Refrigerant Piping:**

4.1 The suction line of refrigerant piping shall be insulated as per manufacturer's specifications.

5. **Ducting Insulation with Resin bonded fibre glass:**

5.1 The air handling ducts shall be insulated with resin bonded glass wool with density not below 24 kg/cub.m.

5.2 Duct insulation thickness shall be as follows:

Duct in conditioned space	-	25 mm thick
Duct in unconditioned space	-	50 mm thick
Duct with treated fresh air	-	50 mm thick

5.3 **Installation**

5.3.1 Clean the surface with a wire brush and make it free from rust and oil.

5.3.2 Apply one coat of cold setting compound.

5.3.3 Wrap the duct with insulation blankets of the thickness mentioned in item 5.2 above and then with 250 g polythene sheet and covered with 0.1mm thick aluminium sheet using 50 mm wide aluminium adhesive tape of Johnson make.

5.3.4 Reinforce and tie with G.I. wire of 1.0 mm at intervals of 450 mm.

5.3.5 The ducts in areas exposed to the weather shall be additionally covered with one layer of tar felt b.h. the tar felt shall be stuck with bitumen r 85/40 or 80/25.

6.0 **Acoustic Lining:**

6.1 The acoustic lining shall consist of 25 mm resin bonded glass wool of density 48 kg/cub.m (min) then it shall be covered by 0.5 mm perforated aluminium sheets having 3 mm perforation at 6 mm centres.

6.2 **Installation**

6.2.1 The duct surface shall first be cleaned from inside.

6.2.2 The insulation boards shall be wrapped in glass cloth of 7 mil thickness with the end stitched.

6.2.3 Then the boards shall be fixed inside the duct.

6.2.4 The insulation shall then be covered with 0.5 mm thick perforated aluminium sheets.

6.2.5 The sheet and the insulation shall be secured to the duct by means of cadmium plated bolts, nuts and washers. The ends should be completely sealed off, so that no insulation material is exposed.

7.0 **Walls and Ceiling Acoustic Treatments of Plant Rooms and A.H.U. Room**

7.1 **Material**

Resin bonded glass wool of density 32 kg/cub m of 50mm thickness.

8.0 **Installation:**

8.1 Fix 40 mm x 50 mm g.i. sheet channel at 0.5 mtr interval longitudinally then fix cross battens at1.0 mtr centre using suitable gutties, and brass screws. The battens & gutties shall be treated with fire retardant chemical before fixing.

8.2 Fill each rectangle with 50 mm glass wool wrapped in glass cloth.

8.3 Tie with 24 gauge G.I. wires at 300 mm intervals.

8.4 Then cover with 26 gauge (0.50 mm) perforated G.I. sheet having 3mm perforations at 6 mm centres. Overlap all joints and provide beading of 25 mm by 2 mm flats.

TESTS AT SITE

1.0 **General:**

The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the architect, in accordance with the provisions of the applicable ASHRAE standards or approved equal and furnish necessary test certificates from manufacturers.

3.4 **Valves**

Hydraulic/Pneumatic test certificates.

3.5 **Motors**

Manufacturer's test certificate as per motor data sheet.

3.6 **Instruments and Controls**

Visual examination.

4.0 **For Associates Works at Site :**

4.1 All electrical items will be subjected to inspection at any stage during manufacturing activity. Routine electrical test as per relevant codes. Inspection of manufacturer's test certificates.

4.2 Inspection of raw materials to be used for fabrication and assembly and inspection of manufacturer's certificates.

4.3 Inspection of welding including welders qualification as desired by inspection engineers. Inspection of fabricated items.

4.4 Pressure testing of pipe fit used for the refrigerant and water services.

4.5 Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of ventilation system.

4.6 Checking of calibration of controls and instrumentation

4.7 Checking of assemblies for electrical control panel, instruments panels, local panels (dimensional and functional) annunciator panels etc.

4.8 Inspection of complete electrical installation at site.

4.9 Performance testing of complete Ventilation system as per specifications.

5.0 The above inspection procedure is given for general guidance and information of vendors and inspection of purchaser/consultant is strictly not limited to these and inspection engineer of purchaser/consultant will have full right to have detailed inspection at any stage right from placement of order to completion of project as desired by inspection engineer, co-ordination of inspection agency of purchaser/consultant with his factory/sub-vendor's factory/erection site will be the sole responsibility of successful vendor after placement of order for complete air

conditioning plant covered under these technical specifications.

6.0 **Piping System:**

6.1 In general pressure tests shall be applied to piping only before connection of equipment and appliances. In no case shall piping, equipment or appliances be subjected to pressure exceeding their test ratings.

6.2 Tests shall be completed and approved before any insulation is applied.

6.3 After tests have been completed, the system shall be drained and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fittings, and debris.

6.4 **Water Piping**

All water piping shall be tested and proven tight under hydrostatic pressure of 1 1/2 times the design pressure unless stated otherwise in the specifications. Prescribed pressure shall be maintained for four hours.

7. **Duct Work:**

7.1 All branches and outlets shall be tested for air quantity, and the total of the air quantities shall be within plus five percent (5%) of fan capacity.

7.2 Fire dampers, volume dampers and splitter dampers shall be tested for proper operation.

8.0 **Balancing and Adjustment:**

All air handling ventilation equipment, duct work and outlets shall be adjusted and balanced to deliver the specified air quantities indicated, at each inlet and outlet, on the drawings. If these air quantities cannot be delivered without exceeding the speed range of the sheaves or the available horse power, the architect shall be notified before proceeding with the balancing of air distribution system.

9. **Electrical Equipment:**

9.1 All electrical equipment shall be cleaned and adjusted on site before application of power.

9.2 The following tests shall be carried out :

9.2.1 Wire and cable continuity tests.

9.3 Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using a 500 volt meggar. The meggar reading shall be not less than one mega ohm.

9.4 Earth resistance between conduit system and earth must not exceed half (1/2) ohm.

9.5 Phasing out and phase rotation tests.

9.6 Operating tests on all protective relays to prove their correct operation before energizing the main equipment.

9.7 Operating tests on all starters, circuit breakers, etc.

10.0 **Performance Tests:**

10.1 The installation as a whole shall be balanced and tested upon completion, and all relevant information, including the following shall be submitted to the architects.

10.1.1 Air volume passing through each unit, duct, grilles, apertures.

10.1.2 Differential pressure readings across each filter, fan and coil, and through each pump.

10.1.3 Static pressure in each air duct.

10.1.4 Electrical current readings, in amperes of full and average load running, and starting, together with name plate current of each electrical motor.

10.3 Any other readings shall be taken which may subsequently be specified by the Engineer.

10.4 Performance / capacities of each of the equipment supplied under the scope of Ventilation works shall be tested and checked.

11.0 **Miscellaneous:**

11.1 The above tests are mentioned herein for general guidance and information only but not by way of limitation to the provisions of conditions of contract and specification.

11.2 The date of commencement of all tests listed above shall be subject to the approval of the architect, and in accordance with the requirements of this specification.

11.3 The contractor shall supply the skilled staff and all necessary instruments and carry out any test of any kind on a piece of equipment, apparatus, part of system or on a complete system if the architect requests such a test for determining specified or guaranteed data as given in the specification or on the drawings.

11.4 Any damage resulting from the tests shall be repaired and/or damaged material replaced all the satisfaction of the Engineer.

11.5 In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommended after the adjustment or repairs have been completed.

11.6 The contractor must inform the architect when such tests are to be made, giving sufficient notice, in order that the architect or his nominated representative may be present.

11.7 Complete records of all tests must be kept and 3 copies of these and location drawings must be furnished to the architect.

11.8 The contractor may be required to repeat the test as required, should the ambient conditions at the time not given, in the opinion of the architect, sufficient and suitable indication of the effect and performance of the installation as a whole or of any part, as required.

MODE OF MEASUREMENTS

1.0 **Unit Prices in the Schedule of Quantities:**

1.1 The item description in the schedule of quantities is in the form of a condensed resume. The unit price shall be held to include every thing necessary to complete the work covered by this item in accordance with the specifications and drawings. The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over.

1.2 The unit price of the various items shall include the following :

1.2.1 All equipment, machinery, apparatus and materials required as well as the cost of any tests which the consultant may request in addition to the tests generally required to prove quality and performance of equipment.

1.2.2 All the labour required to supply and install the complete installation in accordance with the specifications.

1.2.3 Use of any tools, equipment, machinery, lifting tackle, scaffolding, ladders etc. required by the contractor to carry out his work.

1.2.4 All the necessary measures to prevent the transmission of vibration.

1.2.5 The necessary material to isolate equipment foundations from the building structure, wherever necessary.

1.2.6 Storage and insurance of all equipment apparatus and materials.

1.3 The contractor's unit price shall include all equipment, apparatus, material and labour indicated in the drawings and/or specifications in conjunction with the item in question, as well as all additional equipment, apparatus, material and labour usual and necessary to make in question on its own (and within the system as a whole) complete even though not specifically shown, described or otherwise referred to.

2.0 **Measurements of Sheet Metal Ducts, Grilles/Diffusers etc.**

2.1 **Sheet Metal Ducts**

2.1.1 All duct measurements shall be taken as per actual outer duct surface area including bends, tees, reducers, collars, vanes & other fittings. Gaskets, nuts, bolts, vibration rotation pads are included in the basic duct items of the BOQ.

2.1.2 The unit of measurements shall be the finished sheet metal surface area in metres squares. No extra shall be allowed for lapse and wastages.

2.1.3 All the guide vanes, deflectors in duct elbows, branches, grille collars quadrant dampers etc. shall be measured for actual sheet metal surface and paid for at the same rate as duct of same thickness.

2.1.4 The unit duct price shall include all the duct hangers and supports, exposing of concrete reinforcement for supports and making good of the same as well as any materials and labour required to complete the duct frame.

2.2 **Grilles/Diffusers**

All grilles/diffusers as per tender requirements shall be treated as a lump sum item. Where extra grilles diffusers are ordered upto award of work, they should be measured as follows:

2.2.1 All measurements of grilles/diffusers shall be the actual neck size excluding the outer flanges.

2.2.2 The square or rectangular grilles/diffusers shall be measured in plain sq.m.

2.2.3 All round diffusers shall be measured by their diameters in cm.

2.2.4 All linear diffusers shall be measured as per actual length in metres.

3.0 **Measurements of Piping, Fittings, Valves, Fabricated Items:**

3.1 **Pipe**

Including water piping, steam piping and all other piping required to be executed at site for completion of the works.

3.1.1 All pipes shall be measured in linear metre (to the nearest cm) along the axis of the pipes and rates shall be inclusive of all fittings e.g. tees, bends, reducers, elbows etc. deduction shall be made for valves in the line.

3.1.2 Exposing reinforcement in wall and ceiling and floors of possible and making good the same or installing anchor fasteners and inclusive of all items as specified in specifications and schedule of quantities.

3.1.3 Rates quoted shall be inclusive of providing and fixing vibration pads and wooden pieces, wherever specified or required by the project co-coordinator.

3.1.4 Flexible connections, wherever required or specified shall be measured as part of straight length of same diameter, with no additional allowance being made for providing the same.

3.1.5 The length of the pipe for the purpose of payment will be taken through the centerline of the pipe and all fittings (e.g. tees, bends, reducers, elbows, etc.) as through the fittings are also presumed to be pipe lengths. Nothing extra whatsoever will be paid for over and above for the fittings for valves and flanges, section 3.2 below applies.

3.2 **Valves and Flanges**

3.2.1 All the extra ci & cm flanged valves shall be measured according to the nominal size in mm and shall be measured by number. Such valves shall not be counted as part of pipe length hence deduction in pipe length will be made wherever valves occur.

3.2.2 All gun metal (gate & globe) valves shall include two Nos. of flanges and two numbers 150 mm long ms nipples, with one side threaded matching one of the valves, and other welded to the M.S. slip-on-flange. Rate shall also include the necessary number of bolts, nuts and washers, 3 mm thick insertion gasket of required temp. grade and all items specified in the specifications.

3.2.3 The rates quoted shall be inclusive of making connections to the equipment, tanks,

pumps etc. and the connection made with an installed pipe line shall be included in the rates as per the BOQ.

3.3 **Structural Supports**

Structural supports including supports fabricated from pipe lengths for pipes shall be measured as part of pipe line and hence no separate payment will be made. Rates shall be inclusive of hoisting, cutting, jointing, welding, cutting of holes and chases in walls, slabs or floors, painting supports and other items as described in specifications, drawings and schedule of quantities or as required at site by project co-coordinator.

3.4 **Copper Connections for Fan Coil Units**

3.4.1 Copper connection assembly for making connections to the fan coil units shall be measured, as part of the fan coil unit price and shall include brass flare nuts, brass straight connector, brass tees, brass reducing fittings, fixing of automatic 3 way valve, making connections and leak testing, complete assembly as per specifications and drawings. Nothing extra shall be payable on account of any variation in the length of copper pipe.

4. **Insulation:**

4.1 The measurement for vessels, piping, and ducts shall be made over the bare uninsulated surface area of the metal.

4.2 **Pipes, Ducts & Vessels**

4.2.1 **Pipes**

The measurements for installation of piping shall be made in linear metres through all valves, flanges, and fittings. Pipes/bends shall be measured along the centerline radius between tangent points. If the outer radius is r1 and the inner radius is r2 the centre line radius shall be measured as (r1+r2)/2. Measurement of all valves, flanges and fittings shall be measured with the running metre of pipe line as if they are also pipe lengths. Nothing extra over the above shall be payable for insulation over valves, flanges and fittings in pipe line/routings. Fittings that connect two or more different sizes of pipe shall be measured.

4.2.2 **Ducts**

The measurements for insulation of ducts shall be made in actual square metres of bare uninsulated duct surface through all dampers, flanges and fittings. In case of bends the area shall be worked out by taking an average of inner and outer lengths of the bends. Measurements for the dampers, flanges, fittings shall be for the surface dimension for the connecting duct, nothing extra over the above shall be payable for insulation over dampers, flanges and fittings in duct routing.

4.2.3 **Vessels**

The area of standard dished and flat ends of vessels shall be the square of the diameter of the uninsulated body of the shell. Areas for other shapes shall be the actual calculated area. There shall be no deduction or additions for nozzles, handles ribs, dampers, expansion joints etc. All projections on vessels or tanks shall be measured separately as pipe/duct.

4.3 **Accessories Insulation**

4.3.1 The unit of measurement for accessories such as expansion tank, pumps, chiller heads etc. shall be uninsulated are in square metres.

4.3.2 In case of curved or irregular surfaces, measurements shall be taken along the curves.

4.3.3 The unit insulation price shall include all necessary adhesives, vapour proofing and finishing materials as well as additional labour and material required for fixing the insulation.

4.4 **Acoustic Duct Lining**

4.4.1 In case of acoustic lining of air ducts, measurements of the bare inside duct surface in square metres, shall be final for billing purposes.

4.4.2 The insulation/acoustic panels shall include cost of battens, supports, adhesives, vapour proofing, finished tiles/boards/sheets as well as additional labour and materials required for completing the work.

SCHEDULE OF EQUIPMENT

S.No	Description	Unit	Condition of Services	
1.	**Tube Axial fans**			
1.1	Type	Tube axial fan	Tube axial fan	
1.2	Fan	PR FAN 1	PR FAN 2	
1.3	Area Served	Kitchen	Laundry	
1.4	Air Qty CFM	10300 cfm	13000 cfm	
1.5	Fan Static Pressure mmwg	25	25	
1.6	Fan motor rating	HP	---------- To suit duty----------	
1.7	Type of motor		---------- TEFC ----------	
1.8	Quantity	Nos	2	1
2.	**CENTRIFUGAL FAN**			
2.1	Type		SISW	
2.2	Fan		EX 1	Ex2 Ex3
2.3	Area Served		Kitchen	Laundry CSSD
2.4	Air Qty CFM		20600 cfm	13000 cfm 20000 cfm
2.5	Fan Static Pressure mmwg		40	40 40
2.6	Fan motor rating	HP	---------- To suit duty----------	
2.7	Type of motor		---------- TEFC ----------	
2.8	Quantity	Nos	01	01 01

3.	**Package Type Air Washers**			
3.1	Area Served	Kitchen	Laundry	CSSD
3.2	Capacity (CFM)	19000	12000	18000
3.3	Quantity Nos	1	1	1
3.4	Cooling Fill Pad area (sqm)	3.7	2.3	3.5

3.5	Type of Fill	------Honey comb construction----- Acetate paper fill
3.6	Thickness (mm)	---------- 200----------
3.7	Fan Static Pressure mmwg	----------40 ----------
3.8	Fan motor rating HP	----------To suit duty----------
3.9	Type of motor	----------TEFC/SPDP----------
3.10	Filters	Standard Filters Required
3.11	Pump tupe	---------- Monoblock----------
3.12	Quantity	1 1 1
3.13	Pump Rating	----------To suit duty----------

LIST OF APPROVED SUBCONTRACTORS MAKES AND MANUFACTURERS

The subcontractors/makes/brands of equipment listed below are approved for installation.

All items to be used in the works samples, catalogues and specifications are to be submitted by the contractor for approval of the Engineer. Only approved makes shall be used in the works. The approved samples shall be kept in the custody of the Engineer for comparison.

ITEM	APPROVED MAKES/SUBCONTRACTORS
Sub Contractors	Blue Star/Voltas/Suvidha/ETA
Water chilling machines	
Screw type	York /Trane/Carrier /Mcquay/Voltas
Centrifugal type	York /Trane/Carrier /Mcquay/Voltas
Package type Reciprocating/ Type water chilling machine	Blue star/ Carrier- aircon/ Voltas
Electric Hot Water Generator/Boiler	Rapidcool / Emerald / Khokhar
Airhandling Unit	
Unitary type	Save-air India/Caryaire/Blue Star/Carrier-Aircon/ZECO
Ductable type	Save-air India/Caryaire/BlueStar/Carrier-Aircon/ZECO
Double skin type	Save-airIndia/Caryaire/BlueStar/Carrier-Aircon/ZECO
AHU cooling coils	Bluestar/voltas/carrier-aircon/Zeco/Coil co.
Centrifugal fan of double skin type AHU	Nicotra/Comefri/Flakt/Kruger
Cooling Towers	Advance/Bell/Paharpur/Mihir/Aadi
Mono block pumps	Kirloskar/Beacon-weir/Mather & Platt
End suction back pull out pump	Kirloskar/Beacon-weir/Mather & Platt/KSB/Greav

ITEM	APPROVED MAKES
Humidifier	Rapid cool/Emerald/Khokar
Ventillation Fans	
Duct Inline fans	Flakt/ Comefrei/Nicotra/Kruger/Nuaire/Systems Air
Tube Axial fans	Flakt/Comefrei/Nicotra/Kruger/Nuaire/Systems Air
Exhaust Fans (AHU sections)	Save-airIndia/Caryaire/BlueStar/Carrier-Aircon /ZECO
Centrifugal Blower	GEC/ Swent / Flakt/Nadi / Divine
Propeller Fan	GEC(Alsthom)/Crompton Greaves/ Khaitan/ Polar/Usha
Pipes	
GI	ITC/ Jindal/Tata/SAIL
MS upto 150 mm dia	ITC/ Jindal/Tata/SAIL/HSL
MS 200 to 300 dia	ITC/ Jindal/Tata/SAIL/HSL
GI Sheets	TATA/SAIL/Jindal/Bhushan Steel
Grilles/Diffusers	Dynacraft/Servex/Ravistar/Caryaire/Opella/ Mapro
Fire dampers	Caryaire/Dynacraft / Ravistar
Valves	
Gate Valve	Leader/Divine/Sant/Bankim Sarkar
Butterfly Valves	Advance/C&R/Castle/Arrow/Audco
Balancing Valves	Advance/C&R/Castle/Arrow/Audco
Non-return Valves	Advance/C&R/Castle/Arrow/Univas
Pot & Y- Strainer	Emerald/Sant/Rapid cool
Three way mixing valves	Staefa/Johnson/Honeywell/Danfoss
Two way motorized valve	Audco/Staefa/Johnson/Honeywell/Danfoss
Actuating motor for 3 way & 2 way valves	Staefa/Johnson/Honeywell/Danfoss

ITEM	APPROVED MAKES
Insulation	
Fibre glass	FGP Ltd./UP Twiga/Kimmco / owen corning
Expanded Polystrene	Beardsell Ltd./ BASF/Styrene Packing/ Indian Packaging Industries
Air Filters	Thermadyne/Klenzaids/Kirloskar /Anfilco/Johnflower/Dynafilter
Thermometers/Pressure Gauge	Fiebig/Emerald/H Guru/Japsin
Thermostats/Humidistats	Honeywell/Penn /Staefa/Johnson/ Rapidcontrol/Anergy
Electric Strip Heaters	Escorts/Daspass
Controls	Honeywel/ Johnson / Staefa / Satchwel.
Electric Panels	CPRI approved vendor
Electric Motors	Siemens/NGEF/Kirloskar/ABB/ Bharat Bijlee. /Crompton Greaves
Starters/Contactors	L&T/ GE Power/ Siemens/ Schneider
ACB/MCCB	L&T/ GE Power/ Siemens/ Schneider
Switch Fuse/ Fuse Switch Units	L&T/ GE Power/ Siemens/ Schneider/ Standard
Cables	
PowerCables & Control cable	CCI/Universal/ICC/NICCO/INCAB/Ford Gloster/ National
Thermal Relays	GEC (Alsthom)
Lamps & Push Buttons Relays	L&T/GE/ Siemens/ Schneider
Current Transformer/ Ammeter/Voltmeter	L&T/GE/ Siemens/ Schneider

NORTH EASTERN INDIRA GANDHI REGIONAL INSTITUTE OF HEALTH & MEDICAL SCIENCES (NEIGRIHMS), SHILLONG, MEGHALAYA

Supply, Installation, Testing & Commissioning of Ventilation System for Kitchen, Laundry and CSSD at NEIGRIHMS, Shillong

VOLUME – III

BILL OF QUANTITIES

January, 2009

HSCC (INDIA) LTD.
(CONSULTANTS & ENGINEERS FOR MEGA HOSPITALS & LABORATORIES)
E-6(A), sector-1, NOIDA (U.P) 201301 (India)

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Tender No. HSCC/NEIGR/VENT/2009

BILL OF QUANTITY FOR VENTILATION SYSTEM FOR KITCHEN, LAUNDRY & CSSD - NEIGRIHMS, SHILLONG.

Item No.	Description	Qty	Unit	Rate In Rs (in Figure)	Rate in Rs (in Words)	Amount (Rs.)
1	2	3	4	5	6	7
1	**VENTILATION / EXHAUST BLOWER**					
1.1	**CENTRIFUGAL BLOWER** Supply, installation,testing and commisioning of SISW Duct mounted Centrifugal blower complete in all respect as per specifications and technical data as given in schedule of equipments.					
1.1.1	Ex-1 20600 CFM for Kitchen	1	No.			
1.1.2	Ex-2 13000 CFM for Laundry	1	No.			
1.1.3	Ex-3 20000 CFM for CSSD	1	No.			
2.0	**TUBE AXIAL FAN** Supply, installation,testing and commisioning of tube axial flow fans complete in all respect as per specifications and technical data as given in schedule of equipments.					
2.1	Ex-1 10300 CFM for Kitchen	2	Nos.			
2.2	Ex-2 13000 CFM for Laundry	1	No.			
3.0	**PACKAGE TYPE AIRWASHER** Supply, installation, testing & commissioning of Package type Airwaher complete with fan sectio with fan & motor, coolong pad section with coolong pads, water sump, piping & fittings complete with all accessories as per specifications.					
3.1	AW-1 19000 CFM for Kitchen	1	No.			
	AW-2 12000 CFM for Laundry	1	No.			
	AW-3 18000 CFM for CSSD	1	No.			

4.0 **GSS DUCTING**

Supply, installation, testing and balancing of G.S.S ducting of following thickness including necessary supports, hangers, nut bolts, gaskets, splitter dampers, vanes canvass connections etc. complete as per specifications & drawings:

4.1	1.25 mm (18 G) GSS	50	Sqm.
4.2	1.0 mm (20 G) GSS	1070	Sqm.
4.3	0.80 mm (22 G) GSS	680	Sqm.
4.4	0.63 mm (24 G) GSS	150	Sqm.

5.0 FIRE DAMPERS

Supply, installation, testing and commissioning of motorized combined smoke & fire dampers made out of GI sheet of at least 90 minutes fire rating complete with GI damper of required size, smoke sensor, etc as per specifications and shop drawings. 5 Sqm

Actuator & control panel 4 sets

6.0 VOLUME CONTROL DAMPERS

Supply, installation and testing of volume control dampers of GI sheet, box type to be provided in ducts complete with suitable links, levers and quadrants for manual control of air volume and air balancing as per specifications and drawings.

5 Sqm.

7.0 GRILLES

7.1	Supply, installation and balancing of supply air grilles with volume control dampers of powder coated MS construction suitable for installation in walls, false ceilling boxing etc as per specifications and drawings.	12	Sqm.
7.2	Supply, installation and balancing of return air grilles without volume control dampers of powder coated MS construction suitable for installation in walls, false ceilling boxing etc as per specifications and drawings.	14	Sqm

8.0 STARTER PANELS

Supply, installation, testing and commissioning of cubicle type totally enclosed wall/floor mounted free standing type, dust, damp and vermin proof for ventillation fans made of 2mm thick CRCA sheet steel in compartmentalized design as per specification and drawings. These distribution boards shall be mounted on 50x50x6 MS angle frame work grouted to floor/walls of recessed. The rate includes the angle iron frame, support, painting, numbering, earthing etc. as required.

8.1 STARTER PANEL (Kitchen)

INCOMER :

1 No. 100 Amps 415/500 TPN FSU with suitable HRC fuse, 1 no of 0-150 amp ammeter with selector switch & CT's , 1 no. 0-500 volt voltmeter with selector switch & fuses , 1set of indicating lights (RYB).

Bus Bar
125 A TPN Aluminium bus bar 415V , 50 Hz.

OUTGOINGS :
2 nos.suitable starter for 10/12.5 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP,02 nos. ON-OFF indication lamps with push button for Air Washer motor.

2 nos.suitable starter for 3 / 5 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button for exhaust fan motor.

1 no.suitable starter for 10/12.5 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button as spare.

Complete panel as above 1 No

8.2 STARTER PANEL (Laundry)

INCOMER :
1 No. 100 Amps 415/500 TPN FSU with suitable HRC fuse, 1 no of 0-150 amp ammeter with selector switch & CT's , 1 no. 0-500 volt voltmeter with selector switch & fuses , 1set of indicating lights (RYB).

Bus Bar
125 A TPN Aluminium bus bar 415V , 50 Hz.

OUTGOINGS :

2 nos. suitable starter for 7.5/10 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button for Air Washer motor.

1 no. suitable starter for 3 / 5 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button for exhaust fan motors.

1 no. suitable starter for 7.5/10 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button as spare.

Complete panel as above 1 Nos

8.3 STARTER PANEL (C.S.S.D.)

INCOMER :

1 No. 100 Amps TPN FSU with suitable HRC fuse, 1 no of 0-150 amp ammeter with selector switch & CT's , 1 no. 0-500 volt voltmeter with selector switch & fuses , 1set of indicating lights (RYB).

Bus Bar

125 A TPN Aluminium bus bar 415V , 50 Hz.

OUTGOINGS :

1 nos.suitable starter for 10/12.5HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button for Air Washer and exhaust fan motor.

1 no. suitable starter for 7.5/10 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button as spare. 1 no.suitable starter for 10/12.5 HP motor with thermal overload protection and spare NO-NC contacts for interlocking, SPP, 02 nos. ON-OFF indication lamps with push button as spares. **Complete panel as above**	1	No

9.0 CABLING

Supplying, laying, effecting proper connections, testing & commissioning of following size of 1.1 kv PVC insulated aluminium conducting armoured cables as per IS 1554 Part-1laid underground/cable tray/on surface of wall/hume pipe etc. & termination with brass compression glands as required.

9.1	3.5 C X 50 sq. mm. Cable *	200	Meter
9.3	3C X 6 sq. mm. Cable *	200	Meter
9.4	3C X 4 sq. mm. Cable *	150	Meter

* - to be re-assesed at site

10.0 CABLE TRAYS

Supply & installation of following sizes of perforated MS cable trays including horizontal & vertical bends, reducers, tees, cross members and other accessories as required and duly supported from the ceiling/wall/floor with MS suspenders/supports and including painting etc. as required.

10.1	100 mm widthx50 mm deep x1.6 mmthickness	100	Meter

11.0 EARTHING

11.1 Providing and fixing GI earth strip on walls/ trenches complete as per specifications and as required.

11.1.1	25mm x 3mm	50	Meter

11.2 Providing and fixing earth wire of complete as per specifications as required.

11.2.1	8 SWG wire	150	Meter

12.0 CONTROL CABLING

Supply, laying, effecting proper connections, testing & commissioning of 1.5 sq.mm. PVC insulated copper multicore cables from AHU's and AC equipments to central control console.

12.1	10 core cable	100	Meter
12.2	8 core cable	150	Meter
12.3	6 core cable	100	Meter

13	Civil work required for the completion of above work including foundations, repair work and original finish.	Lump / Sump

TOTAL

Add for Operation & maintenance cost for 1st year
Add for Operation & maintenance cost for 2nd year
Add for Operation & maintenance cost for 3rd year
Add for Operation & maintenance cost for 4th year
Add for Operation & maintenance cost for 5th year

TOTAL