

MAHINDRA WORLD CITY, JAIPUR
MAHINDRA TECHNOLOGY PARK BLOCK A2 & B1

Tender for
Low Side Air-conditioning &
Ventilation System

General Conditions
Special Conditions
Technical Specifications
List of Approved Makes of Material
Schedule of Quantities

ARCHITECT



RAJINDER KUMAR ASSOCIATES

B 6/17 Shopping Center
Safdarjung Enclave, New Delhi-29
Tel.: 26162930 / 26162931
Fax: +91-11- 2618 6874

Sarab

CONSULTANTS PVT. LTD.
F-301, Lado Sarai, New Delhi,
Tel: 29521180
Fax: +91-11-29521183
E-mail: kka@kkapl.com

December 2009

MAHINDRA WORLD CITY, JAIPUR

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Sarb

CONSULTANTS PVT. LTD.

Electrical Consultants

**KANWAR KRISHEN
ASSOCIATES PVT. LTD.**
F-301, Lado Sarai,
New Delhi - 110030,
Tel: 29521180
Fax: +91-11-29521183

HVAC Consultants

**B.R.MALHOTRA &
ASSOCIATES**
B1 / 1506 Vasant Kunj,
New-Delhi -110 070
Mobile : 9811381370

MAHINDRA WORLD CITY (JAIPUR) LIMITED, JAIPUR

BID FOR **LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM** WORKS AT MAHINDRA TECHNOLOGY PARK WITHIN THE IT/ITES SEZ

Bid No : **MWCJL/IT_ITES/MTP/09-10/P14**

Date of Issue : **December 7, 2009**

Bid Document issued to:

M/s

.....

.....

By

Mahindra World City (Jaipur) Limited
411, 506, Neelkanth Tower#1,
Bhawani Singh Marg, C-Scheme
Jaipur -302001
Phone No: 0141-4007025-29
Fax : 0141-4007030

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MAHINDRA WORLD CITY (JAIPUR) LIMITED, JAIPUR

Bid No : MWCJL/IT_ITES/MTP/09-10/P14

(LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS)

**NAME OF WORK : CONSTRUCTION OF MAHINDRA
TECHNOLOGY PARK AT MAHINDRA
WORLD CITY**

**PERIOD OF ISSUE OF
BIDDING DOCUMENT : FROM: December 7, 2009
TO December 9, 2009
TIME:-10:00 HOURS TO 17:00 HOURS**

**LAST DATE AND TIME : Date :- December 16, 2009
(Hard Copy Submission)
FOR RECEIPT OF BIDS Time: 15:00 Hrs.**

INVITATION FOR BID (IFB)

MAHINDRA WORLD CITY (JAIPUR) LIMITED, JAIPUR

INVITATIONS FOR BIDS (IFB)

Date : December 7, 2009
Bid No : MWCJL/IT_ITES/MTP/09-10/P14

1. **MAHINDRA WORLD CITY (JAIPUR) LIMITED** having its Registered office at 408, 4th Floor, Ganapati Palaza, MI Road, Jaipur- 302001, is developing an IT/ITES SEZ and invites item rate Bids for the below mentioned works from the selected Bidders.
2. Hard copies of the document can be obtained from the Architect office at the below mentioned address by paying **Rs. 2500/-** only upto **December 9, 2009**

M/s Rajinder Kumar Associates

B-6/17 Shopping Center,
Safdarjung Enclave
New Delhi 110029, India
T: (91)112-6179093
F: (91) 112-6186874

3. Bids must be delivered to **Mahindra World City (Jaipur) Limited**, 411, 506, Neelkanth Tower#1, Bhawani Singh Marg, C-Scheme, Jaipur -302001, on or before **15:00 Hours** on **December 16, 2009** in Hard Copy. If the office happens to be closed on the date of receipt of the Bids as specified, the Bids will be received on the next working day at the same time and venue. .
4. Other details can be seen in the Bidding documents.

TABLE - IFB 1

Sr. No.	Name of work	Bid security / EMD (Rs.)	Cost of document (Rs.)	Period of completion
1	Low Side Air-conditioning & Ventilation System Works at Mahindra Technology Park Block A2 & B1	50,000/	2,500/-	Five (05) Months

Seal of office

SECTION 1: INSTRUCTIONS TO BIDDERS

(ITB)

Section 1: Instructions to Bidders**Table of Clauses**

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1A. General Instructions

1. Scope of Bid

- 1.1 **Mahindra World City (Jaipur) Limited** ("MWCJL"), (hereinafter referred to as "**Employer**") invite Bids for the **Low Side Air-conditioning & Ventilation System Works for Mahindra Technology Park Block A2 & B1 at Mahindra World City being developed by it** (as defined in these documents and referred to as "**the Works**") .

2. One Bid per Bidder

- 2.1 Each Bidder shall submit only one Bid for one Contract.
2.2 Bid documents are not transferable

3. Cost of Bidding

- 3.1 The Bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

4. Site visit

- 4.1 The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the Site (as defined in Clause 1 of GCC) and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a Contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
4.2 After visiting the site the bidder shall confirm the fact of actual visit of the site to the employer which will be testimony to the fact that in fact site is available for commencing the work.
4.3 The Contractor shall be deemed to have inspected, tested and examined the site and surroundings and to have satisfied himself as to all the conditions, factors and risks which can be reasonably obtained or inferred from the inspections, and examinations that may influence or affect the progress and cost of Contract Works.

1B. Bidding Documents

5. Contents of Bidding Documents

- 5.1 The set of bidding documents comprises the documents listed in the table below and addenda issued in accordance with Clause 8 (if any)

Sections	1	Instructions to Bidders
	2	Letter of Acceptance and Agreement form
	3	Conditions of Contract
	4	Forms of Securities
	5.	Special Conditions, Technical Specifications, List of Approved Makes & Bill of Quantities

- 5.2 Qualification of Bidders : To be qualified for award of contract, bidders are required to

- a) Submit a written power of attorney authorising the signatory.
b) Update the following information submitted with the application for qualification.
i) Financial strength.
ii) Works in hand
iii) litigation if any.

6. Clarification of Bidding Documents

Bidders requiring any clarification of the Bidding documents may notify the Employer by e-mail to jaipurTenders@mahindraworldcity.com or by Fax only. The Employer will respond to any request for clarification. All such queries shall be made at least three (03) days before date of submission of Bids as per Clause 16.

1C. Preparation of Bids

7. Language of the Bid

7.1 All documents relating to the Bid shall be in the English language.

8. Documents comprising the Bid

8.1 The Bid submitted by the Bidder shall comprise the following:

- a) The Bill of Quantities wherein the Bidder shall fill in the rates; original plus one photocopy duly signed and stamped by the Bidder on each page.
- b) Specifications, original plus one photocopy duly signed and stamped by the Bidder on each page.
- c) any other materials required to be completed and submitted by bidders in accordance with these instructions

The Financial Bid (BOQ) under Sections 5 of Sub-Clause 5.1 shall be filled in without exception.

9. Item Rate Contract

9.1 The Contractor shall note that unless otherwise stated, the Tender is strictly on item rate basis contract.

10. Currencies of BID and payment

10.1 The rates and the prices given are in Indian Rupees.

11. Bid Validity

11.1 Bids shall remain valid for a period not less than 60 (sixty) days after the date for Bid submission specified in Clause 16. A Bid corrected by the Bidder as valid for a shorter period shall be rejected by the Employer as non-responsive.

12. Bid Security

12.1 The Bidder shall furnish as a part of his Bid, a Bid security in the amount as shown in column 3 of the table IFB-1. The Bid security shall be in favour of **Mahindra World City (Jaipur) Limited** in the form of a Demand Draft or Banker's Cheque or Pay order payable at Jaipur.

12.2 The Bid Security of unsuccessful Bidders will be returned within 30 days of the end of the Bid validity period specified in Sub-Clause 11.1.

12.3 The Bid Security of the successful Bidder will be adjusted with Performance Security when the Bidder has signed the Agreement and furnished the required Performance Security.

12.4 The Bid Security may be forfeited

- (a) if the Bidder does not accept the correction of the Bid Price, pursuant to Clause 18; or
- (b) in the case of a successful Bidder, if the Bidder fails within the specified time limit to
 - (i) sign the Agreement; or
 - (ii) furnish the required Performance Security within 10 days from the date of Letter of Acceptance.

12.5 No interest shall be paid on any Bid security/Performance Security/ or Guarantee in lieu thereof.

13. Format and Signing of Bid

- 13.1 The Bidder shall prepare the Bid as specified in Clause 8 in two (02) copies.
- 13.2 The Rate in the original and one duplicate copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the Bid where entries or amendments have been made shall be signed by the person or persons signing the Bid.
- 13.3 The Bid shall contain no alterations or additions or omission or interlocation except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Bidder, in which case such corrections shall be signed by the person or persons signing the Bid.

14. Salient Points

The Scope of work proposed in this Bid is for the [Low Side Air-conditioning & Ventilation System Works](#):

- 14.1 The Bidder should make himself acquainted with the site conditions, level and any other information required for giving a proper quote.
- 14.2 Bidders requiring any technical clarification should seek it from Employer's office before quoting and any ambiguity regarding quantities/specification and drawings will not be entertained after the Bids are finalised.
- 14.3 The Contractor should make his own arrangement of water and power for construction purposes and make all necessary arrangement. The power for commissioning will however be supplied by Employer.

1D. Submission of Bids

15. Sealing and Marking of Bids

- 15.1 The Bidders are not expected to include any conditions contrary to Bid provisions. However, if it is necessary to include certain conditions, the same should be submitted with proper reasons, in a separate sealed cover. The covers should be suitably super scribed indicating the contents. All letters, enclosures, and Bill of quantities shall be submitted in duplicate. Bidder should clearly indicate on each copy under their full signature, whether it is the Original or duplicate copy.
- 15.2 The Bidder shall submit the original Bid in one sealed envelop marking as "**FINANCIAL BID for [Low Side Air-conditioning & Ventilation System works for Mahindra Technical Park Block A2 & B1](#)" At Mahindra World City, Jaipur". The duplicate copy duly marked should be in separate sealed envelope.**
- 15.3 The envelopes shall be addressed to the Employer at the following address:

Mahindra World City (Jaipur) Limited
411, 507, Neelkanth Tower#1,
Bhawani Singh Marg, C-Scheme
Jaipur -302001
Phone No: 0141-4007025-29

16. Deadline for Submission of the Bids

- 16.1 Bids must be received by the Employer at the address specified above no later than **15:00** hours on **December 16, 2009** In the event of the specified date for the submission of Bids declared a holiday for the Employer, the Bids will be received up to the appointed time on the next working day.
- 16.2 The Employer may extend the deadline for submission of Bids by issuing an amendment indicating the revised deadline.

1E. Bid Opening and Evaluation

17. Process to Be Confidential

- 17.1 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 Any effort by a Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.
- 17.2 The employer may at its absolute discretion , ask the bidders for any clarification including breakdown of rates, subject to this no bidder shall contact the employer relating to the bid from the time of opening to the time of contract awarded.

18. Correction of Errors

- 18.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
- (a) Where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and
 - (b) Where there is a discrepancy between the unit and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.
- 18.2 The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount the Bid will be rejected.

19. Employer's Right to Accept any Variation

- 19.1 The Employer reserves the right to accept or reject any variation, deviation from the Bid document, or any alternative offer. Variations, deviations and alternative offers and other factors which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Bid evaluation.
- 19.2 Acceptance of tender on behalf of employer (Mahindra World City [Jaipur] Ltd) shall be done by the committee empowered in this behalf or by officer of company duly authorised in this behalf.
- 19.3 It is made clear that the employer is not bound to accept lowest or any tender(bid). The employer reserves the right to reject any or all tenders received for consideration without assigning any reasons and without incurring any liability to affected bidders.

1F. Award of Contract

20. Award Criteria

- 20.1 The Employer will negotiate with the Bidder whose Bid has been determined to be substantially responsive to the Bidding documents. On completion of negotiations the Employer will award the Contract to the most suitable Bidder.

21. Employer's Right to Accept any Bid and to Reject any or all Bids

- 21.1 Notwithstanding Clause 20, the Employer reserves the right to accept or reject any Bid or part of the 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 grounds for the Employer's action.

22. Notification of Award and Signing of Agreement

- 22.1 The Bidders whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that 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").

- 22.2 The Agreement will incorporate all Agreements between the Employer and the successful Bidder. Within 10 days of issue of Letter of Acceptance, the successful Bidder will sign the Agreement and deliver it to the Employer.
- 22.3 Upon accepting the Performance Security for the Successful Bidder and signing of the Agreement, the Employer shall issue a 'Notice to Proceed' to the Contractor, in which the date of commencement of the Contract shall be indicated.
- 22.4 Upon furnishing of the Performance Security by the successful Bidder, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

23. Performance Security

- 23.1 Within 10 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security valid till Completion of the Contract in the form of a bank guarantee in Employer's prescribed format for an amount equivalent to 5 % of the Contract price by adjusting Bid Security:
- 23.2 Failure of the successful Bidder to comply with the requirements of Sub-Clause 23.1 shall constitute a breach of Contract, cause for annulment of the award, forfeiture of the Bid security and any such other remedy the Employer may take under the Contract, and the Employer may resort to awarding the Contract to any other Bidder, on sole discretion of Employer.

24. Corrupt or Fraudulent Practices

- 24.1 The Employer expects the Bidders, Suppliers, Contractors, and Consultants, observe the highest standard of ethics and integrity during the procurement and execution of such Contracts .Therefore, the Employer will reject the Bid/ terminate the contract with no obligations and blacklist such Bidder / contractor, barring him from participation in future Bidding in the event he found indulged in any malpractice such as gift, bribe, or other inducements to any person with a view to influence the placing or operation of the Contract.
- 24.2 The bidder hereby undertakes that if the information given in bidding documents or otherwise be found to be untrue or false, he will be liable to be disqualified and his security will be forfeited and further it is discovered to be false during the contract period affecting prejudicially the interest of employer, the contract will be terminated and security deposit will be liable to be forfeited.

SECTION-2

LETTER OF ACCEPTANCE AND AGREEMENT FORM

Table of Forms:

- LETTER OF ACCEPTANCE & PROCEED THE WORK
- AGREEMENT FORM

LETTER OF ACCEPTANCE
(letterhead paper of the Employer)

To,
.....
.....

Dear Sirs,

This is to notify that your Bid and subsequent negotiations for the execution of **LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS AT MAHINDRA TECHNOLOGY PARK IN BLOCK A2 & B1 WITHIN THE IT/ITES SEZ** for the negotiated Contract Price of Rs..... (Rupees) is hereby accepted by Mahindra World City (Jaipur) Limited.

You are hereby requested to furnish Performance Security Deposit in the prescribed format of the Bank Guarantee attached herewith for an amount of Rs. within ten (10) days, of receipt of this Letter Of Acceptance, valid up to 180 days from the Date Of Intended Completion i.e. any extension thereof and sign the Contract, failing which action as per Sub-Clause 21.1 of Instruction to Bidders shall be taken.

Subsequent to furnishing the requisite security, you are hereby instructed to proceed with the execution of the said works as the site will be handed over to you on ___ __2009_ in accordance with the Contract documents. The stipulated date of commencement and stipulated completion dates will be _____ and _____ respectively.

Thank you

Yours faithfully,

Chief Operating Officer
Mahindra World City (Jaipur) Limited
411, 506, Neelkanth Tower#1,
Bhawani Singh Marg, C-Scheme
Jaipur -302001
Phone No: 0141-4007025-29

Agreement Form (On stamp paper of Rs 100/-)

Agreement

This Agreement, made the _____ - 2009, between **Mahindra World City (Jaipur) Limited** (hereinafter called "the Employer") of the one part and

_____ [name and address of Contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute **LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS AT MAHINDRA TECHNOLOGY PARK IN BLOCK A2 & B1 WITHIN THE IT/ITES SEZ** (Bid No. **MWCJL/IT_ITES/MTP/09-10/P14** (hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein, at a Contract price of Rs. _____ (Rupees _____)

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:
 - i) Letter of Acceptance;
 - ii) Contractor's Bid;
 - iii) Contract Data;
 - iv) Conditions of Contract (including Special Conditions of Contract);
 - v) Specifications;
 - vi) Drawings;
 - vii) Bill of Quantities and Rates; and
 - viii) Any other document listed in the Contract Data as forming part of the Contract.

In witness whereof the Parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of

_____ was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said _____

in the presence of:

Binding Signature of Employer _____

Binding Signature of Contractor _____

SECTION 3: CONDITIONS OF CONTRACT

General Conditions

3A. General

1. Definitions

The following terms shall have the meaning hereby assigned to them except where the context otherwise requires:

ARCHITECT / CONSULTANT:

Rajinder Kumar Associates
B-6/17 Shopping Center, Safdarjung Enclave
New Delhi 110029, India
T: (91)11-26162930 / 26162931
F: (91) 11-26186874

Bill of Quantities or BOQ means the priced and completed bill of quantities and rates forming part of the Contract.

The **Contract** is the binding between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

The **Contractor** shall mean the successful Bidder and their heirs and legal representative, assigns and successors on whom the work order or letter of intent has been issued 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.

Date of Commencement is the date as stated in the Letter to Proceed from the Employer to the Contractor.

Actual Date of Commencement is the date from which the Contractor started his work.

Days are calendar days; **months** are calendar months.

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

The **Defects Liability Period** is 24 months calculated from the Actual Completion Date

The Employer is the Party who will employ the Contractor to carry out the Works.

Engineer in Charge shall be HEAD (Infrastructure & Development) of the Employer or person nominated by him.

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

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 in Charge by issuing an extension of time.

The **Actual Completion Date** is the date on which the Engineer in Charges shall issue the Completion Certificate as per Clause 28

The **Site Possession Date** shall be the date within seven days from the date of issue of Notice to proceed with the work.

Materials are all supplies, including consumables, used by the Contractor for incorporation in the Works.

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

The **Site** is located at **Mahindra World City (Jaipur) Limited, IT/ITES SEZ. Village: Kalwada, Tehsil: Sanganer, District: Jaipur**

Specification means the Specification of the Works referred in the Contract and any modification or addition made or approved by the Engineer in Charge in writing.

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 a written instruction given by the Engineer in Charge which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

Party and Parties is the Employer and the Contractor individually and the word Parties shall be construed accordingly

Relevant Authority shall mean all Parties which have jurisdiction on the works.

2. Interpretation

- 2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer in Charge will provide instructions clarifying queries about the Conditions of Contract.
- 2.2 The documents forming the Contract shall be as follows and their order of priority shall be interpreted in the given order
- (i) Agreement
 - (ii) Letter of Acceptance, Notice to proceed with work.
 - (iii) Contractor's Bid
 - (v) Conditions of Contract including Special Conditions of Contract
 - (vi) Bill of Quantities
 - (vii) Drawings
 - (viii) Specifications
 - (ix) any other document listed in the Contract Data as forming part of the Contract.

3. Legal Construction

- 3.1 Subject to provision of clause, the Work Order shall be in all aspect, construed and operated as Contract under Indian Contract Act 1872, and in accordance with Indian Laws enforce for the time being and is subject to the jurisdiction of the court, Jaipur only.

4. Language and Law

- 4.1 The language of the Contract shall be English only and the Law governing the Contract shall be Law of Republic Of India and the law which will govern the conduct of the contract and according to which the contract shall be in force in the state of Rajasthan, it will include the exemption granted under various enactments.

5. Communications

- 5.1 Communications between Parties which are referred to in the conditions are effective only when given in writing. A notice shall be effective only when it is delivered. In the case delivery is refused, it will be deemed to be received if service is effected by postal agency. Any letter, notice and notification under the contract shall be served on the party concerned when received by fax, telex, courier deliver or registered post letter at the following address of contractor or employer.

Address of Contractor :

Address of Employers

Corporate Addresses

Mahindra World City (Jaipur) Limited

411, 506, Neelkanth Tower#1,
 Bhawani Singh Marg, C-Scheme
 Jaipur -302001
 Phone No: 0141-4007025-29
 Fax : 0141-4007030

6. Personnel

- 6.1 The Contractor shall submit organisation chart indicating the key personnel to carry out the functions stated in the Schedule or other personnel approved by the Engineer in Charge. The Engineer in Charge will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.
- 6.2 If the Engineer in Charge or Construction Manager asks the Contractor to remove a person who is a member of the Contractor's staff or his work force the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

7. Insurance and obligation under labour and environment law :

- 7.1 Notwithstanding that the Contractor is to indemnify the Employer and submit the policies in original to the Employer, the Contractor shall take All Risks and Workmen's Compensation insurance policies to cover the whole project as envisaged under the Contract and without limiting the obligations, responsibilities, duties and/or liabilities of the Contractor, the Contractor shall effect at his own costs for others insurance policies deemed necessary in the joint names of the Employer and the Contractor to cover the Contract works as given below:
 Insurance requirements are as under:

Sr. No.	Policy for	Insurance cover required
1	All risk insurance for works	By Contractor
2	Loss or damage to Employer's Equipment & material.	By Contractor
3	Other Employers property	By Contractor
4	Personal injury or death insurance: a) Third Party	By Contractor
	b) For Contractor's Employee	By Contractor Contractor should ensure such insurance is in force through out the Contract period (Including defect liability period) and necessary proof to be submitted before the commencement of the project and at least a fortnight before the expiry of current insurance. The Contractor should indemnify and include in the policy the Employer
5	Motor Vehicle Insurance	Comprehensive insurance policy to be taken by contractor as per statutory requirement.
6	Third Party liability insurance (Including the name of Employer)	By Contractor Minimum cover Rs. 10 Lacs.
7	Contractor's Equipments (Including liability arising out of usages of such equipment)	By Contractor.

8 Possession of the Site

- 8.1 The Employer shall give possession of the Site to the Contractor alongwith the **acceptance letter**.

9 Settlement of Dispute

- 9.1 If any dispute of any kind whatsoever shall arise between the Employer and the Contractor in connection with or arising out of the Contract, including without prejudice to the generality of foregoing, any question regarding its existence, validity or termination or the execution of the works, whether during the process of works or after completion and whether before or after termination or breach of the Contract, the Parties shall seek to resolve any such dispute or difference by referring the matter to Engineer in Charge. The Engineer in Charge will give its decision within fifteen (15) days of referring the dispute. Either Party if not in Agreement with Engineer in Charge's decision, may within fifteen days of decision by the Engineer in Charge refer to the senior management of the Employer, who will give its decision with thirty (30) days of referring the dispute. Either Party if not in Agreement with senior management decision, may refer to arbitration pursuant to Clause no. 10 of General Conditions of Contract.

10 Procedure for Disputes Resolution

- 10.1 The Arbitration shall be conducted in accordance with the arbitration procedure stated below.
The procedure for arbitration will be as follows:
- 10.1.1 In case of dispute or difference arising between the Employer and a Contractor relating to any matter arising out of or connected with this Agreement, such disputes or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996. The arbitral tribunal shall consist of three (03) arbitrators one each to be appointed by the Employer and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties and shall act as Presiding arbitrator. In case of failure of the two arbitrators appointed by the Parties to reach upon a consensus within a period of thirty (30) days from the appointment of the arbitrator appointed subsequently, the Presiding Arbitrator shall be appointed by the Indian Council of Arbitration/President of the Institution of Engineer (India)/The International Centre for Alternative Dispute Resolution (India).
- 10.1.2 If one of the Parties fails to appoint its arbitrator in pursuance of sub-Clause 10.1.1 above within 30 days after receipt of the notice of the appointment of its arbitrator by the other Party, then the Indian Council of Arbitration/President of the Institution of Engineer (India)/The International Centre for Alternative Dispute Resolution (India), shall appoint the arbitrator. A certified copy of the order of the Indian Council of Arbitration /President of the Institution of Engineer in Charges (India)/The International Centre for Alternative Disputes Resolution (India), making such an appointment shall be furnished to each of the Parties.
- 10.1.3 Arbitration proceedings shall be at Jaipur, Rajasthan, India, and the language of the arbitration proceedings and that of all documents and communications between the Parties shall be English.
- 10.1.4 The decision of the majority of arbitrators shall be final and binding upon both Parties. The cost and expenses of Arbitration proceedings will be paid as determined by the arbitral tribunal. However, the expenses incurred by each Party in connection with the preparation, presentation, etc. of its proceedings as also the fees and expenses paid to the arbitrator appointed by such Party or on its behalf shall be borne by each Party itself.
- 10.1.5 Without prejudice to the above provision, Where the amount in dispute is Rs.50 lacs and below, the disputes or differences arising shall be referred to the Sole Arbitrator. To be nominated by employer. The arbitration will take place in accordance with the Indian Arbitration and Conciliation Act 1996. The Arbitration shall be at Jaipur. Arbitration may be commenced prior to or after completion of the contract provided that the obligation of the employer and the contractor shall not be altered by reason of the arbitration being conducted during the progress of the contract.
- 10.1.6 Performance under the Contract shall continue during the arbitration proceedings and subject to the satisfactory performance of the Contractor, payments due to the Contractor by the Employers shall not be withheld, unless they are the subject matter of the arbitration proceedings.

3B. TIME CONTROL

11 Avoidance Of Delay

- 11.1 It is paramount that the Contractor shall constantly plan his work so as to most efficiently utilize all or any available part or parts of the Site, any completed part or parts of another Contractor's works which is to be integrated into the Contract Works (if any), the available drawings and all others matters as are available to him, as well as his own resources in order to avoid or reduce any standstill and down time.
- 11.2 In the event that the Contractor cannot commence or proceed with a particular part of the Contract Works as per the programme furnished to the Employer in accordance with Clause 12.1, for any reason whether attributed to the Contractor or not, the Contractor shall be obliged to reschedule and proceed with other parts of the Contract Works at no costs to the Employer to ensure that the completion date of the Contract Works will be met.
- 11.3 Should the Contractor fall behind any program submitted in accordance with Clause 12.2, due to any act, default, neglect or omission of the Contractor and requires over- time, night work or shift work and /or an increase of man power and/or construction plant to regain the scheduled progress (whether or not instructed by the Employer), the cost of such measures shall be borne by the Contractor.
- 11.4 Within the time stated in the Contract Data, the Contractor shall submit to the Engineer in Charge for approval a Construction Program.
- 11.5 The Engineer in Charge's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Engineer in Charge again at any time. A revised Program is to show the effect of Variations.

12 Extension of the Intended Completion Date

- 12.1 **Time shall be of the essence with respect to the commencement and completion as per the key Contractual dates as mentioned in the Contract Data as Milestones for the execution and completion of the Contract Works as stated.**
- 12.2 The Contractor acknowledges that a high rate of working is required to achieve the Dates for Completion of the Contract Works and Contractor shall be deemed to have allowed for shift working, sufficient plant, labour, floodlighting and any or all other measures to achieve the same.
- 12.3 The Dates of Completion of the Contract Works may be extended by the Employer subject to compliance by the Contractor with Clause 11 (Avoidance of Delay), by such period which reasonably reflects any delay in completion of the Contract Works which, notwithstanding due diligence and taking of all reasonable steps by the Contractor to avoid or reduce the delay as provided for in Clause 11, is caused:-
- a) By the occurrence of an event of Force Majeure;
 - b) By a delay in handing over of the Site or part of the Site by the Employer after the Dates for Commencement of the Contract Works;
 - c) Any variations requested by the Employer;
 - d) By other Contractors carrying out works not forming part of the works to be carried out under the Contract, and employed by the Employer;
 - e) By an instruction to suspend the Contract Works issued by the Employer pursuant to this Contract provided that such suspension is not due to the default of the Contractor;

and which affects the Contract Works PROVIDED that such delays are not due to the Contractor. PROVIDED FURTHER THAT if, while the Contractor is continuing works during the period when liquidated and ascertained damages are being deducted, the Employer gives instruction or matters occur which would entitle the Contractor to an extension of time then the Employer shall assess and give the Contractor an extension of time and so notify the Contractor accordingly.

- 12.4 It shall be a condition precedent that the Contractor shall notify the Employer in writing of any factors and the relevant Contract provision (if any) which entitles Contractor to an extension of time together with a statement of :
- a.) the reason why the delay in completion of the Contract Works is likely to result or has resulted;
 - b.) an estimate of the period by which the Contract Works are likely to be or had been delayed; and
 - c.) details of steps that the Contractor proposes to take to avoid or reduce the delay; within seven (07) days of the commencement or occurrence of any such factor or such extension of this seven (07) days period as the Employer may allow.
- 12.5 The Contractor shall notify The Employer within fourteen (14) days of the cessation of the factors notified to The Employer under Sub-Clause 12.4; to enable any provisions, that the Contractor may require to the proposed extended Date for Completion to be made as quickly as possible and such other particulars as shall be reasonably necessary to enable the Employer to properly consider the revision.
- 12.6 Without prejudice to any other grounds which do not entitle the Contractor to an extension of time, the Contractor shall not be entitled to extensions of time for delays resulting from weather conditions, or discrepancy in the Contract Documents, whether such events affect the Contract Works or not.
- 12.7 Notwithstanding the foregoing, the Employer shall not be obliged to take into account any circumstances that are not notified to The Employer in accordance with the periods referred to in Sub-Clause 12.3 and 12.4.
- 12.8 The Employer shall as soon as is reasonably practical after receipt of the Contractor's notification furnished in accordance with the sub-Clause 11.3 determine and notify the Contractor in writing of any extension of time to which the Employer considers the Contractor is entitled under Sub-Clause 12.4.
- 12.9 The Contractor had agreed NOT TO CLAIM for all costs, loss and /or expense suffered or incurred by reason of any extension of time granted by the Employer in accordance to Sub-Clause 12.4 herein.

13 Force Majeure

- 13.1 Force Majeure shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the Party affected, and shall include the following:
- 13.1.1 War, hostilities or warlike operations (whether a state of war be declared or not), invasion, act of foreign enemy and civil war, rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, riot, civil commotion and terrorist acts, confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government authority or act of any local state or national government authority
 - 13.1.2 Strike (other than strike by employees/staff/labour of Contractor or Sub-Contractor), sabotage, embargo, import restriction, epidemics, quarantine and plague.
 - 13.1.3 Earthquake, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or nuclear or other natural disaster

14 Delays Ordered by the Engineer in Charge

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

3C. QUALITY CONTROL

15 Identifying Defects

- 15.1 The Engineer in Charge / Architect shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer in Charge may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer in Charge considers may have a Defect.
- 15.2 The Contractor shall permit the Employer's technical auditor to check the Contractor's work and notify the Engineer in Charge and Contractor of any defects that are found. .

16 Correction of Defects

- 16.1 The Engineer in Charge shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. Once the defects are notified to the contractor the Defects Liability Period shall extend automatically for as long as Defects remain to be corrected.
- 16.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Engineer in Charge's notice.

17 Uncorrected Defects

- 17.1 If the Contractor has not corrected a Defect within the time specified in the Engineer in Charge's notice, the Engineer in Charge will have the right to engage third party to the defects rectified at risk & cost of the contractor along with overheads. Such amount will be recovered from the Contractor.

3D. COST CONTROL

18 Bill of Quantities

- 18.1 The Bill of Quantities shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.
- 18.2 The Bill of Quantity is used to calculate the Contract Price. The Contractor Shall be paid for the actual quantities executed & inspected & duly approved and accepted by the Engineer in Charge and the Contract Price shall be adjusted based on approved actual quantities of the Contract works as described in Bill Of Quantity for each item.
- 18.3 The rates set out in the Bill of Quantity (BOQ) are fixed, firm and shall be inclusive of all costs and expenses as under. No escalation in rate is permitted during the tenure of contract and shall not be subject to variation on any account what so ever.
- 18.3.1 Preliminaries works / costs such as site measurement, supervision, setting out, insurances, water, electricity/power, security/ watch & ward protection of public, working/liaison with consultant engineers, Government and other Relevant Authorities etc.
- 18.3.2 All associated temporary and false works.
- 18.3.3 All tests, sampling, inspection, reports, opening up of works and related works
- 18.3.4 Material, labour, plant, equipment, machinery, tools and all related costs.
- 18.3.5 Shifts works, night works, overtime works, incentives, bonus, related labour employment costs etc.
- 18.3.6 Working with site constraints and conditions.
- 18.3.7 Liaison, including dealing and compliances with requirements, restrictions, etc. of all Relevant Authorities.
- 18.3.8 Overhead cost, profits, etc.
- 18.3.9 Protection and maintaining all Contract works and any thing affected by the Contract works until completion and handing over.
- 18.3.10 Coordination with Development Commissioner Office located within the SEZ for verification etc. for availing benefits of exemptions for works within SEZ
- 18.3.11 Any other costs and / or expenses deemed necessary for the due execution and completion of the works.
- 18.4 This Project is an SEZ. As per Special Economic Zone Act 2005, all the taxes, duties, royalties, levies (except income tax on the profit of the Contractor) are exempted; hence, the quoted rates shall be exclusive of all taxes, duties, royalties, levies, service tax etc. Any tax component, considered shall be indicated separately and shall be admissible only if applicable, proof of payment of such taxes will be required for acceptance of claim in there respect. The Contractor shall put his best efforts to forward the exemptions and benefits granted by the Government he gets from time to time. Employer shall deduct Tax Deduction at Source (TDS) for such taxes at the rates fixed and revised by Relevant Authorities from each payment/bill due to Contractor. Employer shall issue TDS certificate in favour of Contractor for the TDS so recovered. In case employer is not able to avail any tax benefit due to negligence or non compliance of SEZ rule and regulation by contractor then the same will be recovered from contractor.
- 18.4.1 The rates as contained in the BOQ shall include all PF, ESI etc. and all other payment as per the statutory requirements. The Contractor shall produce proof of compliance of such requirement to the Employer and upon submission of such proof only, the Employer shall

release periodic payments to the Contractor. In the event that the Contractor fail to produce such proof / paying such payment, Employer shall pay such payment direct (but is not obliged) to the Relevant Authorities and shall recover the same from whatsoever monies due or to become due to the Contractor along with 15% overhead charges.

19 Tax

- 19.1 The rates quoted by the Contractor shall be deemed to be exclusive of taxes which are exempted under **SEZ Act 2005** and separate disclosure of all taxes which are not exempted alongwith basic rate in the bid. In case, any tax is levied inspite of Employer giving all requisite documents to the Contractor and Contractor's best efforts, same shall be paid extra to the Contractor upon Contractor submitting proof of such payments.
- 19.2 **INCOME TAX:** Deduction of income tax at source will be made by the Employer at the applicable rates which is obligatory as per the provisions of Income Tax Act. It shall be the responsibility of Contractor to arrange and produce a "No Deduction Certificate" from the Income Tax Authorities, if the payment of their invoices are to be made without deduction of Income Tax at source.
- 19.3 If any tax exemptions, concessions, reductions, allowances or privileges may be available to the Employer, the Contractor shall use its best endeavours to enable the Employer to benefit from any such tax savings to the maximum allowable extent.
- 19.4 **BASE DATE :** Base date for reimbursement of any new enactment in taxes, duties and levies by central or state govt. or any other statutory authorities as applicable to the Contract, shall be seven (7) days prior to the date on which the price bid or revised price bids were stipulated to be received.

20 Retention

- 20.1. Retention Money at the rate of 5 % of the value of work done for each running bill will be deducted until the actual completion of work, up to a maximum of 5% of Contract Price.
- 20.2 Retention money shall be refunded within 30 days after discharge of defect liability period of 12 months.
- 20.3 No retention sum shall be deducted from interim progress payment subject to the submission of an unconditional bank guarantee from a scheduled bank in the Employer's format equivalent to 5% of the Contract Price which would valid up to the Completion of Defect Liability period with 180 days extra claim period.

21 Liquidated Damages

- 21.1 If the contractor fails to complete the works by the date of completion as stated in the Tender or within extended time as per agreed project baseline schedule, the Owner shall withhold a sum calculated at the rate of 1 % of the total contract value per week (or part thereof) of delay as liquidated damages for the period during which the said work shall so remain or have remained in-complete. The owner may deduct such damages from any money's otherwise payable to the contractor under this contract, up to a maximum of 10 % of the total contract value after which Owner will have right to terminate the contract and claim for compensation from contractor for the financial losses on account of delay of project. The contractor admits that the loss shall always be caused if there is failure on its part.
- 21.2 The delay shall be assessed based on average delay over all due milestones. Reconciliation statement for Project Tracking giving detail of delay, duly verified by Engineer-in-Charge / project manager shall be submitted alongwith monthly running bills.
- 21.3 The Liquidated Damages imposed for not achieving intermediate milestone shall be subjected to refund/adjustment in case of Contractor achieve the final Milestone with the period as stipulated in the Contract.
- 21.4 **Time shall be of the essence with respect to the commencement and completion as per the key Contractual dates for the execution and completion of the Contract Works as stated in Contract Data**, and payment or deduction of liquidated damages shall not relieve the Contractor from his obligation to complete the work as per agreed construction program and milestones or from any other of the Contractor's obligations and liabilities under the Contract.

22 Performance Security

The Performance Security in the form of unconditional bank guarantee shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount equal to 5% of Contract Price from a Nationalised or Scheduled bank in the Employer's prescribed format the Performance Security shall be valid until a date 180 days from the date of expiry of Actual Date of Completion.

23 Defect Liability and Cost of Repairs

Loss or damage to the Works or Materials to be incorporated in the Works between the Actual Date of Completion and the end of the Defects Liability Periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions. The Contractor shall be responsible to make good at his own expense any defect which may develop within the period mentioned as Defect Liability Period in the Contract Data. The Employer shall give the Contractor a notice in writing about the defects and the Contractor shall repair the defect within maximum of seven (07) days or fourteen (14) days depending upon whether the defect is minor or major. If the Contractor fails to repair/remove the defect, the Employer may get the work execute from others at Contractor's risk & cost. The Employer shall have the right to appropriate all or part of the Retention Money towards the expense in repairing the defects.

3E. FINISHING THE CONTRACT

24 Completion

24.1 After completion of the work, the Contractor will serve a written notice to the Engineer in Charge to this effect. The Engineer in Charge upon receipt of this notice shall conduct a complete joint survey of the work within seven (07) days and prepare a defects list jointly. The defects pointed out by the Engineer in Charge or his nominee would be rectified by the Contractor within fourteen (14) days and thereafter acceptance report be signed jointly by the Contractor, Engineer in Charge and the Employer. And a '**Completion Certificate**' shall be issued to Contractor by Employer.

25 Taking Over

25.1 The Employer shall take over the Site and the Works within seven days of the Engineer in Charge issuing a certificate of Completion.

26 As Built Drawings

26.1 The Contractor shall supply "As Built" Drawings 3 sets (hard copy) and soft copies in CAD format in CD alongwith Operation & Maintenance Manuals, SOPs and Gurantees by the dates stated in the Contract Data.

26.2 Contarctor's rates include the As-built drawings and associated manuals.If the Contractor does not supply the As Built drawings by the dates stated in the Contract Data, or they do not receive the Engineer in Charge's approval, the Engineer in Charge shall withhold the amount stated in the Contract Data from payments due to the Contractor.

27 Termination Of Contract

27.1 Due to any default by the Contractor, the Employer shall be entitled to terminate the Contractor's employment under the Contract by giving one (01) week advanced notice in writing by stating the reason. The date after seven (07) days from the date of issuance of the Termination Notice shall hence be defined as "Date of Termination". The Contractor will be paid for all works duly and properly completed up to the Date of Termination but shall not be entitled to anticipated profit or any consequential or indirect loss or damage and shall hold harmless and indemnify the Employer against Contractor's Contractors/suppliers or third parties arising from termination under this Clause.

27.2 The Contractor had agreed in the event of delay in progress or non-achievement of the Milestone Dates, The Employer shall reserve the sole discretion right in deploying its own plant and machinery or engaging third party to speed up the Contractor's works and the Contractor's Contract shall be terminated with written notice at any point of time without any compensation or claims to be paid to the Contractor. All additional / extra cost incurred by The Employer shall be charged to the Contractor due to such event.

28 Payment upon Termination

28.1 Full payment to Contractor's workers, Contractors, suppliers and third parties engaged by the Contractor for any portion of the Contract works shall be paid in full by the Contractor and thereafter must be removed from site on or before the Date of Termination. If the Contractor failed to make full payment to these workers, Sub Contractors, suppliers and third parties

and/or remove them from site on the Date of Termination, then the Employer will carry out such duties on behalf of the Contractor. The Employer will recover all cost incurred due to the performing of such duties on behalf of the Contractor by making deduction from amount/s due to the Contractor or by any other process.

29 Breach Of Contract

The following events shall be fundamental breach of Contract:

- 29.1 The Contractor has contravened any Clause / sub-Clause of the Conditions of Contract.
- 29.2 The Contractor does not adhere to the agreed construction program and agreed environmental management plan and also fails to take satisfactory remedial action as per Agreements.

The Contractor shall carry out all instruction of the Engineer in Charge which comply with the applicable laws where the Site is located if the Contractor fails to carry out the instructions of Engineer in Charge within a reasonable time determined by the Engineer in Charge in accordance with General Condition of Contract Clause **11**.

3F Special Conditions of Contract

1. General

The Contractor is advised to note that the following Special Conditions are part of the Contract and he will not have any right to claim at any time for delays or for expenditure incurred by him in fulfilling the following special conditions.

2. Scope of Works

- 2.1 The Contract Works shall comprise of but not be limited to:-
 - 2.1.1 The scope of work is for the construction of Mahindra Technology Park [Low Side Air-conditioning & Ventilation System](#) works as defined in BOQ
 - 2.1.2 The work to be carried out under the contract shall include all the items given in the Bill of Quantities and such other item as may be instructed by the Employer time to time and shall expect as otherwise specified in these conditions include all labour, materials, tools plant equipment and transport, hoisting, etc. which may be required in preparation and completion of the works.
 - 2.1.3 All the above shall be as per issued relevant drawings, Specifications of IS and other relevant National and International Standard Specifications and good engineering practices, safety measures as required all as per agreed construction methodology in consultation and coordination with and under the inspection of the Employer's personnel / design consultants.
- 2.2 All the Contract Works shall be executed in full compliance with the Specifications of the Contract and all requirements and always to the satisfaction of the Employer.
- 2.3 The Contractor acknowledge that he understands the Special Economic Zone (SEZ) rules and regulation as per **SEZ Act 2005** and he further acknowledge that he will abide all the rules and regulations of SEZ Act, laws related to custom duties, notified area and all other related things affecting the Contract works directly or indirectly and shall keep the employer harmless from any violation of the provisions of SEZ Act 2005.
- 2.4 The Contractor shall resolve local constraints and problems, liaise, seek, and obtain any consent, permit, license, approval, etc. from all Relevant Authorities including paying all fees, charges, levies, etc all at his own cost.
- 2.5 Clearing all debris and disposing to location approved by Municipal authorities during progress of Contract works and before and after the dates of Completion.
- 2.6 All temporary works, haul/access roads that are necessary for the proper and due completion of the Contract Works.

3. Milestone dates:

Milestone date shall be as negotiated and agreed at the time of award of contract.

4. Schedule of Works

The Contractor shall submit a work schedule including the commencement date, to reflect the ground realities and indicating the milestones.

5. Measurements

The payable quantity (ies) against the executed work shall be determined on the basis of quantity certified, wherein certification conducted jointly by the Contractor and the Engineer-in-Charge. Work accepted, approved and certified by the Contract Dept. / PM, will only be paid for as specified in Bills of Quantities and payments shall be at the same rates.

6. Running Account Bills

The Contractor has to prepare and submit the Running Account Bills in triplicate once in a month along with details measurements in serially machine numbered register, abstract sheets, deviation statement and any specific instructions which may be given in this regard by the Engineer In-Charge shall also be attached to by the contractor

Running Bill Certification:

- 6.1 The Contractor shall prepare and submit running bill to the Engineer In-Charge once a month throughout the construction period considering that No payment shall be made for works estimated to cost less than rupees 1 (One) Lac.
- 6.2 Within 5 days of the receipt of Contractor's running bill for payment, the Engineer In-Charge / Employer's representative shall check and point out corrections, if any to be made in the bill. The Contractor shall correct the bill and resubmit the same to the Engineer In-charge.
- 6.3 Within 10 days of receipt of the corrected bill from the Contractor, the Engineer In-charge/ Employer representative shall check the bill and forward the same to Manger Contract for verification for certification, who will certify the amount due to Contractor and recommend payment of the amount by the accounts department to the Contractor
- 6.4 Within 6 days of receipt of the bill from Engineer In-Charge, account dept will release the payment along with certificate showing details pertaining to works done, total recoveries and statutory deductions.
- 6.5 Any running / interim Certificate of Payment given by the Infra / Account Dept. relating to work done or the materials delivered shall be adhoc in nature and may be modified or corrected by any subsequent interim Certificate or the Final Certificate of payment.
- 6.6 An interim payment not exceeding 75% of the provisional bill amount may be certified by the Engineer-in-charge. Balance payment shall be made once Engineer-in-charge certifies quantity and item rate. Interim payment can be made within 7 days of engineer-in-charge certificate.

Final Bill payment

- 6.7 The Final Bill shall be submitted by the Contractor within two month of the date of Completion of the Work or if the work is completed earlier, within one month of such completion. The contractor shall give to the employer a detailed account of the total amount which he consider payable to him under the contract..
- 6.8 The final bill will be checked in terms actual measurement at site, quality of works and material supplied / used, approved extra items, by the Engineer In-Charge within **30** days from the date of the bill is received by the Engineer In-Charge, provided the contractor has complied with all formalities as described in various clauses of the Contract and thereafter the same would be forwarded to the next concerned dept.
- 6.9 The payment of the final bill shall be made to the Contractor by the Employer within 15 days from the receipt of the Engineer in-charge approval certificate for payment.
- 6.9.1 No further claim shall be made by the Contractor in respect thereof even after submission of the final bill and the same shall be deemed to have been fully waived and absolutely extinguished.
- 6.10 The final billing shall be accompanied by all substantiating documents as required for running bills with the addition of the following items that shall be supplied by the contractor:
 - 6.10.1 All written guarantees / warrantees and spares required by the Contract documents.
 - 6.10.2 Operation and Maintenance manuals and instructions for equipment and apparatus.

- 6.10.3 Re producible and blue prints of all requisite As Built drawings along with the soft copy thereof on latest version of AutoCad software.

Certificate for payment format : (may be finalized later with the Engineer In-Charge)

	Value of Work done for Interim Certificate As per Contract	(1)
Less (-)	Deductions :	
	Retention 5% on '1' subject to a maximum of 5% on Contract Value	(a)
	Previous Payments made (Payment made till date including Advance/ Adhoc payments made upto the period of this bill)	(b)
	Deductions (a+b)	(c)
	Deduction on Govt. / Statutory liabilities such as TDS etc.	(d)
	Total Deductions (c+d)	(2)
	Net Value of This Bills (Amount payable)	(1 - 2)

7. Subcontract or Subletting of Works

7.1 Sub-Letting:

No part of the Contract shall be sublet without the written permission of the Employer nor shall transfers be made by the 'Power of Attorney' authorizing others to carryout the work or receive payment on behalf of the Contractor.

7.2 Sub-Contract:

7.2.1 The Contractor is not permitted to subcontract any part of his works in this Contract without prior approval in writing from the Employer. It may be made clear that under ordinary circumstances, no subcontract shall be permitted.

7.2.2 In any case, whether any part of the works is subcontracted or not; the principal liabilities of the works shall lie with the Contractor.

8. Contract Drawings

8.1 The Engineer in Charge shall give Two sets of Contract Drawings, approved for construction, to the Contractor within 2 weeks from the date of submission.

8.2 The Contractor shall ensure that a complete up to-date list of drawing is maintained at site. All Contract Drawings shall be properly filed and indexed for ready reference.

8.3 The Contractor shall ensure that only the valid up to-date Contract Drawings are used for preparation of Working Drawings.

8.4 The privilege of the authorship and Employership of drawing and designs of the building remains with Engineer in Charge. Drawings and design prepared by their Consultants shall be used only for the purpose specified in the Contract and all drawings issued shall be returned to Engineer in Charge after completion of works.

8.5 The Contractor shall submit shop and fabrication drawings as required by the Engineer- in-Charge.

8.6 Contractor is not authorize to disclose drawings or any part of drawing and photographs of site without written approval from the Employer.

9 Additional Work

Any additional works, instructed during the Contract Period and within the Contract Amount, will be paid as per Bill of Quantity rates and it shall not be considered as a cause for the Contractor to claim for delay, incurred overhead, mobilization etc.

10 Protection of the Works during Contract Period

It is clearly understood that any damage occurring to the Works (completed or under execution) is the Contractors responsibility and no claims will be entertained by the Employer since the matter shall be covered by the relevant Insurances.

11 Discrepancies in alignment

Discrepancies in alignment and levels etc. noticed during construction and/or on completion shall be rectified (including affected works executed by other Contractors) by the Contractor at his own cost and risk, Engineer in Charge's approval does not relieve the Contractor of his responsibilities.

12 Temporary Power and Water Supply

All costs, both for power supply and temporary installations and Power and Water required for construction and labour shall be borne by the Contractor.

13 Site Offices of the Contractor

The successful Bidder is to provide and maintain a site office at a location approved by the Engineer in Charge, within 15 days from the date of issue of Notice to Proceed.

14 Safety on Site

The Contractor shall ensure full compliance of Safety Code. All measures to ensure safety of workers and plant at site shall be taken by the Contractor. The cost of all safety equipments and the cost of full compliance of provisions given in safety code at site would be deemed to be included in various Items of the Bill of Quantities and Rates.

15 As Built Drawings

The Contractor shall prepare As Built Drawings both in hard copy and in digital format. The drawings shall be prepared for any given section of the work as soon as the work for that particular section is completed. Preparation of As Built Drawings shall keep pace with the work and shall not be left over towards the end of the project. Three (03) hard copies and one soft copy of all drawings shall be submitted.

No separate payment will be made for the preparation of As-Built Drawings; Cost of preparation of As Built Drawing is deemed to be included in all other priced bill items.

16 Labour

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Engineer in Charge, deliver to the Engineer in Charge a return in detail, in such form and at such intervals as the Engineer in Charge may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer in Charge may require.

The contractor shall make his/their arrangements for the engagement of all labour, skilled and unskilled. No Contractor shall employ any person who is under the age of 18 years.

The Contractor shall, in respect of labour employed by him, comply with or cause to be complied with the provision of various labour laws and rules as applicable to them from time to time in regard to all matters provided therein and shall indemnify the Employer in respect of all claims that may be made against the Employer for non-compliance thereof by the Contractor.

17 Contractor's Other Obligations

- 17.1 All safety training and skill development of Contractor's workers and operators shall be carried out by the Contractor and all costs related to such training shall be borne by the Contractor as required under statutory law.
- 17.2 The Contractor shall obtain all necessary approvals/ permission from the Relevant Authorities including where necessary securing the presence of the Relevant Authorities or their representative to inspect and supervise the operations in connection with the Contract Works. The Contractor shall bear all costs, fees, charges etc so imposed for the attendance of the Relevant Authorities or their representatives.
- 17.3 The Contractor shall be responsible for any damage caused by any work carried out by Contractor to the existing services and utilities whether shown or not shown in the drawings from whatsoever cause arising thereof and shall make good to its original condition at his own costs and expense to the satisfaction of the Employer.
- 17.4 Upon completion of the Contract Works the Contractor shall remove and clear all debris, waste and/or any excess materials, construction plant, and temporary works from the site and shall do all things to clear up the site which shall include any cleaning where instructed by the Employer to other areas affected by the Contract Works. During the Contract period the Contractor shall ensure that the site is kept clean and in proper order and free from rubbish, waste or debris and Contractor shall do all things necessary to prevent any damage to or pollution or the creation of any health or environmental hazard at or around or adjacent to the Site.
- 17.5 The Contractor shall defend (if requested to), save harmless and indemnify the Employer against all claims, demands, interest, penalties, proceedings, damages, loss, costs, charges and expenses arising out of or in connection with any failure, neglect or omission, by the Contractor to perform his obligations under the Contract or any damage to property (including the Contract Works) or injury to person (whether resulting in death or not) caused or contributed by the Contractor and/or his servants or agents or independent Contractors appointed by the Employer to carry out works on behalf of Contractor (whether or not such claims, losses and/or damages have been insured by the Employer). In addition, this indemnity shall include all legal costs incurred by the Employer as a consequence of such claim, demand or proceeding being made.
- 17.6 The Contractor shall, subject to this Contract and other obligations imposed by law, execute the Contract Works and provide all labour, materials, construction equipment and all things necessary and incidental for the Contract Works to the satisfaction of the Employer and / or the Relevant Authorities.
- 17.7 The contractor shall abide by labour laws. It will get itself registered under the provision of contract labours (Registration and abolition) Act'1970 and it will obtain a separate PF code number for payment of PF contribution to Fund. The contractor shall take all necessary precaution against the pollution of drinking water, underground water and for the protection of the environment, tree and vegetation etc.
- 17.8 The Contractor shall bear all payments and other related costs on his own in connection with the execution and completion of additional, rectification, etc, works due to or caused by any act, default, neglect or omission by the Contractor. This shall also include the employment of consulting Engineer in Charges, professional experts and such other personnel as may be necessary for such works.
- 17.9 The Contractor acknowledges that he will not have any objection in re-structuring the Contract with respect to material and labour in order to realize the exemptions and benefits granted by the Government whenever required, and he will pass on such benefits to the Employer.
- 17.10 The Contractor shall indemnify the Employer against all claims in respect of patent rights and any or all other intellectual property rights, and shall defend all actions arising from such claims, and shall himself pay all royalties, license fees, damages, cost of charges of all and every sort that may be legally incurred in respect thereof.
- 17.11 The Contractor shall never disclose, share, publish, and/or make copies of any drawing, specification, methodology or any other information in any manner given to the Contractor during the Contract or after the completion of the Contract without the written permission of Employer.

3G. SAFETY MANUAL

CHAPTER 01

1.0. THE MAIN CONTRACTOR.

1.1. RELATIONSHIP WITH THE CLIENT.

A close relationship and continuous interaction must be maintained with the client by the Construction Manager of the main or managing contractor. The client does have specific safety and health requirements to be observed and co-operation with his contractor, throughout the contract is essential. The prospective main contractors are given information on which to base their tenders and at the Tender Stage; the prospective contractors are expected to understand fully the Scope and Design Intent of these provisions.

1.2. Selection of sub contractors.

Management contractors should select sub or works contractors, using the same criteria of practical safety policy. Again, it must be ensured that the terms of contracts include adequate provision for safe working and for specified safety and health items.

1.3. Planning.

Detailed planning should take the following matters into account

- Know hazardous operations, e.g., use of cranes and site transport, steel erection scaffolding, etc.
- Requirement for plant and equipment to ensure safe working, or ease of handling.
- The sequence of work and its phasing between contractors, to minimise the possibility of one contractor placing another contractor's men at risk. Where appropriate, the segregation of contractors should be considered.
- The need to provide information, instruction and appropriate training, both on general site safety and on hazards specific in the site. The latter could range from restricted zones, permit-to-work systems and lifting operation, to the wearing of safety helmets.
- The need for fire precautions and emergency procedures.
- The need for environmental monitoring and health surveillance.
- Site security and foreseeable risks to the public, including the need for directional and warning signs
- Safe access across the site for persons, vehicles and plant. Thought should be given to arrangements for keeping the site tidy, accommodation for site staff, welfare, first aid and other facilities
- The provision of safe places of work at different stages of the job, including the provision of scaffolding for a number of sub or works contractors.

1.4. Control.

Sub and works contractors should be briefed about the safety policy and site rules of the main contractor at an initial safety meeting. Decisions on all other matters affecting safety and health should be laid down so that the responsibilities of all parties are made clear before contractors start work. Such matters should include.

- Appropriate precautions and work methods for identified hazards or hazardous work.
- Necessary plant and equipment and arrangements for its provision, maintenance use and inspection.
- The question of trade union or other workforce safety representation and the need for a joint safety committee.
- Arrangements for some form of induction training for new-starters on site.
- Arrangements for any specialist training.
- Arrangements for promulgating safety and health information, e.g. on site notice boards.

It is important that such safety and health arrangements are reviewed at the first project meeting, where the site management can set the tone for the conduct of work by resolving, at an early stage, any difficulties which may arise.

1.5 Co-ordination.

The Construction Manager, appointed by the main contractor, must be totally responsible for compliance with health and safety code. He must appoint a Chief Safety Officer and form a

Safety Committee along with operatives from sub vendors. This Safety Committee will be Chaired by the Client's representative and sit twice a week and report to the Project Controller. The Construction Manager must take suitable arrangements to ensure the effective co-ordination of the work of all contractors on site. He should ensure that he is kept informed on a day to day basis, of progress and problems which arise. Clear lines of communication should be set up between each contractor and the Safety Officer of the Main Contractor. Operatives must also know whom to contact over safety and health matters requiring action or a decision. Such effective co-ordination will be enhanced by ensuring that 'safety and health' figures prominently on the agenda of regular project meetings. Safety Committee's weekly report must be submitted to the Project Controller in every Project Meeting.

1.6 Monitoring.

Arrangements must be made for safety and health monitoring of the site on a regular basis. This will include, not only ensuring the safety of such items as scaffolding excavations and plant but also environmental matter such as hazardous dust fume noise etc. In all cases, the Construction Manager should ensure that daily site inspections are carried out, by Safety Officer, more in depth inspections being done periodically by visiting safety advisers. It may be necessary for arrangements to be made for specialist occupational health and hygiene advice. The Check List for daily inspection is given in the following Chapters.

1.7 Records.

The main contractor should ensure that all statutory notifications, examinations and inspections are carried out. Except for plant used exclusively by individual contractors, all records should be kept by the Construction Manager.

1.8 Standards.

The following standards shall be followed, unless more onerous provisions have been specified in the Safety Provisions given in this Code.

IS: 3696 (Part I) - 1966 Safety code for scaffolds and ladders: Part I Scaffolds

IS: 3696 (Part II) - 1966 Safety code for scaffolds and ladders: Part II Ladders

IS: 4082-1977- Recommendations on stacking and storage of construction materials at site (first revision)

1.9 Non Compliance of Safety and Health Provisions:

The Compliance of the Safety and Health provisions are of utmost important to the Client. The prospective contractors must note that the client will take a serious view of any non compliance report of Safety Committee. Based on Safety Committee's report, the Client has a right to order stoppage of work till rectification is carried out to the satisfaction of the Safety Committee and all stoppages on this account will be at the entire risk, costs and consequences of the Contractor.

CHAPTER 2.0

2.0 CONTRACTOR'S SAFETY INSPECTION CHECKS LIST.

Contractor _____ Contract No. _____
 Project _____
 Location _____
 Type of Work _____
 Date _____ Checked By _____

Sr	ITEM	STATUS	(Inspector) REMARKS
3.0	ACCIDENT PREVENTION ORGANISATION.		
3.1	Trained First Aid Person		
3.2	First Aid Kit.		
3.3	Safety Material Posted.		
3.4	Emergency Phone # Posted.		
4.0	HOUSEKEEPING & SANITATION		
4.1	General neatness of working areas.		
4.2	Regular disposal of waste and trash.		
4.3	Passageways and walkways clear.		
4.4	Adequate lighting		
4.5	Projecting nails removed.		
4.6	Oil and grease removed.		
4.7	Waste containers provided and used.		
4.8	Sanitary facilities adequate and clean.		
4.9	Drinking water tested and approved.		
4.10	Adequate supply of water.		
4.11	Drinking cups, Clean Dispensers.		
5.0	FIRE PREVENTION.		
5.1	Fire extinguishers identified, checked, lighted.		
5.2	Hydrants clear access to public thoroughfare open.		
5.3	Good housekeeping.		
5.4	NO SMOKING posted and enforced where needed.		
6.0	PERSONAL PROTECTION.		
6.1	Hard-hats		
6.2	Noise Level Exposure.		
6.3	Eye Protection.		
6.4	Safety Lines & Belts.		
6.5	Life Jackets.		
7.0	ELECTRICAL INSTALLATION.		
7.1	Adequate well insulated wiring.		
7.2	Fuses & GFI provided.		
7.3	Fire hazards checked.		
7.4	Electrical dangers posted.		

ITEM	STATUS	REMARKS
8.0 HAND & POWER TOOLS		
8.1 Tools and cords in good condition.		
8.2 Proper grounding.		
8.3 All mechanical safeguards in use.		
8.4 Tools neatly stored when not in use.		
8.5 Right tool being used for the job at hand.		
8.6 Wiring properly installed.		
8.7 Enough men used to handle material.		
9.0 LADDERS.		
9.1 Stock ladders in good condition.		
9.2 Stock ladders not spliced.		
9.3 Properly secured, top and bottom.		
9.4 Side rails on fixed ladders extend above top landing.		
9.5 Built-up ladders constructed of sound materials.		
9.6 Rungs not over 12 inches on centre.		
9.7 Stepladders fully open when in use.		
9.8 Metal ladders not used around electrical hazards.		
9.9 Proper maintenance and storage.		
10.0 SCAFFOLDING.		
10.1 All structural members adequate for use.		
10.2 All connections adequate		
10.3 Safe tie-in to structure.		
10.4 Ladders and working areas free of debris, snow, ice, grease.		
10.5 Proper footings provided.		
10.6 Passerby protected from falling objects.		
10.7 Supports plumb, adequate cross bracing provided.		
10.8 Guard rails and toe boards in place.		
10.9 Scaffold machines in working order.		
10.10 Ropes and cables in good condition.		
11.0 HOISTS, CRANES & DERRICKS.		
11.1 Inspect cables and sheaves.		
11.2 Check slings and chains, hooks and eyes.		
11.3 Equipment firmly supported.		
11.4 Outriggers used if needed.		
11.5 Power lines inactivated, removed, or at safe distance.		
11.6 Proper loading for capacity at lifting radius.		
11.7 All equipment properly lubricated and maintained.		
11.8 Signalmen where needed.		
12.0 MOTOR VEHICLES.		
12.1 Brakes, lights, warning devices operative.		
12.2 Weight limits and load sizes controlled.		
12.3 Personnel carried in safe manner.		
13.0 BARRICADES.		
13.1 Floor openings planked over or barricaded.		
13.2 Roadways and sidewalks effectively protected.		
13.3 Adequate lighting provided.		
13.4 Traffic controlled.		

Sr.	ITEM	STATUS	REMARKS
14.0	HANDLING & STORAGE OF MATERIALS.		
14.1	Neat storage area, clear passageway.		
14.2	Stacks on firm footings, not too high.		
14.3	Men picking up loads, correctly.		
14.4	Materials protected from heat and moisture.		
14.5	Protection against falling into hoppers and bins.		
14.6	Dust protection observed.		
17.0	MASONRY.		
17.1	Proper scaffolding.		
17.2	Masonry saws properly equipped, dust protection provided.		
17.3	Safe hoisting equipment.		

CHAPTER 3.0**3.0 ACCIDENT PREVENTION ORGANISATION.****3.1 Trained First Aid Person**

A contractor shall provide, or ensure that there is provided, such number of suitable persons as is adequate and appropriate in the circumstances for rendering first aid to his employees if they are injured or become ill at work: and for this purpose a person shall not be suitable unless he has undergone -

- a) Such training and has such qualifications as the Health and Safety Executive may approve for the time being in respect of that case or the class of case, and
- b) Such additional training, if any, as may be appropriate in the circumstances of that case.

In practice, (a) refers to a trained first aider and (b) to an occupational first aider. In addition, a person who holds a current first aid certificate issued by registered medical association or Indian Red Cross Society will be classed as a "Suitable Person" for the purposes of Regulation.

For most sites, the contractor should ensure that at least one first aider is normally present when the number of employees at work is between 50 and 150, there should be at least one additional first aider for every 150 or so should ensure that sufficient first aiders are appointed to provide adequate coverage for each shift. Provisions for medical care must be made available by the contractor for every employee covered by the regulations. In the absence of infirmaries, clinics, or hospitals in proximity to the work site, properly trained and certified first aid personnel must be available, and first aid supplies must be provided by the contractor. Appropriate equipment for transportation of injured personnel to a physician or hospital must be provided for.

3.2. First Aid Kit

Regardless of the number of employees there must be at least one first-aid box on site. Every first aider and occupational first aider should have easy access to first-aid equipment, and provision should be made for every employee to have reasonably rapid access to first aid. Each box should be placed in a clearly identified and readily accessible location, and contain a sufficient quantity of suitable first-aid materials and nothing else. Boxes and kits should be checked frequently to ensure they are fully stocked and all items are in a usable condition. Sufficient quantities of each item should always be available in every first aid box or cabinet.

Sr.No	Item	Numbers of Employees.				
		1-5	6-10	11-50	100	150
1	Guidance Card individually wrapped.	1	1	1	1	1
2.	Sterile adhesive dressings.	10	20	40	40	40
3.	Sterile eye pads with attachment.	1	2	4	6	8
4	Triangular bandages	1	2	4	6	8
5	Sterile coverings for serious wounds (where applicable)	1	2	4	6	8
6	Safety pins.	6	6	12	12	12
7	Medium sized sterile un medicated dressings.	3	6	8	10	12
8	Large sterile un medicated dressings	1	2	4	6	10
9	Extra Large sterile un medicated dressings.	1	2	4	6	8
10	Sterile water or saline in 300 ml disposable containers, where tap water is unavailable.	1	1	3	6	6

The first-aid box or cupboard should protect the contents from dampness and dust and be clearly marked with a white cross on green background.

3.2.1 First - Aid Rooms.

Where there is 250 or more person at work on site, a suitably staffed and equipped first-aid room should be provided. In addition, where there is a large (over 150) number of employees divided into several dispersed working groups, or the location of the site makes access to places of treatment outside it difficult, the contractor should consider whether a centralised first-aid room may be needed.

- A first aid room should:
- a) Be under the charge of an occupational first aider in most circumstances; names and locations of all first aiders should be displayed.
 - b) Be readily available and used only for the rendering of first aid
 - c) Be clearly identified and of sufficient size to allow access for a stretcher, wheelchair, etc. and to hold a couch with space for people to work around it
 - d) Contain in addition to the previously mentioned first aid materials ; a sink with hot and cold running water, drinking water, paper towels, impermeable work surfaces, clean garments for use by first aiders and occupational first aider's clinical thermometer a couch with pillow and blankets frequently cleaned
 - e) Be heated, lighted, ventilated and cleaned regularly
 - f) Be designed so that immediate contact can be made with the person on call, e.g. radio, siren, and a telephone link if feasible. It should be stressed that a sufficient number of first - aid boxes must be provided for any work area which is not within easy reach of the first aid room.

3.3 Emergency Phone # Posted.

Project Name _____ Project No. _____

The following are the business telephone numbers where project key personnel can be reached at all times. In addition, the emergency telephone numbers of other vital agencies are listed:

	BUSINESS	RESIDENCE
CLIENTS PROJECT CONTROLLER		
CHIEF CONSTRUCTION MANAGER		
SAFETY OFFICER (CONTRACTOR).		
OTHER EMERGENCY TELEPHONE NUMBERS		
FIRE		
AMBULANCE		
DOCTOR		
HOSPITAL		
POLICE		
GAS COMPANY		
ELECTRIC COMPANY		
WATER COMPANY		
TELEPHONE COMPANY		
INSURANCE CARRIER		
OTHER		
OTHER		
OTHER		

CHAPTER 4.0

4.0 HOUSEKEEPING & SANITATION

At the work site, an adequate supply of potable water must be provided, as well as clean drinking water dispensers. Potable water for cleanup must be provided. Where non potable water is used for industrial or fire fighting purposes it must be identified by appropriate signs.

CHAPTER 5.0

5.0 FIRE PREVENTION.

Electrical wiring equipment for heating, light, or power purposes must be installed in compliance with the requirements. Internal combustion engine-powered equipment must be located with exhausts well away from combustible materials. Smoking is to be prohibited in the vicinity of fire hazards, and such areas must be conspicuously posted. Care shall be taken properly to ground nozzles, hoses, or steam lines used in hazardous tankage or vessels.

In location of temporary buildings and yard storage, appropriate care shall be taken for proper separation to preclude an accumulation of fire potential. The contractor is responsible for maintaining the entire area, but particularly storage areas, free from accumulation of unnecessary combustible materials.

Site Fire Check List

1. Are safe ashtrays provided where smoking is permitted?
2. Are heaters properly guarded?
3. Are wet clothes kept clear of heaters?
4. Are portable heaters secure from being knocked over?
5. Is all temporary wiring well supported and protected?
6. Are any circuit's overloads?
7. Are all flammable liquids, gas cylinders and flammable materials separately and properly stored?
8. Are all gas appliances fitted with control taps?
9. Is rubbish being "burned in proper fashion"?
10. Is all flame cutting and welding taking place with proper precautions?
11. Are all blowlamps and blowtorches being used correctly?
12. Do all night watchmen and security patrols know the fire routines?

Preventing the spread of fire

1. Is waste accumulating in hoist shafts, under butts, in odd corners?
2. Are separate metal waste containers supplied for each of the following: oily rags, paint rags, paint scrapings, waste flammable liquids, wood shavings and off cuts?
3. Is all waste regularly cleared?
4. Are all huts safely sited?

Means of escape

1. Are all gangways, stairs and platforms free from obstruction?
2. Does everyone know what to do in emergency?
3. Is fire drill practised, and is there a system to ensure that all persons have evacuated the area?

Fire Fighting

1. Have all extinguishers been checked and / or recharged?
Are they clearly identified and easily accessible? Are operatives trained in their use

CHAPTER 6.0

6.0 PERSONAL PROTECTION.

Workers are often reluctant to use protection equipment. Such items should not only be suitable for their purpose but also be as comfortable as possible and acceptable to the workers concerned. Only then can efforts to ensure that equipment is worn or used prove successful.

All necessary personal safety equipment as considered adequate by the Engineer-in-charge shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use; and the contractor shall take adequate steps to ensure proper use of equipment by those concerned.

- a) Workers employed on mixing asphaltic materials, cement and lime mortars / concrete shall be provided with protective footwear and protective gloves.
- b) Those engaged in handling any material which is injurious to eyes shall be provided with protective goggles.
- c) Those engaged in welding works shall be provided with welder's protective eye-shields.
- d) Stone workers are employed in sewers and manholes, which are in use, the contractor shall ensure that man-holes cover are opened and manholes are ventilated at least for an hour before workers are allowed to get into them. Manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to public.
- e) The contractor shall not employ men below the age of 18 and women on the work of painting with products containing lead in any form. Whenever men above the age of 18 are employed on the work of lead painting, the following precautions shall be taken :-
 - i) No paint containing lead or lead products shall be used except in the form of paste or ready.
 - ii) Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scraped.
 - iii) Overalls shall be supplied by the contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

CHAPTER 7.0

7.0 HAND & POWER TOOLS

Hand and power tools must be maintained in a safe condition, whether furnished by the contractor or by the employee. When power-operated tools are designed to accommodate guards, they must be equipped with appropriate guards when in use. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains and other moving parts of equipment must be guarded if the parts are exposed to contact by employees.

All hand-held power tools must be equipped with a constant pressure switch that shuts off when the pressure is released. Electric power-operated tools shall be of the approved double insulated type, or grounded in accordance with good electrical practice. Pneumatic power tools must be secured to the hose or whip by positive means. Safety clips or retainers must be maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled.

Pneumatically driven nails, staplers, and similar equipment provided with automatic fastener feed that operate at more than 100 psi pressure at the tool must have safety devices on the muzzle to prevent the tool from ejecting fasteners, unless the muzzle is in direct contact with the work surface.

Hoses shall not be used for hoisting or lowering tools, and hoses exceeding ½-in inside diameter must have a safety shutoff at the source of supply to reduce pressure in case of a hose failure.

All fuel-powered tools must be stopped while being refuelled, serviced, or maintained.

Only trained employees may be allowed to operate a powder-actuated tool. Such tools must be tested each day before loading to see that the safety devices are in proper working condition, in accordance with manufacturer's recommended test procedure. Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any employee, and hands shall be kept clear of the open barrelled end. Fasteners shall not be driven into very hard or brittle materials such as cast iron, glass block, face brick, hardened steel, or hollow tile. For driving into materials that are easily penetrated, appropriate backing must be available to prevent the pin fastener from passing completely through.

All employees using abrasive wheels must use eye protection, and other tools must be operated using appropriate personal safety equipment.

CHAPTER 8.0

8.0 LADDERS

Use of Ladders and Folding Step-Ladders.

- This regulation applies to all ladders and pairs of steps but not roof ladders and crawling boards.

Ladders must :

- a) Be fixed near the top if practicable, or near the bottom if not: if suspended they must be secure,
 - b) Be placed (except when suspended) on a firm level base; they must not stand on loose packing (e.g. bricks),
 - c) Be intermediately secured, where necessary, to prevent swaying and sagging, and
 - d) Be supported, or suspended, equally on each stile.
- If a ladder, standing on the ground, cannot be fixed to prevent slipping, then someone must hold it at the base when it is being used.
 - A ladder which is not more than 3 m in length, need not be fixed or footed, provided it is securely placed so as to prevent it from slipping or falling. This exemption does not apply to ladders which are used as a means of communication between one working place and another, or to suspended ladders.
 - Ladder must :
 - a) Extend at least 1.05 m above any landing place beyond the highest rung from which a person may be working, or have a nearby handhold of equivalent height.
 - b) Be placed so that there is space behind each rung for proper foothold (e.g. no rung should coincide with a scaffold tube).

CHAPTER 9.0

9.0 SCAFFOLDING

Collapse of any scaffold or part of a substantial part of the scaffold falling or overturning; also collapse or part collapse of the suspension arrangements of a slung or suspended scaffold, causing the platform or cradle to fall more than 5m.

9.1. Provision of Scaffolds, ETC.

Scaffolds must be provided for all work which cannot be safely done from the ground or part of the building.

Ladders, properly secured, can be used - but only for light work which can be done with one hand.

9.2. Supervision of Work and Inspection of Material.

Scaffolds must be erected, altered, or dismantled only under competent supervision and, as far as possible, by experienced persons. All scaffolding materials must be inspected before use to check that they are up to standard.

9.3. Construction and Material.

Sufficient sound material must be provided for a scaffold to be strong enough and stable enough for the job.

Wherever timber is used for any kind of scaffolding purpose, it must be of the right type for the job, be free from back and must not be painted so that any defects are hidden.

Scaffold tubes and fittings must not be bent, distorted or unduly rusty.

9.4. Defective Material

- Scaffold tubes, couplers or fittings that are bent unduly rusty or distorted should be rejected.

Timber with dangerous splits and knots should always be rejected.

- Ropes and lashings showing signs of chafing through wear, or of being corroded, should be rejected.
- All scaffold components must be properly stored when not in use and kept separately from all other building materials.

9.5. Maintenance of Scaffolds.

Scaffolding must be kept in good order and every effort made to prevent the accidental displacement of any part.

9.6. Partly Erected or Dismantled Scaffolds.

In any scaffold is either partly erected (or partly dismantled), but nevertheless is still capable of being used to some extent, it must have a bold warning notice fixed, or all access blocked off or barred, at the point beyond which it cannot be safely used.

9.7. Standards or Uprights, Ledgers and Putlogs.

- Scaffold standards should be vertical and spaced closely enough for the intended use of the scaffold.
- Base plates must be used. Timber sole plates should also be used to distribute the load from the standard over a wider area, as well as to offset possible local subsidence.
- Ledgers must be level and fixed to standards with right-angle couplers.
- Putlogs and transoms must be firmly fixed to ledgers or standards.

The flattened end of the putlog must be pushed right into the wall to provide maximum support.

- Putlogs and transoms should be spaced according to the expected load and the thickness of the boards to be used in the platform.

In normal use, putlogs and transoms should be spaced so that the spans of scaffold boards should not be greater than:

- 32 mm boards : 1 m
- 38 mm boards : 1.50 m
- 50 mm boards : 4.60 m

9.8. Ladders used in Scaffolds

- Ladders used as uprights must be :
 - a) Strong enough for the load,
 - b) Equally supported on each stile, and
 - c) Secured to prevent slipping.
- Ladders are only to be used to support a scaffold platform when the work is light, e.g. painting.

9.9. Stability of Scaffolds

- All scaffolds must be :
 - a) On a solid, even base; or suspended from a sound structure.
 - b) Braced to prevent failure, and
 - c) Tied to the building or structure unless specially designed to be completely independent.
- Any building or structure which supports a scaffold must be strong enough to carry the scaffold and its load.
- Mobile scaffolds must :
 - a) Be stable, weighted at the base if necessary.
 - b) Be used only on a flat, level surface.
 - c) have the wheels locked to prevent movement whilst being used for work, and
 - d) Be pushed, or pulled only at the base when being moved.
- Scaffolds must not be built on loose bricks, drain pipes, chimney pots, etc. Bricks or blocks can be used to support a platform no higher than 600 mm from the ground or floor.

9.10. Slung Scaffolds

- a) Be strong enough,
 - b) Be properly secured to be overhead anchor-ages and to be platform frame,
 - c) Be spaced so as to keep the platform stable,
 - d) Be vertical, and
 - e) Be kept taut.
- No rope other than wire rope may be used for suspension.
 - Packing must be used to prevent damage to suspension ropes or chains at any point where sharp or rough - edged protrusions could cause chafing.
 - The platform must be secured to prevent swaying whilst in use.

9.11. Cantilever, Jib, Figure and Bracket Scaffolds.

Cantilever or jib scaffolds must be anchored to a structure which is strong enough to carry the total load. Outriggers must be long enough and strong enough and the scaffold must be braced to ensure stability.

Figure or bracket scaffolds supported by dogs or spikes must not be used if there is any danger of these pulling out of the brickwork or stone-work.

9.12. Support for Scaffolds, etc.

No part of the building may be used to support scaffolding unless it is strong enough to do so. Unless gutters have been designed as walkways and are strong enough to bear the weight, they must not be used to support scaffolding or ladders.

9.13 Suspended Scaffolds (Not Power Operated)

- The ropes, winches, blocks and tackle must be strong enough and correctly rigged. A safe anchorage for the suspension must be provided.
- Winches or similar lifting devices must :
 - a) Have brakes which apply when the operating lever is released, and
 - b) Be protected from the weather, falling dirt, etc.
- Outriggers must :
 - a) Be long enough and strong enough,
 - b) Be horizontal (light cradles are excepted),
 - c) Have stops at their outer ends (light cradles excepted)
 - d) Be tied down or properly counterweighted at the tail, and
 - e) Be close enough together to support the rails and scaffolds properly.
- Counterweights Must :
 - a) Be bolted or securely attached to the outriggers, and
 - b) Be at least three times the overturning moment or load.
- Platforms must be hung clear of the building or face of the structure.
- Runways must :
 - a) Be strong enough and in good condition,
 - b) Have stops at each, and
 - c) Be bolted or tied securely to their supports.
- Suspension ropes or chains must :
 - a) Be properly secured, both overhead and to the frame of the platform, and
 - b) Be kept taut.
- Winches must :
 - a) Have at least two full turns of rope on the drum when the platform is in its lowest position, and
 - b) Be marked with the length of rope on the drum.
- Suspended scaffolds and associated equipment must be maintained in good condition. Platforms must be prevented from tipping or swaying whilst in use.
- Steel wire rope must be used for the suspension of all platforms other than lightweight cradles.

Lightweight cradles may be suspended by fibre ropes and pulley blocks which should not be more than 3.20 m apart. (only ropes recommended by manufacturers for this purpose should be used).
- Platforms of suspended scaffold must :
 - a) Be close boarded,
 - b) Be at least 430 mm wide on lightweight cradles.
be at least 600 mm wide on all other types, if used only for workmen, or
be at least 800 mm wide, if used for workmen and materials, and
 - c) Never be used to carry another higher platform.

Platforms should be as close as possible to the face of the building, but where persons sit on the edge of the platform to carry out their work, then the distance between platform and building can be up to 300 mm.

9.14. Boatswain's Chairs Cages, Skips etc. (Not Power Operated)

- Hand-operated boatswain's chairs, skips etc. must :
 - a) Be well constructed, strong enough, and properly maintained.
 - b) have outriggers strong enough and firmly anchored,
 - c) Have chains, ropes and lifting gear firmly secured to the outriggers above and to the chair, skip etc. The construction (lifting operations) regulations apply to the lifting gear,
 - d) Be designed so that the occupant cannot fall out,
 - e) Carry no loose materials which could interfere with the safety of the occupant,
 - f) Have means of preventing spinning and tipping (a swivel connection at the suspension point is strongly advised),
 - g) In the case of skips, be at least 910 mm deep, and
 - h) Be under the supervision of a competent person during installation and use.

- A boatswain's chair may only be used as a workplace when the work would not take long enough to make the use of a suspended (or standard) scaffold reasonably practicable.

CHAPTER 10.0

10.0 HOISTS, CRANES & DERRICKS

Safety of Hoist ways. Platforms and Cages.

- Hoist ways must be enclosed wherever access is provided or wherever persons could be struck by the platform or other moving parts. Gates must be fitted in the enclosure at all landing places and must normally be at least 2m high, but gates 910 mm high are acceptable where persons are not at risk of falling down the hoist-way or coming into contact with moving parts. Gates must be kept closed except for the movement of persons and materials; it is the duty of all persons to see that this is done.
- Hoist platforms and cages must be fitted with a device capable of supporting them, fully loaded, should hoists, ropes or driving gear fail.
- Hoists must be fitted with over-run stops at the top.

Operation of Hoists.

- Hoists must only be capable of being operated from one position at a time, whether by rope, lever or switch. Hoists must not be operated from the cage.
- Where the hoist driver cannot see the platform or cage during its movement, a signalling system, which covers all landing places, must be used.

Safe working Load and Marking of Hoists.

- A) The platform of materials or goods hoists must carry a notice stating (i) the safe working load and (ii) that passengers must not ride on the platform.
- The safe working load must not be exceeded except for test purposes.
- B) Cages for passenger's hoists must carry a notice stating (i) the safe working load and (ii) the number of passengers permitted.
- No greater number of passengers may be carried and the safe working load must not be exceeded except for test purposes.

Cranes & Derricks

Manufacturer's recommendations on operating conditions shall be followed by the contractor. Rated load capacities and recommended operating speeds and special hazard warnings or instructions must be conspicuously posted on all equipment visible to the operator while he is at his control station.

A boom angle indicator and a load-indicating device in good working order must be provided for cranes and derricks. Hand signals to crane and derrick operators shall be those prescribed by the applicable ANSI standards for the type of crane in use. Accessible areas within the swing radius of the rear of the rotating superstructure of a crane must be barricaded to prevent an employee from being struck or crushed by the crane.

In operating boom equipment, careful clearance shall be given to electrical distribution and transmission lines. For lines rated 50 kV or below, minimum clearance is 10 ft, whereas for loads rated over 50 kV, minimum clearance shall be 10 ft + 0.4 in per each kV over 50 - or use twice the length of the line insulator, but never less than 10 ft.

For hammerhead tower cranes, adequate clearance must be maintained between the moving and rotating structures and fixed objects to allow the passage of employees without harm. Employees required to perform duties on the horizontal booms of hammerhead tower cranes must be protected against falling by guard rails or by safety belts and lanyards. Overhead and gantry cranes must have the rated load of the crane plainly marked on each side, and if the crane has more than one hoisting unit, each must have its rated load marked on the load block in marking clearly legible from the ground or floor. All operation must be prescribed in ANSI B30.2, "Safety code for Overhead and Gantry Cranes"

Derricks in use must meet the applicable requirements for design, construction, installation, inspection, testing, maintenance, and operation prescribed in ANSI B30.6, "Safety code for Derricks"

CHAPTER 11.0

11.0 MOTOR VEHICLES

Motor equipment left unattended at night near areas where work is in progress must have appropriate lights, reflectors, or barricades to identify the location of the equipment. A safety tire rack, cage, or equivalent protection must be used when a worker is inflating, mounting, tires installed on split rims or rims equipped with locking rings. Heavy machinery that is suspended or held aloft by the use of slings, hoists, or jacks must be blocked or cribbed to prevent falling or shifting before employees are permitted to work under them. Bulldozer and scraper blades and similar equipment shall be either fully lowered or blocked when being repaired or when not in use. All controls must be in the neutral position and the motor stopped and brakes set, unless work being performed requires otherwise. Parked equipment must be checked and parking brakes set. All cab glass shall be safety glass. All vehicles must have a service brake system, an emergency brake system, and a parking brake system. Vehicles that require additional light shall have at least two headlights, as well as brake lights.

Other standard vehicles equipment such as seat belts, rear-view mirrors, and safety latches on operating levers shall be in accordance with standard vehicle codes, and state-inspected where appropriate.

CHAPTER 12.0

12.0 BARRICADES

- i) Contractor shall erect and maintain barricades required in connection with his operation to guard or protect.
 - a) Hoisting Areas.
 - b) Areas adjudged hazardous by contractor or Client.
 - c) Owner's existing property subject to damage by Contractor's operations.
- ii) Contractor's employees and those of his subcontractors shall become acquainted with Project Managers barricading practice and shall respect the provisions thereof.

12.1. Guarding of Floor Openings and Floor Holes.

12.1.1 Every temporary floor opening shall have railings, or shall be constantly attended by someone. Every floor hole into which persons can accidentally fall shall be guarded by either:

- a) A railing with toe board on all exposed sides, or
- b) A floor hole cover of adequate strength and it should be hinged in place. When the cover is not in place, the floor hole shall be constantly attended by some one or shall be protected by a removable railing.

12.2. Every stairway floor opening shall be guarded by a railing on all exposed sides, except at entrance to stairway. Every ladder way floor opening or platform shall be guarded by a guard railing with toe board on all exposed sides (except at entrance to opening), with the passage through the railing either provided with a swinging gate or so offset that a person can not walk directly into the opening.

12.3. Guarding of Open-Side Floors and Platform.

Every open-sided floor or platform 120 cm or more above adjacent floor or ground level shall be guarded by a railing (or the equivalent) on all open sides, except where there is entrance to ramp, stair-way, or fixed ladder. The railing shall be provided with a toe board beneath the open sides wherever.

- a) Persons may pass;
- b) There is moving machinery ; or
- c) There is equipment with which falling materials could create a hazard.

CHAPTER 13.0

13.0 HANDLING & STORAGE OF MATERIALS

13.1 Paints Varnishes and Thinners.

- a) Storage and Stacking - Paints, varnishes, lacquers, thinners and other flammable materials shall be kept in properly sealed or closed containers. The containers shall be kept in a well ventilated location, free from excessive heat, smoke, sparks or flame. The floor of the paint stores shall be made up of 10 cm thick loose sand.

Paint materials in quantities other than required for daily use shall be kept stocked under regular storage place.

Where the paint is likely to deteriorate with age, the manner of storage shall facilitate removal and use of lots in the same order in which they are received.

Temporary electrical wiring / fittings shall not be installed in the paint store. When electric lights, switches or electrical equipment are necessary, they shall be of explosion proof design.

- b) Handling - Ventilation shall be adequate to prevent the accumulation of flammable vapours to hazardous levels of concentration shall be provided in all areas where painting is done.

When painting is done in confined spaces where flammable or explosive vapours may develop, any necessary heat shall be provided through duct work remote from the source of flame.

Sources of ignition, such as open flame and exposed heating elements, shall not be permitted in area or rooms where spray painting is done nor shall smoking be allowed there.

Care should be taken not to use any naked flame inside the paint store. Buckets containing sand shall be kept ready for use in case of fire. Fire extinguishers when required shall be of foam type conforming to accepted standards.

Each workman handling lead based paints shall be issued 1/2 litre milk per day for his personal consumption.

CHAPTER 14.0

14.0 HEALTH STANDARDS

14.1 DRINKING WATER

- a) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.
- b) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.
- c) Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or any other source of pollution.

14.2 WASHING FACILITIES

- a) In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.
- b) Separate and adequate cleaning facilities shall be provided for the use of male and female workers.
- c) Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

14.3 LATRINES AND URINALS

- a) Latrines shall be provided in every work place on the following scale namely:-
 - i) Where female are employed there shall be at least one latrine for every 25 females.
 - ii) Where males are employed, there shall be at least one latrine for every 25 males.

Provided that where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females as the case may be upto first 100, and one for every 50 thereafter.

- b) Every latrine shall be under cover and so partitioned off as to secure privacy and shall have proper door and fastenings.
- c) Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat-resisting non-absorbent materials and shall be cement washed inside and outside at least once a year , latrines shall not be of standard lower than borehole system.
- d)
 - i) Where workers of both sexes are employed, there shall be displayed out side each block of latrine and urinal, a notice in the language understood by the majority of the workers " For Men only " or " For Women only "
 - ii) The notice shall also bear the figure of man or woman, as the case may be.
- e) There shall be at least one urinal for male workers upto 50 and for female workers upto 50 employed at a time, provided that where the number of male or female workers, as the case may be exceeds 500 , it shall be sufficient if there is one urinal for every 50 males or females upto the first 500 and one for every 100 or part thereafter.
- f)
 - i) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.
 - ii) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of Public Health Authorities.
- g) Water shall be provided by means of tap or otherwise so as to conveniently accessible in or near the latrines and urinals.
- h) Disposal of excreta: Unless otherwise arranged by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed off by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with 15 cm layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).
- i) The contractor shall at his own expense , carry out all instructions issued to him by the Engineer-in-charge to effect proper disposal of night soil and other conservancy work in respect of the contractor's workmen or employees of the site. The contractor shall be responsible for payment of any charges which may be levied by the municipal or cantonment authority for execution of such on behalf.

14.4 PROVISION OF SHELTER DURING REST

At every place there shall be provided , free of cost , four suitable sheds , two for meals and other two for rest separately for the use of men and women labour . The height of each shelter shall not be less than 3m from the floor level to the lowest part of the shed roof. These shall be kept clean and the space provided shall be on the basis of 0.6sq.m per head.

Provided that the Engineer-in-charge may permit subject to his satisfaction , a portion of building under construction or other alternative accommodation to be used for the purpose.

14.5 CRÈCHES

- i) At every work place , at which 20 or more women workers are ordinarily employed , there shall be provided two rooms of reasonable dimensions for the use of their children under at the age of six years . One room shall be used as a play room for the children and the other as their bedroom.
- ii) The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.
- iii) The contractor shall supply adequate number of toys and games in playroom and sufficient number of cots and bedding in the bed room.
- iv) The contractor shall provide one aya to look after the children in the crèche when the number of women workers does not exceed 50 and two when the number of women workers exceeds 50.
- v) The use of the rooms earmarked as crèches shall be restricted to children, their attendants and mothers of the children.

14.6 CANTEENS

- i) In every work place where the work regarding the employment of contract labour is likely to continue for six months and where in contract labour numbering 100 or more are ordinarily employed , an adequate canteen shall be provided by the contractor for the use of such labour .
- ii) The canteen shall be maintained by the contractor in an efficient manner.
- iii) The canteen shall consist of at least a dining hall, kitchen, storeroom, pantry and washing places separately for workers and utensils.
- iv) The canteen shall be sufficiently at all times when any person has access to it.
- v) The floor shall be made of smooth and impervious materials and inside walls shall be lime washed or colour washed at least once a year .The inside walls of the kitchen shall be lime washed every four months.
- vi) The premises of the canteen shall be maintained in a clean and sanitary condition.
- vii) Suitable arrangements shall be made for the collection of disposal of garbage.
- viii) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause nuisance.
- ix) The dining hall shall accommodate at a time 30 percent of the contract labour working at a time.
- x) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one sq.m per diner to be accommodated as prescribed in sub-rule (ix).
- xi) a) 1. There shall be provided and maintained sufficient utensils crockery, furniture and any other equipment necessary for efficient running of canteen.
2. The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.
b) 1. Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.
2. A service counter, if provided, shall have top of smooth and impervious material.
3. Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipment.
- xii) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.
- xiii) Sufficient tables stools or benches shall be available for the number of diners to be accommodated as prescribed in sub rule (ix).
- xiv) The food stuff and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour .
- xv) The charges for food stuffs, beverages and other items served in the canteen shall be based on "No profit No loss" and shall be conspicuously displayed in the canteen.

- xvi) In arriving at the price of foodstuffs, and other article served in the canteen , the following items shall not be taken into consideration as expenditure namely :-
- a) The rent of land and building.
 - b) The depreciation and maintenance charges for the building and equipment provided for the canteen.
 - c) The purchase, repairs and replacement of equipment including furniture , crockery, cutlery and utensils.
 - d) The water charges and other charges incurred for lighting and ventilation.
 - e) The interest and amounts spent on the provision and maintenance of equipment provided for the canteen.
- xvii) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

14.7 ANTI-MALARIAL PRECAUTIONS

The contractor shall at his own expense, conform to all anti-malarial instructions given to him by Engineer-in-charge including the filling up of any borrow pits which may have been dug by him.

CHAPTER 15.0

15.0 RECORD OF FIRST AID TREATMENT.

Project Data:

Project:

Location:

Injured Data:

Name:

Employer:

Employer's Supervisor:

Injury Data:

Date:

Time:

Description of Injury:

First Aid Treatment:

Treatment administered by:

Type of treatment administered:

Referred for Medical Treatment:

_____No

_____Yes.

Doctor _____

Hospital _____

Report Prepared By:

Date:

Treatment Received By:

Date:

CHAPTER 16.0

16.0 DAMAGE REPORT FORM

Contract _____

Plant and equipment affected. _____

Serial numbers or identifying marks _____

Owner of plant or equipment _____

Place, date and time of incident _____

Circumstances of incident _____

Details of damage _____

Names of operators involved (if not Company employers, also give details of such contractors concerned) _____

Were normal working methods used ? _____

Contributory causes of incident _____

Names of witness _____

(attach statements) _____

Preventative action proposed or taken _____

Signature of Site Agent or Manager _____

Date _____.

CHAPTER 17.0

17.0 PERSONNEL ACCIDENT REPORT FORM.

Division / Dept (if applicable) _____

Contractor _____

Full name and address of injured person (IP) _____

Occupation of IP _____ Age of IP _____

Employed (state if self - employed or under training) _____

Trade of sub contractor (where applicable) _____

Particulars of accident:

Date and time of accident _____

Exact place where accident happened. _____

What was IP doing at time of accident? _____

Did IP cease work? _____

First air or hospital treatment. _____

Time lost (state if IP is still off work) _____

Brief description of accident, giving dimensions where applicable _____

Details of tools, equipment plant or machinery. _____

What protective clothing / equipment was being worn / used by IP? _____

Nature of injury and part of the body injured. e.g. punctured foot, hand, broken leg. _____

Contributory factors:

Unsafe system of work YES/NO _____

Lack of training, supervision etc. YES/NO _____

Environmental Conditions (wind, rain, ice, etc.) YES/NO _____

State of equipment (faulty brakes, damaged lifting gear, etc.) YES/NO _____

Housekeeping (untidy access, nails in timber. etc) YES/NO _____

Other _____

Delete as appropriate and give details.

Names and address of witness _____

If reportable:

Date and time Safety Officer informed by Telephone _____

Preventative action taken or proposed _____

Signature of Site Agent or Manager _____

Date _____

SECTION 4: FORMS OF SECURITIES

Forms of Securities

Acceptable forms of securities are annexed. Bidders should not complete the Performance and Advance Payment Security forms at this time. Only the successful Bidder will be required to provide Performance and Advance Payment Securities in accordance with one of the forms, or in a similar form acceptable to the Employer.

Annex A: Performance Bank Guarantee

Annex B: Bank Guarantee for Advance Payment

ANNEXURE –A

PERFORMANCE GUARANTEE

This Guarantee of guarantee (hereinafter referred to as “**Guarantee**”) made this date by Bank (Bank Name)....., a scheduled bank with its head office at (address)..... (hereinafter referred to as the “**Bank**”) of the first part in favour of M/s. Mahindra World City (Jaipur) Limited, a company incorporated under Companies Act, 1956 and having its office at 408, 4th Floor, Ganpati Plaza, M I Road, Jaipur -302 001 and Corporate office at 411, 507, Neelkanth Towers, BS Road, C-Scheme, Jaipur. (hereinafter referred to as “**Employer**” which expression shall, unless repugnant to the meaning and context here to, include its affiliates, successors and assigns) of the other part.

WHEREAS:

- A. M/s. Mahindra World City (Jaipur) Limited is developing a special economic zone at Jaipur called “Mahindra World City, Jaipur” (hereinafter referred to as “**SEZ**”);
- B. On the assurance of M/s -----having its office at ----- (hereinafter referred to “**Contractor**”) that they are having the necessary infrastructure and capacity to undertake construction of ----- package at the SEZ to the quality, specifications and time frame as per the terms and conditions stipulated by MWCJ, MWCJ and Contractor have entered into a contract ref: **MWCJL/IT ITES/_____** dated ____ **day** ____ **Month** ____ **Year** (hereinafter referred to as “**Contract**” which expression shall include any agreed amendments or modifications thereto) to execute the work within the SEZ in accordance with the terms and conditions of such Contract;
- C. Contractor has, by its acceptance to enter into the Contract with MWCJ has agreed to furnish a bank guarantee to MWCJ to ensure timely and satisfactory performance and completion of the work as per terms of the Contract;
- D. The Bank has, at the request of the Contractor, agreed to grant in favour of MWCJ, a guarantee to secure performance by Contractor of its obligations under the said works contract.

NOW THIS GUARANTEE WITNESSES AS FOLLOWS:

- 1. The Bank hereby unconditionally, unequivocally and irrevocably guarantee to MWCJ and agrees and undertakes that if in the sole and unfettered opinion of MWCJ, Contractor has failed to perform its obligations under the said Contract and any amendments or modifications thereto, the Bank shall upon demand of MWCJ forthwith pay to MWCJ, without demur, contestation or dispute, without reference to Contractor, the amount set forth in certificate by MWCJ as the amount of loss / claim / damage / cost / expense arising or likely to arise out of breach or non fulfilment of the said Contract. Any such certificate or demand by MWCJ on the Bank, shall be conclusive as regards the amount due and payable by the Bank to MWCJ under this Guarantee, notwithstanding any dispute between Contractor and MWCJ as to the liability for or quantum of loss / damage / claim / costs / expenses and notwithstanding any notice by Contractor to the Bank withhold or not to pay any amount to MWCJ against this Guarantee either before or after invoking of this Guarantee by MWCJ Provided always the total liability of the Bank hereunder shall be limited to Rs. (.....) (Rupees.....).
- 2. This Guarantee of the Bank shall be effective immediately from the date hereof and shall be in force for till a certificate is issued by MWCJ to the Bank in accordance with Clause 4 of this Guarantee or the claim expiry date of this guarantee whichever is earlier. If a demand is served, before the claim expiry date, this Guarantee shall continue in full force and effect (notwithstanding the validity date) in respect of the

amount so demanded until the obligation of the Bank in respect hereof is finally determined and the payment made to MWCJ.

3. The Bank agrees that MWCJ has the fullest liberty, without affecting in any manner the Bank's obligations hereunder, to vary any of the terms and conditions of the said Contract, to extend the time of performance by the Contractor from time to time and to forbear from enforcing any of the terms of the said Contract without any notice to or the consent of the Bank and the Bank shall not be released from its liability under this Guarantee by reason of any such variation or extension or forbearance being granted to Contractor. The Bank agrees that MWCJ has no obligation whatsoever to exercise its rights against collateral, if any, of Contractor but may immediately call on this Guarantee.
4. This Guarantee herein contained shall remain in valid and effect till MWCJ certify that the terms and conditions of the said Contract have been fully and properly carried out and that the Contractor has fulfilled all its obligations under the Contract and that MWCJ has no claim against the Contractor on any account against the said Contract or the expiry date whichever is earlier.
5. Only neglect or forbearance, on the part of MWCJ, in the enforcement of the payment of any money, the payment whereof is intended to be hereby secured or the giving of the time for the payment hereto shall in no way relieve the Bank of their liability under this Guarantee.
6. The Bank shall not revoke this Guarantee during its currency except with the previous consent in writing of MWCJ.
7. Any notice or communication under this Guarantee shall be in writing and shall be served on the Bank at its address first hereinbefore mentioned and to MWCJ at its address first hereinbefore mentioned. Either party may notify to the other in writing any change in such address for service of notice upon it. The notices shall be served personally against acknowledgement or by Registered Post
8. This Guarantee shall not be affected by any change in the constitution of the Bank or of Contractor or of MWCJ.
9. This Guarantee shall be governed by the applicable laws of India.
10. The expression "The Bank" and the Contractor hereinbefore used shall include their respective successors and permitted assigns.

Notwithstanding anything contained herein above in the Bank Guarantee.

- 1- Our liability under this Bank Guarantee shall not exceed Rs. _____/-
- 2- This Bank Guarantee shall be valid up to _____
- 3- We shall be liable to pay any amount under this Bank Guarantee or part thereof only if we received (if your serve upon us) a written claim or demand under this Guarantee up to _____ at _____ Bank Ltd., _____(Address)

ANNEXURE –XXXX

DRAFT FOR ADVANCE BANK GUARANTEE

Bank Guarantee Bond (RE : Mobilization Advance)

This Bond (hereinafter referred to as “**Guarantee**”) made this (date)..... by Bank (Bank Name)....., a scheduled bank with its head office at (address)..... (hereinafter referred to as the “**Guarantor**”) of the first part in favour of M/s. Mahindra World City (Jaipur) Limited, a company incorporated under Companies Act, 1956 and having its office at 408, 4th Floor, Ganpati Plaza, M I Road, Jaipur -302 001 and Corporate office at 411, 507, Neelkanth Towers, 1, Bhawani Singh Marg, C-Scheme, Jaipur. (hereinafter referred to as “**Employer**” which expression shall, unless repugnant to the meaning and context here to, include its affiliates, successors and assigns) of the other part.

WHEREAS:

- A. M/s. Mahindra World City (Jaipur) Limited is developing a special economic zone at Jaipur called “Mahindra World City, Jaipur” (hereinafter referred to as “**SEZ**”);
- B. On the assurance of M/s -----having its registered office at ----- (hereinafter referred to “**Contractor**”) that they are having the necessary infrastructure and capacity to undertake construction of ----- package at the SEZ to the quality, specifications and time frame as per the terms and conditions stipulated by EMPLOYER, EMPLOYER and Contractor have entered into a contract Ref. No. _____ dated _____ (hereinafter referred to as “**Contract**” which expression shall include any agreed amendments or modifications thereto) to execute the work _____ (work specification) within the SEZ in accordance with the terms and conditions of such Contract;
- C. And whereas Employer has agreed to pay the said Contractor a sum of Rs. _____ (Rupees _____) as Mobilisation Advance as per terms and conditions of the above said Contract, that the said Contractor shall submit in favour of your company and an unconditional and irrevocable Bank Guarantee for an equal amount valid till completion period i.e _____ .(Date)
- D. The said Contractor has agreed to refund to the Company the balance unrecovered sum in the event of the said Contract Agreement being terminated or coming to as end for whatsoever reason,
- E. We the Guarantor, at the request of the Contractor, agreed to Guarantee in favour of EMPLOYER, a guarantee to advance payment made by EMPLOYER to the Contractor.

NOW THIS GUARANTEE WITNESSES AS FOLLOWS:

1. The Bank hereby unconditionally, unequivocally and irrevocably guarantee to EMPLOYER and agrees and undertakes that if in the sole and unfettered opinion of EMPLOYER, Contractor has failed to pay the amount equivalent to Rs. -----given as advance by EMPLOYER to the Contractor (hereinafter referred to as “**Advance**”)with in the time stipulated in the Contract, the Bank shall upon demand of EMPLOYER forthwith pay to EMPLOYER, without demur, contestation or dispute, without reference to Contractor, amount equivalent to Advance. Any such certificate or demand by EMPLOYER on the Bank, shall be conclusive as regards the amount due and payable by the Bank to EMPLOYER under this Guarantee, notwithstanding any dispute between Contractor and EMPLOYER as to the liability for or quantum of loss / damage / claim / costs / expenses and notwithstanding any notice by Contractor

to the Bank withhold or not to pay any amount to EMPLOYER against this Guarantee either before or after invoking of this Guarantee by EMPLOYER Provided always the total liability of the Bank hereunder shall be limited to Rs. (.....) (Rupees.....).

2. This Guarantee of the Bank shall be effective immediately from the date hereof and shall be in force for till a certificate is issued by EMPLOYER to the Bank in accordance with Clause 5 of this Guarantee unless a claim or demand in writing is served upon the Bank by EMPLOYER. If a demand is so served, this Guarantee shall continue in full force and effect (notwithstanding the expiration date) in respect of the amount so demanded until the obligation of the Bank in respect hereof is finally determined and the payment made to EMPLOYER.
3. The Bank agrees that EMPLOYER has the fullest liberty, without affecting in any manner the Bank's obligations hereunder, to vary any of the terms and conditions of the said Contract, to extend the time of performance by the Contractor from time to time and to forbear from enforcing any of the terms of the said Contract without any notice to or the consent of the Bank and the Bank shall not be released from its liability under this Guarantee by reason of any such variation or extension or forbearance being granted to Contractor. The Bank agrees that EMPLOYER has no obligation whatsoever to exercise its rights against collateral, if any, of Contractor but may immediately call on this Guarantee.
4. The Bank agrees that EMPLOYER has the fullest liberty, without affecting in any manner the Bank's obligation hereunder, to assign this guarantee in favour of any EMPLOYER affiliate company in India without the consent of but with prior intimation to, the Bank, and the Bank shall not be released from its liability under this Guarantee by reason of any such assignment. The Bank shall forthwith, on receipt of such intimation; undertake necessary endorsements or amendments hereto to incorporate the assignment in favour of such EMPLOYER affiliate assignee.
5. This Guarantee herein contained shall remain in force and effect till EMPLOYER certify that the Contractor has dully paid the Advance back to EMPLOYER. The Bank shall be released of its liabilities and obligations under this Guarantee only after such a certificate as aforesaid is issued by EMPLOYER to the Bank.
 - i) The Bank shall not revoke this Guarantee during its currency except with the previous consent in writing of EMPLOYER.
 - ii) Only neglect or forbearance, on the part of EMPLOYER, in the enforcement of the payment of any money, the payment whereof is intended to be hereby secured or the giving of the time for the payment hereto shall in no way relieve the Bank of their liability under this Guarantee.
6. Any notice or communication under this Guarantee shall be in writing and shall be served on the Bank at its address first hereinbefore mentioned and to EMPLOYER at its address first hereinbefore mentioned. Either party may notify to the other in writing any change in such address for service of notice upon it. The notices shall be served personally against acknowledgement or by Registered Post / Fax / Telex.
7. The Bank hereby agrees that their liability hereunder shall not be discharged or released or altered or impaired in any manner by ay change in the constitution structure or our Bank or by merger or amalgamation by our Bank with any other Bank, Company, Corporation or Body.
8. The Bank hereby agrees that their liability hereunder shall not be discharged or released or altered or impaired in any manner by ay change in the constitution structure or powers of the said, Contractor or of the Employer.

9. This Guarantee shall be governed by the applicable laws of India.
10. The expression "The Bank" and the Contractor hereinbefore used shall include their respective successors and permitted assigns.

Notwithstanding anything contained herein

We the Bank _____ (Name) _____ (Address) _____ hereby irrevocably and unconditionally undertake to pay your company, by Banker's Cheque / Demand Draft favouring **Mahindra World City (Jaipur) Ltd., payable at Jaipur** on First Demand without protest or demur or proof or condition any and all amount demanded by your Company in writing, with reference to the guarantee and that the liability of the _____ (Bank Name), under this guarantee is restricted to Rs. _____ (amount in figures) _____ (Amount in words). Our guarantee shall remain in force until _____ (date) Unless a claim in writing is presented to us during the validity period of this Guarantee and / or during a further grace period of _____ (extended period) thereafter upon expiry of the said validity,

11. IN WITNESS WHEREOF..... FOR AND ON BEHALF OF THE BANK HAS SIGNED THIS GUARANTEE ON THE DAY AND THE YEAR FIRST ABOVE WRITTEN.

12. ()

13. WITNESSES :

1-

2-

**SECTION 5:
SPECIAL CONDITIONS, TECHNICAL SPECIFICATIONS,
LIST OF APPROVED MAKES & BILL OF QUANTITIES**

MAHINDRA WORLD CITY, JAIPUR

TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS

INTRODUCTORY NOTE

MAHINDRA TECH PARKS at MAHINDRA WORLD CITY - Jaipur is an under construction complex of ten number multi-storey buildings totalling over 16,00,000 sq.ft of floor area designed by the well known architects Rajinder Kumar Associates.

Entire complex shall be airconditioned by a centralised chilled water station of about 8500ton of airconditioning.

First phase comprises airconditioning of two buildings A2 &B1 which shall need two chillers of 600 TR each with a standby of similar size.

Scheme envisages two primary circuits, two secondary circuits of chilled water with tertiary pumps dedicated for individual building.

MAHINDRA WORLD CITY, JAIPUR

TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS

GENERAL OBLIGATIONS

1. The contractor shall set out the work and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions and alignment of all parts thereof. If at any time any error shall appear during the progress of the work the contractor at his own expense rectify such error if so required to the satisfaction of the Architect.
2. The contractor shall give all necessary personal superintendence during the execution of works, and so long thereafter as the Architect may consider necessary until the plant is commissioned. The contractor shall also during the whole time the works are in progress employ a competent representative and qualified engineers who shall be constantly in attendance at the building site while the men are at work. Any directions, explanations, instructions or notices given by the Architect to any representative shall be held to be given to the contractor.
3. The contractor shall on the request of the Architect immediately dismiss from the works any person employed thereon by him who, in the opinion of the Architect may not be allowed to rejoin the work without the permission of the Architect.
4. The contractor shall keep the owner indemnified against any risk, injury etc. to his staff & workers, permanent or temporary. He will also carry out the job with complete and total consideration of safety to every body.
5. Where the contractor is a partnership firm, prior approval in writing of the OWNER shall be obtained before any change is made in the constitution of the firm.
6. The contractor shall have to prepare detailed shop drawings, co-ordinated Bar schedule and obtain necessary approval from the Architect.
7. The rates quoted by the contractor shall include provision of scaffolding, hoist, tackles, shuttering material and all other materials required for the proper execution of the work. He shall also provide without extra charges all labour, material and equipment required by the Architect for testing and measuring the work.
8. The contractor shall carry-out work in accordance with applicable by-laws and obtain at his cost certificates pertaining to their adherence to such laws/by-laws.

MAHINDRA WORLD CITY, JAIPUR

TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS

SPECIAL CONDITIONS OF CONTRACT

1. After completion of installation the contractor shall satisfy the buyer/architect regarding the capability of the plant to maintain specified inside conditions during summer and monsoon. For this purpose two tests each of 48 hours duration shall be conducted and all relevant parameters recorded to compute the capacity and capability of the plant and individual equipment. Necessary instruments, duly calibrated, required for this purpose shall be provided by the contractor. In case any test fails the same shall be conducted during next season. Installation shall be considered complete in all respects only when all the tests have been carried out satisfactorily.
2. Before the above tests are carried out, a balancing report on Fluid Flows shall be submitted for Air flow from each fan, in each main and branch duct, and each outlet shall be carried out with telescopic probe and adjusted to match the design data.

Water flow from each pump and each inlet/outlet shall be carried out and adjusted to match the design data.
3. The contractor shall make his own heat-load calculations and satisfy himself regarding the capacity and selection of equipment.

B A S I S O F D E S I G N

MAHINDRA WORLD CITY, JAIPUR

TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS

BASIS OF DESIGN

1. SYSTEM DESIGN DATA

Design Data for Jaipur

i. Out Door Design Data

a. Summer:

Dry Bulb - 110 F (43.3 C)
Wet Bulb - 75 F (23.9 C)

b. Monsoon :

Dry Bulb - 95 F (35 C)
Wet Bulb - 78 F (25.6 C)

ii. Inside conditions:

Summer & Monsoon

Dry Bulb - 73 F +/- 2F (23 C +/- 1C), RH not exceeding 55%

Winter heating has been excluded from the scope of central air-conditioning.

Provision for future shall be limited to enhanced power supply for electric heat.

Fresh Air 20 cfm per person

Occupancy 10 sq.m per person

Lights 10 watts per sq.m

Office equipment load 40 watts per sq. m

2. VENTILATION

Basements shall have a normal ventilation of 10 air changes per hour, enhanced to 30 air changes per hour for smoke exhaust in case of emergency.

Toilets shall have an air change / hour of 10 drawing most of it from air-conditioned space.

3. DESIGN PARAMETERS

Performance rating of the centrifugal water chilling machine shall be based on the following design parameters :

Temperature of chilled water entering chiller : 54 F
Temperature of chilled water leaving chiller : 44 F
Fouling factor for chiller : 0.0005 sq.ft. F,Btu.
Temperature of condensing Water entering condenser : 88 F with cooling towers

Temperature of condensing water leaving condenser : 98 F with cooling towers
 Fouling factor for condenser : 0.001 Sq.ft.F, Btu
 Refrigerant : HFC / R134a
 Maximum power input of chiller at full load (water cooled chillers) : 0.7 kW / TR

Piping shall be sized for the following Design parameters;

Maximum flow velocity = 6 FT/Sec.
 = 1.83 Mtrs/Sec
 Maximum Friction = 5 FT water column per 100 Ft run
 Pipe header - Maximum velocity = 3.5 FT/Sec.
 = 1.1 M/Sec.

Design parameters for selection of Air handling unit and its components shall be :

Maximum face velocity across coils = 550 FT/Min.
 Maximum fan outlet velocity = 1850 FT/Min.
 = 564 M/Min.
 Maximum fans speed = 750 RPM
 Maximum fan motor speed = 1500 RPM
 Maximum fins/inch of cooling coil = 12
 Water in temp; for cooling coil = 45F (7 C)
 Water out temp; from cooling coil = 54F (12.2 C)
 Noise Level : All refrigeration and air-conditioning equipment and materials, (like motors, compressors, pumps etc.) shall be selected designed and installed for quiet operation.
 Noise level of double skin airhandling units shall not exceed 45 db outside the AHU room.
 Noise level of pump-motor unit shall not exceed 55 db at 5ft away from each unit.

4. INSULATION

Exposed roof shall be insulated with 50mm thick polystyrene or equivalent.

5. HEAT LOADS

Calculated loads in TR for summer and monsoon are given below

AHU	CFM	TR(S)	TR(M)	Motor	Line size	QTY
BLOCK B1						
GROUND FLOOR						
G1&G2 (Horizontal Floor ounted)	22000	42	43	15	80	2
ATRIUM (Horizontal Floor mounted)	7500	20	20	5	40	1
FIRST FLOOR						
F1&F2 (Horizontal Floor mounted)	17000	35	38	12.5	80	2

AHU	CFM	TR(S)	TR(M)	Motor	Line size	QTY
PASSAGE (Horizontal Floor mounted)	3000	7.5	7.5	3	40	1
SECOND FLOOR						
S1&S2 (Horizontal Floor mounted)	17000	35	38	12.5	80	2
PASSAGE (Horizontal Floor mounted)	3000	7.5	7.5	3	40	1
THIRD FLOOR						
T1&T2 (Horizontal Floor mounted)	17000	35	38	12.5	80	2
PASSAGE (Horizontal Floor mounted)	3000	7.5	7.5	3	40	1
FOURTH FLOOR						
F1&F2 (Horizontal Floor mounted)	20000	41	44	15	80	2
PASSAGE (Horizontal Floor mounted)	3000	7.5	7.5	3	40	1
BLOCK A2						
GROUND FLOOR						
G1 (Horizontal Floor mounted)	24700	53	52	20	80	1
G2 (Horizontal Floor mounted)	16350	36	35	12.5	80	1
G3 (Horizontal Floor mounted)	11200	25	25	7.5	50	1
PASSAGE (Horizontal Ceiling susp)	2000	5	5	2	32	1
FIRST FLOOR						1
F1 (Horizontal Floor mounted)	18850	43	47	12.5	80	1
F2 (Horizontal Floor mounted)	14000	35	37	10	80	1
F3 (Horizontal Floor mounted)	7500	16	18	5	65	1
ATRIUM(Horizontal Floor mounted)	12000	24	20	10	80	1
SECOND FLOOR						
S1 (Horizontal Floor mounted)	18850	48	52	12.5	80	1
S2 (Horizontal Floor mounted)	14000	35	37	10	80	1
S3 (Horizontal Floor mounted)	13300	29	33	10	80	1
PASSAGE (Horizontal Ceiling susp)	2000	5	5	2	32	1
THIRD FLOOR						
Th1 (Horizontal Floor mounted)	20900	52	54	15	80	1
Th2 (Horizontal Floor mounted)	16000	39	42	10	80	1
Th3 (Horizontal Floor mounted)	15300	38	38	10	80	1
PASSAGE (Horizontal Ceiling susp)	2000	5	5	2	32	1

It is proposed to instal Two chillers of 600 TR each and one of same capacity as standby.

6. PERFORMANCE TEST

The bidder /contractor shall carry out his own heat load calculations and satisfy himself as regards its sufficiency and shall satisfy the purchaser about its satisfactory performance, according to the given parameters, on completion of installation.

Tests shall be conducted for summer & monsoon.

7. WORKING DRAWINGS :

Successful bidder shall prepare working drawings keeping in view various parameters of heat generating source, movement of paper through the printing machine and effect of movement of air at high velocity over the same.

S P E C I F I C A T I O N S

MAHINDRA WORLD CITY, JAIPUR

TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS

TECHNICAL SPECIFICATIONS

PUMPS

1. SCOPE

The scope will include supply, installation testing & commissioning of water pumps as per following specifications and requirements of the Bill of quantities.

2. TYPE & CONSTRUCTION

The centrifugal pumps, with rising characteristics shall be capable of developing the required total head for capacity indicated in the bill of quantities. They will perform without undue noise and vibration.

Construction of the pump will be as described hereafter.

<u>S.No</u>	<u>Description</u>	<u>Material/Type</u>
1.	Pump	End suction Split Casing (as per BOQ.)
2.	Casing	Cast iron Gr.FG 200 or IS:200
3.	Impeller	Bronze
4.	Shaft	High tensile steel with protective sleeve of Chrome Steel AISI-410 or Bronze
5.	Bearings	Heavy duty ball bearings
6.	Base plate	Cast iron/M.S.
7.	Seals	Mechanical
8.	Maximum speed	1450 rpm
9.	Drive	TEFC, IP-55 Encl, Squirrel cage Induction type suitable for 400 +/- 10%, 3phase, 50 cycles A.C. supply of high efficiency corresponding to eff-1 rating

3. ACCESSORIES & FIXTURES

The following accessories and fixtures shall also form a part of each pump.

- a) Air Vent cock
- b) Lubrication fixtures
- c) Suction & delivery pressure gauges of 100mm dial with gauge cocks.
- d) Drain nipple.

4. PERFORMANCE RATING

Performance characteristics/ratings and power consumption showing the operating points shall be submitted. The same will be verified at the time of testing & commissioning.
Pump efficiency shall be atleast 80%.

5. PAINTING

The entire assembly of pump-motor-baseplate will be given two coats of paints of proper colour and shall have an identification mark.

TECHNICAL SPECIFICATIONS

VARIABLE FREQUENCY DRIVE AND LOGIC CONTROLLER

Scope shall include

- A. Furnish and install as Powersaver Variable Speed Pumping System.
- B. The control system shall include as, a minimum, the programmable logic pump controller, adjustable frequency drive(s) and remote sensor/transmitters. Provide additional items as specified or as required to properly execute the sequence of operation.
- C. Pump logic controller, adjustable frequency drives, sensor/transmitters and related equipment shall be installed by the contractor as per BOQ.
- D. Line voltage power wiring shall be supplied with the pumping package.
- E. Low voltage (24 VDC and 115 VAC) wiring shall be installed by the contractor as per wiring diagrams supplied with the pumping package

COMPONENTS

Pump Logic Controller (secondary circuit)

1. The Technologic pump logic controller assembly shall be listed by and bear the label of Underwriter's Laboratory, Inc. (UL) and Canadian Underwriter's Laboratory (CUL). The controller shall be specifically designed for variable speed pumping applications and shall be combination of Pump Logic Controller & Variable frequency drive in a single enclosure.
2. The controller shall function to proven programs that safeguard against damaging hydraulic conditions including:
 - Pump flow surges
 - Hunting
 - End of curve
3. The pump logic controller shall be capable of receiving up to two discrete analog inputs from zone sensor/transmitter as indicated on the plans. It will then select the analogue signal that has deviated the greatest amount from its setpoint. This selected signal will be used as the command feedback input for a hydraulic stabilization function to minimize hunting. Each input signal shall be capable of maintaining a different set point value. Controller shall be capable of controlling up to three pumps in parallel.
4. The pump logic controller shall be capable of accepting an additional analog input for a flow sensor. This input shall serve as the criteria for the end of curve protection algorithm.
5. The hydraulic stabilization program shall utilize a proportional-integral-derivative control function. The proportional, integral and derivative values shall be user adjustable over an infinite range.
6. The pump logic controller shall be self prompting. All messages shall be displayed in plain English. The operator interface shall have the following features:
 - a) Multi-fault memory and recall last 10 faults and related operational data.
 - b) Red fault light, yellow warning light, and Green power on light
 - c) Soft-touch membrane keypad switches.
7. The display shall have four lines, with 20 characters on three lines and eight large characters on one line. Actual pump information shall be displayed indicating pump status.

8 A. The following communication features shall be provided to the BAS:

- a) Remote system start / stop non-powered digital input.
- b) Failure of any system component. Output closes to indicate alarm condition.
- c) One 4-20 mA output with selectable output of:
 1. Frequency.
 2. Process variable
 3. Output current
 4. Output Power

8.B. The following communication features shall be provided to the Building automation System via an RS-485 port utilizing open protocol for communication.

1. Individual Analog Input.
2. Individual Zone Set points
3. Individual Pump/AFD on/off status
4. System percent speed
5. System Start/stop command
6. System operation mode
7. Individual KW signals
8. System flow, when optional flow sensor is provided.

CONTROLLER FOR TERTIARY BRIDGE

Each independent zone shall be furnished with tertiary bridge Control System to thermally and hydraulically decouple the zone. The system shall monitor and control chilled water supply to the zone to assure maximum allowable temperature rise and minimum flow demand on the chiller plant. It shall allocate chilled water resources on a predetermined and preprogrammed basis.

Each system shall consist of a microprocessor-based controller housed in a enclosure suitable for wall mounting. The operator interface panel or MMI shall provide authorized personnel access to the program including set points and operational mode.

The operator interface panel/MMI shall incorporate a LCD display capable of being read in ambient light. The controller shall be equipped with its own internal power supply capable of powering the microprocessor and all sensors and the control valve (installed in tertiary bridge return) positioning. Readouts shall include but not be limited to the following:

- Chilled water supply temperature (if required) – Actual & Set point
- Zone supply temperature – Actual & Set point
- Bridge return temperature – Actual & Set point

All set points shall be independently set via authorized access through the operator interface and shall be in English text. The operating program within the controller shall automatically respond to changes in load and variations from set point temperatures to provide the lowest possible demand on the secondary distribution pumping systems.

Temperature sensors shall send a 4-20 mA signal proportional to the temperature sensed. The transmitter shall be field adjusted.

The unit shall be capable of hardwire communications of vital data to the BAS system.

The system shall include an electrically actuated control valve to be located in the tertiary bridge return water line (to be supplied by others). The control valve shall be rated for industrial duty. The valve actuator shall be 230VAC/115VAC/24VAC and the valve position shall respond to a 4-20mA-control signal from the controller.

The supplier shall take unit responsibility that all system components work together as a unit.

Power & control wiring, as required, shall be the responsibility of the contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal and local codes.

Adjustable Frequency Drive

1. The adjustable frequency drive(s) shall be pulse width modulation (PWM) type, microprocessor controlled design. It should be able to adjust torque/voltage v/s frequency graph.
2. The AFD, including all factory installed options, be tested to UL Standard 508. The AFD shall also meet C-UL and be CE marked and built to ISO 9001 standards.
3. The VFD shall be housed in a NEMA 1 enclosure. AFD's with plastic enclosures shall not be acceptable.
4. The VFD shall employ an advanced sine wave approximation and voltage vector control to allow operation at rated motor shaft output speed with no derating. This voltage vector control shall minimize harmonics to the motor to increase motor efficiency and life. Power factor shall be near unity regardless of speed or load.
5. The VFD shall have balanced DC link reactors to minimize power line harmonics. VFD's without a DC link reactor shall provide a 3% impedance line reactor.
6. Automatic motor adaptation (AMA) algorithm shall be utilized. This feature shall allow for automatically optimized drive performance and efficiency leading to additional energy savings
7. Input and output power circuit switching can be done without interlocks or damage to the VFD.
8. The following customer modifiable adjustments shall be provided:
 - a. Acceleration time
 - b. Deceleration time
 - c. Minimum frequency
 - d. Maximum frequency
9. RS-485 communication for open protocol.
10. An automatic energy optimization selection feature shall be provided. This feature shall reduce voltages when lightly loaded and provide a 3% to 10% additional energy savings.
11. The AFD shall be suitable for elevations to 3300 feet above sea level without derating. Maximum operating ambient temperature shall not be less than 104 degrees F. AFD shall be suitable for operation in environments up to 95% non-condensing humidity.
12. The AFD shall be capable of displaying the following information in plain English via a 40 character alphanumeric display:
 - a. Frequency
 - b. Voltage
 - c. Current
 - d. Kilowatts per hour
 - e. Fault identification
 - f. Percent torque
 - g. Percent power
 - h. RPM
13. All AFD's shall be warranted for a period of 18 months after shipment. This warranty shall cover parts and labor.

Sensor / Transmitter

Provide field mounted differential pressure sensor transmitter(s) as indicated on the plans. Unit shall transmit an isolated 4-20mA dc signal indicative of process variable to the pump logic controller via standard two wire 24 DC system. Unit shall have stainless steel wetted parts with two 0.25" male NPT process connections. It shall be protected against radio frequency interference and shall have a watertight, NEMA 4 electrical enclosure capable of withstanding 2000 PSI static pressure with a 0.5" NPT conduit connection. Accuracy shall be within 0.25% of full span.

Sequence of Operation

1. The system shall consist of a Technologic pump logic controller, multiple pump/AFD sets, with manual and automatic alternation and pump staging [wherever applicable].
2. The pumping system shall start upon the closure of customer's contact when the pump logic controller Mode of Operation selector switch is in the REMOTE position.
3. When the pump logic controller selector switch is in the LOCAL position, and start command on Tech 500 is given via operator interface, the pumping system shall operate automatically.
4. Sensor/transmitters shall be provided as indicated on the plans.
5. Each sensor/transmitter shall send a 4-20mA signal to the pump logic controller, indicative of process variable condition.
6. The pump logic controller shall compare each signal to the independent, engineer/user determined set points.
7. When all set points are satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level.
8. The pump logic controller shall continuously scan and compare each process variable to its individual set point and control to the least satisfied zone.
9. If the set point cannot be satisfied by the designated lead pump, the pump logic controller shall initiate a timed sequence of operation to stage a lag pump [wherever applicable].
10. The lag pump shall accelerate resulting in the lead pump(s) decelerating until they equalize in speed [wherever applicable].
11. Further change in process variable shall cause the pumps to change speed together [wherever applicable].
12. When the set point criteria can be safely satisfied with fewer pumps, the Technologic pump logic controller shall initiate a timed destages sequence and continue variable speed operation [wherever applicable].
13. As the worst case zone deviates from set point, the pump logic controller shall send the appropriate analog signal to the AFD to speed up or slow down the pump/motor.
14. In the event of a AFD fault, the pump logic controller automatically initiates a times sequence of events to start the redundant pump/AFD set in the variable speed mode. The redundant variable speed system shall be started through the pump logic controller.
15. Upon AFD fault(s), the pump controller shall display an alarm condition through a plain English message.
16. AFD fault indication shall be continuously displayed on the operator interface of the pump until the fault has been corrected and the controller has been manually reset.

17. In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. Alternative zone sensor/transmitters, if available, shall remain in the scan/compare program for control.
18. Upon sensor failure a plain English warning message shall be displayed on the operator interface of the pump logic controller.
19. In the event of failure to receive all zone process variable signals, a user selectable number of AFDs shall maintain a user adjustable speed; reset shall be automatic upon correction of the zone failure.

TECHNICAL SPECIFICATIONS

COOLING TOWERS

1. SCOPE

The scope of this section covers the supply, installation, commissioning and testing of cooling towers according to the drawings and Bill of quantities.

2. TYPE & CONSTRUCTION :

2.1 Fiber reinforced plastic cooling towers of induced draft type will be of approved make.

2.2 Water Distribution System :

Warm water will flow into a chamber at the top of the cooling tower. A splash box will provide uniform water distribution and keep the incoming water from spilling out of the basin. Water will then flow by gravity from the fiberglass basin through nozzles to the fill. The distribution basin will be in a single piece eliminating leaks between adjoining panels. Water flow will be uniform throughout the fill by means of suitable nozzles.

2.3 Fill/Louvres/Drift Eliminators.

Fill sheets will include both louvers and drift eliminators so as to ensure proper heat transfer as also prevent water from escaping. The eliminators will be designed to ensure a minimal drift loss.

The PVC fill sheets shall be able to withstand hot water temperature as high as 55 Deg. C, without any deformation or deterioration, and their shape will be designed for smooth airflow.

2.4 Cold Water Basin :

Cold water basin shall be of single piece fiberglass reinforced on which cooling tower superstructure will be supported. Suction tank with easily removable double brass strainers shall be provided. It will be complete with drain connection, overflow, bleed off, make up & quick fill connections.

2.5 Mechanical Equipment :

The cooling tower shall have fibreglass/Aluminium blades on propeller fans and shall be driven through V-belts. The fan & fan pulley will be mounted on an oil lubricated bearing housing with stainless steel shaft. An oil reservoir cup with spring loaded cap will be mounted on the front of the tower to supply oil to the bearing housing. Steel components on the tower such as mechanical equipment support will be hot dip galvanised.

3. PERFORMANCE DATA :

Performance ratings at varying loads and outdoor wet-bulb temperatures shall be submitted with the tender. The same will be verified at the time of testing & commissioning of the installation.

TECHNICAL SPECIFICATIONS

AIR HANDLING UNITS - DOUBLE SKIN

1.1 SCOPE

The scope of this section, comprises the supply, erection, testing and commissioning of Double skin construction air handling units, factory assembled and tested, conforming to these specifications and in accordance with requirements of Drawings & of the Bill of Quantities.

1.2 GENERAL

The air handling units shall be complete in all respects and shall generally comply with the specifications as given in the following paragraphs.

2.0 AIR HANDLING UNITS

2.1 The air handling units shall be double skin sectional, draw through type with thermal break profile and shall include pre filter section, filter section, mixing chamber, fan and coil section.

2.2 Fan and Accessories

The fan shall be forward curved, double inlet double width type. The wheel & housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported on angle iron heavy duty ball bearing. The fan shall be selected for a speed not exceeding 1800 RPM. The impeller & fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not exceed 1800 FPM. Fan housing with motor shall be mounted on a common extruded aluminum base mounted inside the fan section on anti-vibration springs mounts or cushy foot mount. The fan outlet shall be connected to casing with the fire retardant double canvass. The fan shall be complete with multi 'V' belt drive and adjustable motor mounting base. The opening for the access of the fan section shall be provided with micro-switch and galvanized iron mesh.

2.3 Cooling/Heating coil

The cooling/heating coil shall be of seamless copper tubes, not less than 0.5 mm thick and 12 mm O.D.. The bends shall be ready made with solder rings on both ends. The coil shall have continuous aluminium dual sine wave fins. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of air flow. The fins shall be uniformly bonded to the tubes by mechanical expansion of the tubes. The coils shall be tested against leaks at a hydraulic pressure of 10 kg/ cm². This pressure shall be maintained for a period of 2 hours. No drop should be observed indicating any leaks. The water headers shall be of copper pipes, to connect all the tubes. The headers shall be complete with water In/Out connections, vent plug on top and drain at the bottom, and designed to provide water velocity between 0.6 to 1.8 m/s (2 to 6 FPS). The coil size shall be designed at an operating air velocity of 500 FPM (2.5 M/S).

2.4 Filtration

Each AHU shall have one or two types of filters and conforming to the specifications given under :

2.4.1 Pre-filters of 80% efficiency by weight with aluminum frame and synthetic media.

2.4.2 High Efficiency filters of 90% efficiency down to 10 micron particle size (wherever specified in "Schedule of Prices").

2.5 Drain pan

The drain pan shall be sandwiched type with SS sheet, welded joints and drains connection of suitable size complete with puf injection tray. The drain pan shall be min. 25 mm deep. Drain outlet shall be of S.S.

2.6 Coil and filter housing

The cooling coils, special and standard filters, etc., shall all be housed in a separate enclosure of suitable size and length. The inspection doors shall have neoprene rubber T-section, rubber seals, hinges and locking arrangements. The gaps between filter frames and housing shall have synthetic rubber packing, to eliminate any air leakage. All filter frames shall be epoxy painted. The flat filter section shall be suitable for mounting filters vertically.

2.7 AHU Enclosure/Housing

2.7.1 The AHU enclosure shall be double skin design with the main frame work made of extruded aluminum structural section. For external AHU, the frame shall be of thermal break profile.

2.7.2 The panels shall be double sandwich type with 0.60 MM precoated galvanized sheet on the outside and 0.60 MM galvanized sheet on the inside. The insulation shall be 25 MM thick (for indoor AHU)/43 MM thick (for outdoor AHU) injected with polyurethane foam.

2.7.3 Each section shall be provided with separate access panel of suitable size. The access panel shall be hinged type with heavy duty hinges and handles made of nylon. The handles shall be self tightening type to ensure leak proof closing.

2.7.4 The opening for access doors and gaps between sections shall be provided with the neoprene rubber T-gaskets fixed in grooves in the extruded sections.

2.7.5 The sandwich panels shall be fixed to the frame work with self and tapping stainless screws and both ends of the screw shall be provided with rubber caps.

2.8 Fan motor & starter

2.8.1 The fan shall be provided with a totally enclosed fan cooled squirrel cage motor which shall have a minimum rating as given under "Schedule of Equipment". The starter rating shall match the motor rating and will conform to specifications under "motor and switch gears.

2.8.2 The fan motors may be of 2 speed, where specifically mentioned in the "Schedule of Prices"

3.0 ACCESSORIES

3.1 Each air handling unit shall be complete with the following accessories :

3.1.1 Stem type thermometers at coil inlet and outlet, with tubing and gauge cocks. (Priced Separately)

3.1.2 Pressure gauge with cock at inlet and outlet of the coil, with tubing and gauge cocks. (Priced Separately)

3.1.3 Butterfly valves at inlet of the coil and dynamic balancing valve at outlet of coil. (Priced Separately)

3.1.4 Drain line from the unit upto floor trap. (Priced Separately)

3.1.5 Automatic air Vent Valves on pipes. (Priced Separately)

3.1.6 Fire retardant Flexible connection between the fan outlet and duct. (Priced Separately)

3.1.7 Vibration isolators of 90% efficiency between AHU and foundation.

4.0 TESTING

The air handling unit shall be tested to measure air quantity and coil performance by measuring temperature difference, water pressure drop across coil and then calculating the capacity.

5.0 LIMITATIONS

- 5.1 The air velocity across the cooling coil shall not exceed 550 FPM (2.79 m per sec.).
- 5.2 The fan outlet velocity shall not exceed 1850 FPM.
- 5.3 The air velocity across the filters shall not exceed 550 FPM.

TECHNICAL SPECIFICATIONS

AIR HANDLING UNITS (DOUBLE SKIN) (CEILING SUSPENDED TYPE)

1. GENERAL:

The air handling units shall be of as per drawing and complete in all respects and shall generally comply with the specifications as given in the following paragraphs.

2. AIR HANDLING UNITS

2.1 The air handling units shall be double skin Sectional/Unitary, draw through type and shall include pre-filter section, fan section, coil section, mixing box wherever required.

2.2 Fan section

The fan shall be forward curved, double inlet double width type. The wheel & housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid carbon steel shaft supported to housing with angle iron frame & pillow block heavy duty ball. The fan shall be selected for a speed not exceeding 1000 RPM. The impeller & fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not be more than 2000 FPM. Fan housing with motor shall be mounted on a common aluminum base mounted inside the air handling housing on and vibration springs mounts or cushy foot mount. The fan outlet shall be connected to casing with the help of fire retardant flexible canvass. The Fan shall be complete with multi 'V' belt drive and adjustable motor mounting base. Inspection door shall be installed with micro switch arrangement with lighting within the fan section. Micro switch shall be interlocked with blower & light with resetting arrangement.

2.3 Cooling coil

2.3.1 The cooling coil shall be of seamless copper tubes, not less than 0.5 MM thick and 12 MM O.D. the coil shall have continuous aluminum fins. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of air flow. The fins shall be uniformly bonded to the tubes by mechanical expansion of the tubes. The coils shall be tested against leaks at a hydraulic pressure of 10 KG/SQ.CM. This pressure shall be maintained for a period of 2 hours. No drop should be observed indicating any leaks. The water headers shall be of copper pipes with M.S. pipe connection, to connect all the tubes. The headers shall be complete with water in/out connections, vent plug on top and drain at the bottom.

2.3.2 The water circulating shall be designed to maintain water velocity in the tube between 0.9 to 1.8 m/s (3 to 6 FPS).

2.4 Filter

Each AHU shall have pre-filter of 90% down to 10 micron efficiency by weight and have synthetic media and aluminum frame as per section - 7.

2.5 Drain pan

2.5.1 The drain pan shall be sandwiched type with S.S. sheets on top and GI sheet on the bottom complete with PUF injected tray.

2.5.2 The drain pan shall be a minimum of 25 mm deep. Drain outlet shall be of S.S. and of 25 mm dia.

2.6 Coil and filter housing

The cooling coils, special and standard filters, etc., shall all be housed in a separate enclosure of suitable size and length. The inspection doors shall have double synthetic rubber seals doors and locking arrangements. The gaps between filter frames and housing shall have synthetic rubber packing,

to eliminate any air leakage. All filter frames shall be epoxy painted. The flat filter section shall be suitable for mounting filters vertically.

2.7 AHU Enclosure/Housing

- 2.7.1 The AHU enclosure shall be double skin design with the main frame work made of extruded aluminum structural section.
- 2.7.2 The panels shall be double sandwich type with 0.60 MM pre-coated galvanized sheet on the outside and 0.60 MM galvanized sheet on the inside. The insulation shall be 25 MM thick foam injected polyurethane foam.
- 2.7.3 The front panels shall be easily open able for servicing the fan and coil sections. It should provide easy access to remove air filters for cleaning.
- 2.7.4 The opening for access doors and gaps between sections shall be provided with the neoprene rubber T-gaskets fixed in grooves in the extruded sections.
- 2.7.5 The sandwich panels shall be fixed to the frame work with self tapping stainless steel screws and both ends of the screw shall be provided with rubber caps.
- 2.7.6 The access door to fan section is to be provided with a switch to shut the fan when the door is open.

2.8. Insulation

- 2.8.1 The panels of Double Skin AHU'S shall be sandwiched with 25 mm thick polyurethane foam insulation of 40 KG/CUB.MT. density having a K value of 0.014 Kcal/Mhr °C.

2.9 Fan Motor & Starter

- 2.9.1 The totally enclosed fan cooled squirrel cage fan motor shall have a minimum rating as given under "Schedule of Equipment". The starter rating shall match the motor rating and will conform to specifications under "Control Panel Motor and Switchgears".

2.10 Controls

Each air handling unit shall be provided with 2-way modulating cum balancing valve as part of this tender. Temperature sensor and air flow switches shall be provided separately as part of BMS tender.

3. ACCESSORIES

- 3.1 Each air handling unit shall be complete with the following accessories :
 - 3.1.1 Stem type thermometers at coil inlet and outlet, with tubing and gauge cocks. (Priced Separately)
 - 3.1.2 Pressure gauge with cock at inlet and outlet of the coil, with tubing and gauge cocks. (Priced Separately)
 - 3.1.3 Butterfly valves at inlet of the coil and dynamic balancing valve at outlet of coil. (Priced Separately)
 - 3.1.4 Drain line from the unit upto floor trap. (Priced Separately)
 - 3.1.5 Automatic air Vent Valves on pipes.
 - 3.1.6 Fire retardant Flexible connection between the fan outlet and duct. (Priced Separately)
 - 3.1.7 Vibration isolators of 90% efficiency between AHU and foundation.

4. TESTING

The air handling unit shall be tested to measure air quantity and coil performance by measuring temperature difference, water flow rate using balancing valve and then calculating the capacity.

5. LIMITATIONS

- 5.1 The air velocity across the cooling coil shall not exceed 550 F.P.M. The fan outlet velocity shall not exceed 1850 FPM,
- 5.2 The air velocity across the filters shall not exceed 550 FPM

TECHNICAL SPECIFICATIONS

AIR DISTRIBUTION

1. SCOPE

The scope of this section will cover supply fabrication, installation and testing of all sheet metal ducts and diffusers and balancing thereof in accordance with these specifications, general arrangement shown on the Drawings and Bill of quantities.

2. MACHINE MADE RECTANGULAR DUCTS

All ductwork including straight sections, tapers, elbows, branches, shores, collars, terminal boxes and other transformation pieces(except pieces to suit may be made at site) must be factory fabricated within the following parameters :

Raw Material

1. Coil stock required to minimize longitudinal joints.
2. Material should be of the minimum gauge necessary to resist both deflection caused by internal pressure* and vibration due to turbulent air flow
3. GI material in particular must be of Lock Forming Quality (LFQ) conforming to the standards of ASTM A653 and A924 or conform to grade D of IS 1079:1988 or IS 513:1986 as specified in IS 277:1992.
4. Zinc coating may be of class VIII.

Longitudinal Joints (Seams)

1. Longitudinal joints shall be restricted to two diagonally opposite edges.
2. These should be machine-formed of any of the following types :
 - a) Pittsburgh lock type
 - b) Button Punch Snap lock type (duct size and gauge limitations as per SMACNA)
3. Joints and seams should be able to withstand 1.5 time maximum operating pressure without deformation or failure.

Transverse Joints

1. Transverse joint must be able to withstand 1.5 times maximum operating pressure without deformation or failure
2. Where a transverse joint acts as a reinforcing member its maximum allowable deflection will be 0.25" (6.25mm) for ducts upto 48" (1220 mm) width (W), and (W/200) for greater widths.
3. For the spacing for transverse joints and type of reinforcement refer 'SMACNA' tables for rectangular ducting covering pressure class from 2" (125 Pa) W.G. to 10" (2500Pa) W.G.
4. For duct sizes below 750 mm, Slip joints (S or standing S cleats) or alternating Slip and Drive ('C' cleats) may be used. Under no circumstances should Drive ('C') cleats be used on all four of the duct sides. All such joints to be spot sealed to avoid visible gaps at the cleat interfaces.
5. Where angle iron flanges are used :

The metal duct shall be lapped by a minimum of 6 mm across the flanges
All flanges shall be applied with 2 coats of zinc-chromate, silver or zinc painted (Red oxide is prohibited)

- Rubber or neoprene gaskets 4 mm thick shall be used between duct flanges in all duct installation
- Flanges to be welded electrically and all holes to be drilled (drill hole spacing as per SMACNA)

Crossbrekaing or Beading

1. Beading is preferred to crossbreaking. Duct Sizes of 19” (500 mm) wide and larger which have more than 10 sq.ft. of unbraced panel shall be beaded or cross broken. This requirement is applicable to 20 g (1.00 mm) or less and 3” W.G. (750 Pa) pressure or less. Ducts for 4” W.G. (1000 Pa) or more do not require beads or cross-breaks.

Sealing Ducts

1. Leakage norms as per SMACNA. Heavy mastic sealants are more suitable as fillets in grooves of longitudinal seams. Mastics having excellent adhesion and elasticity are preferred.

Support Systems

To conform with SMACNA. All support material to be galvanized.

1. Duct sizes refer to the clear space for airflow where internal insulation is used.

Fabrication Equipment and Processes

All cutting, folding, notching, beading, shearing operations must be done by machines (CAD/CAM equipment preferred) for accuracy of parts and speed of fabrication.

Gauges of rectangular ducts shall be as given below. (use of 26 gauge not permitted)

RECTANGULAR DUCT

Size of Duct	Sheet Thickness	Fastner Size	Type of Joints		Bracing with GI tie rods of following sizes	Support Angle
			For Rolastar duct & Rolamate flanges	For Techno Fabriduct and Zeco flanges		
Upto 750 mm	0.63 mm	3/8”	Fabricated out of G.I. sheet of 24 gauge at every 1.2 m interval C&S cleat.	The flanges shall be made out of the same duct sheet and all the four corner shall be fitted for fitting the bolt	Cross tie rods to be fitted with 10mm dia. Threaded GI rod for each piece of duct	25x25x3 mm with 10mm GI rod
751 mm to 1000 mm	0.80 mm	3/8”	E-24 type flange, shall be fabricated out of 24 G sheet at every 1.2 m interval.			25x25x3 mm with 10mm GI rod
1001 mm to 1500 mm	0.80 mm	5/8”	E-22 type flange, shall be fabricated out of 22 G sheet at every 1.2 m interval.			40x40x5 mm with 10mm GI rod

1501 mm to 2250 mm	1.00 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m interval.			40x40x6 mm with 10mm GI rod
2251 mm and above	1.25 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m interval.		Cross tie rods to be fitted with 10mm dia. Threaded GI rod for each piece of duct	50x50x6 mm with GI rods of 12 mm dia.

All fasteners Shall be cadmium coated.

Exposed ducts, where required shall be painted with two coats of enamel paint of approved colour. Ducts and accessories within ceiling spaces, visible from air - conditioned areas shall be provided with two coats of mat black finish paint.

Ducts shall be fabricated as per details shown on Drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees or angles of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

Ducting over furred ceiling shall be supported from the slab above, or from beam, after obtaining approval of the supervisor. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time so as not to cause delay to other contractors.

Rat proofing consisting of 16 gauge galvanised weld mesh, with about 4 mesh per inch, shall be provided in supply air ducts at AHU/Fan outlets, in return air openings of AHU room wall, and above return air slits in conditioned spaces.

Where metal ducts or sleeves terminate in wood work, tight joints shall be made by means of closely fitting heavy flanged collars. Where ducts pass through brick or masonry openings Wooden frame work shall be provided within the openings and crossing ducts provided with heavy flanged collars on each side of wooden frame work, so that duct crossing is made leakproof.

All ducts shall be totally free from vibration under all conditions of operation. Wherever duct is connected to fans, air handling units or fan coil units that may cause vibration in the ducts, ducts shall be provided with double flexible connections, located close to the unit. Flexible connections shall be constructed of fire resistant flexible double canvas sleeve at least 10 cm. long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connections shall be suitable for pressures at the point of installation.

All ducts shall be installed generally as per the drawing and in strict accordance with approved shop drawings to be prepared by the contractor. Wherever duct is supported from R.C.C. slabs, suitable size metallic dash-fasteners will be employed. Proper size holes will be drilled in slabs by means of hammer drill. All vertical duct work shall be supported by structural members at each floor.

Dampers

All dampers shall be of robust construction and tightly fitting. The design, method of handling, and control shall be suitable for the location and service required.

Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation. Control or setting devices shall be made robust, easily operable and accessible through

suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times.

Dampers shall be placed in ducts and at every branch supply or return air duct connection, whether or not indicated on the drawings, for the proper volume control and balancing of the system.

The entire air distribution system shall be balanced. Measured air quantities at fan discharge and at various outlets shall be identical to or less than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be made by volume or splitter after air balancing is complete so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted to the supervisor for scrutiny and approval, provided with completion documents.

Before painting the interiors of conditioned spaces, air distribution system shall be allowed to run continuously for 48 hours for driving away any dust or foreign material lodged within ducts, during installation.

Smoke and Fire Dampers - Spring Return :

All supply and return air ducts in air handling unit rooms and at all floor crossings shall be provided with approved fire dampers of at least 1 1/2 hour fire rating certified by CBRI Roorkee as per UL 555:1973.

Fire damper blades and outer frame shall be formed of 1.6mm galvanised sheet steel. The damper blade shall be pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals shall be provided on top and bottom of the damper housing made of 16G galvanised sheet steel. For preventing smoke leakage side seals will be provided.

In normal position damper blade shall be held in open position with the help of a 24V operated electric actuator thereby providing maximum air passage without creating any noise or chatter.

The damper shall be actuated through electric actuator. The actuator shall be energised with the help of a signal from smoke detector installed in AHU Room /RA Duct/ Damper.

Each damper in case of motorised Smoke-cum-Fire damper shall have its own panel which will incorporate necessary circuit required to step down voltage available from UPS or Emergency Power Supply to shown status of the damper (open or close), to allow remote testing of damper and indication in event of damper closure due to signal from smoke sensor/ Temp. sensor and reset button. Additional terminal shall be provided to have signal (sound beep or visual) in central control room. Damper actuator shall be spring return so as to close the damper in event of power failure automatically and open the same when power is restored.

Supply and Return Air Grilles

Supply and return grilles shall be of powder coated extruded aluminium construction.

Supply grilles shall be provided with screw operated opposed blade volume control device of extruded aluminium in mill finish.

All grilles shall have soft, continuous rubber gasket between the periphery of the grilles and the surface on which it has to be mounted.

Supply and Return Air Diffusers:

Supply and return air diffusers shall be as shown on the drawings and will be of powder coated extruded aluminium. The terminals shall have anti-smudge ring and spring loaded removable central core. The terminal shall be mounted by concealed screw fixing arrangement.

TECHNICAL SPECIFICATIONS

PIPING:

1. SCOPE

The extent and scope of this section covers supply and erection of piping for chilled water circulation & drain. The scheme of piping is shown on the drawings. The pipe size shown in drawings depict only general layout and arrangements and are not intended for use as working drawings. The successful tenderer on award of work, shall prepare detailed working drawings and obtain the approval of the Consultant/Engineer-in-charge before executing the piping work.

2. CHILLED WATER PIPING:

All pipes & fittings shall be brand new and shall be of approved make. The material and type of piping shall be as given here under. The fittings shall be ISI approved.

Pipe Size	Class of Material	Joints & Fittings
Upto 150 mm	As per IS-1239 ERW. M.S., Heavy	Weldable fittings, slip on flanges
200 mm and above	As per IS: 3589 ERW, M.S. Heavy	Weldable fittings slip on flanges

All fittings for piping with welded joints shall be of weldable quality. The fittings shall have the same pressure rating as that of piping. Welding shall be done by certified welders and will conform to IS code for manual arc welding of mild steel IS:10234.

Butt weld preparation shall strictly adhere to the above said code.

Butterfly valves shall be used for isolating equipment such as chillers, pumps strainers etc.

Non return valves shall be provided on delivery side of pump sets.

- 3 All Butterfly Valves' shall be in C.I. body conforming to IS:780. They shall be complete with flow control lever upto size 150mm and worm gear lever control for higher sizes. **Gauge nipples shall be provided on either side of butterfly valves. Valves shall be of PN16 ratings and with SS stems. Butterfly valves 450mm dia and above shall be double flanged.**

Gun metal gate & globe valves can be used in place of butterfly valves for sizes upto 32 mm.

Each strainer shall be provided with removable cover and brass screen. The screen shall be of brass sheet, having perforations, to provide a minimum net free area of 4 times cross section area of piping connected to the strainer. Strainers shall be provided with threaded sockets or flanges depending upon the pipe size. Strainers shall be provided on suction of each pump.

4. COLD WATER & DRAIN PIPING :

All pipes to be used for cold water, drain & condensate drain shall be ERW, galvanised, Medium (Class-B) with screwed fittings. Sufficient number of flanges & unions shall be provided for servicing.

Condensate drain pipes will be insulated as per section "Insulation" and Bill of Quantities.

5. INSTALLATION :

Piping shall be installed only after thorough cleaning and painting with one primer coat of red oxide paint. Pipes shall be cut square and will be free from burrs. Piping shall be suspended from stands, clamps, hangers as specified and required. The pipe supports or hangers shall be designed to withstand combined weight of pipe, pipe fittings, fluid in pipe and insulation. Pipe supports shall be of steel and coated with rust preventing paint and finished with two coats of black enamel paint. Wherever called for "Vibration Isolation" hangers with spring cushion shall be installed close to the sources of

vibration. The supports designed to minimise vibrations shall be heavy enough to damp out vibrations and shall have relatively wide bearing surface to avoid swivel action. The following spacing are recommended for pipe supports.

Pipe (mm)	Spacing
Upto 25	2.0 to 2.2 metre
32 to 65	2.4 to 2.7 metre
75 to 125	2.7 to 3.0 metre
150 & above	3.0 to 3.6 metre

Pipe supports shall be spaced at a maximum interval of 1.5 mtrs. at heavy fittings and valves. Wherever piping passes through walls, pipe sleeves of diameter 50 mm larger than that of piping shall be provided which will be measured & paid at pipe rates. Pipe sleeves shall be of steel or cast iron pipe. Sleeves shall not be installed in structural members except where indicated, or approved. Where pipes pass through fire walls/fire partition, a seal of asbestos rope, mineral wool or any other non-combustible material shall be used for packing the sleeve. Where off-sets have to be laid 45 degree elbows shall be preferably used. Wherever 'Tees' are installed, they should be installed such that "Bull-Heading" is prevented. Wherever required equal/reducing Tee's will be used. Cutting & tapping of main pipe will not be resorted to. Wherever tees cannot be provided a shoe connection in the direction of flow will be adopted. Vertical pipe risers shall be installed straight and true to plumb.

All connections to and from the water headers shall be through shoe connections in the direction of flow of water.

Reducers wherever used in horizontal runs of piping shall be eccentric type, to provide for free drainage wherever required. In other locations, concentric reducers may be used.

All gaskets between flanges shall be of India rubber or neoprene.

Air valve shall be provided at the summit of piping system for air venting.

Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation. 14 gauge metal sheet sleeve shall be provided between the insulation and the clamp, saddle or roller, extending at least 15 cm. on both sides of the clamp, saddle or roller so as to permit expansion.

All piping work shall be carried out in a workman like manner, causing minimum disturbances to the existing services, buildings, roads structures etc. The entire piping work shall be organised, in consultation with the Architect so that laying of pipe supports and pipes and testing shall be carried out in one stretch. Cut-outs in the floor slabs for installing the various pipes are indicated in the Drawings, contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the Drawings do not meet with the requirements.

The contractor shall make sure that sufficient number of clamps, anchors, etc. are provided for pipe supports. Piping layout shall take due care for expansion and contraction in pipes. Flexible connections in two perpendicular directions shall be provided at each pump suction and discharge as shown on Drawings and/or as required.

All pipes shall be accurately cut to the required sizes in accordance with IS : 554 1964 and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter.

Flanged inspection pieces 1.5 meters long, with bolted flanges on both ends, shall be provided at no more than 30 meters centres, to facilitate future cleaning of all welded pipes. Flanges, wherever required shall be used and shall conform to IS 6392, Table 5 or 9.

Insulation shall be applied as per the section "Insulation", wrapped with GI wire and covered with polyethylene sheet. Two coats of cement plaster shall be applied over chicken wire mesh.

Pressure Gauges with Cocks & Sockets

Pressure gauges shall be provided at the following locations.

- a. Supply and return of condensers.
- b. All pumps-suction and discharge.

Besides sufficient number of plugged sockets will be provided at intervals to locate conveniently obstructions if any. These sockets shall be suitable for gauge connections and shall be provided with gauge valves.

6. THERMOMETERS :

Direct reading 225mm long industrial thermometers having reading mercury shall be provided at the inlet and outlet of all heat exchangers to read water entering and leaving temperature. The thermometers shall be installed in separate wells. Thermometer shall be of appropriate range and shall be calibrated before installation.

7. TESTING

Piping shall be cleaned thoroughly, to remove the rust and greasing effect, if any.

Piping shall be tested to hydrostatic test pressure at least 2.5 times the maximum working pressure for a period of 24 hours. However, minimum test pressure shall be 10 kg/sq. cm. The defects in joints and leaks observed during the test shall be rectified to the entire satisfaction of the Consultant/Engineer-in-charge and piping shall again be subjected to pressure test as stated above. No insulation shall be carried out till the satisfactory completion of pressure testing. The contractor shall furnish all the necessary equipment, tools, instruments and labour to perform the test, to de-water and clean the space.

8. BALANCING :

After the completion of installation and testing of piping, all the piping shall be adjusted and balanced to deliver the water quantities as specified / as required/as directed. Three way modulating valves shall be set for full flow conditions during balancing. After balancing position of various balancing valves shall be fixed, identified & recorded.

The instruments/equipment required for adjusting and balancing water system shall be accurately calibrated before taking any measurement.

9. PAINTING :

After successful completion of installation & testing all exposed piping shall be given two coats of approved synthetic enamel paint as per the colour coding requirement conforming to IS : 2379.

10. TWO / THREE WAY VALVE

The 2/3 way mixing/diverting valves for AHUs shall be of C.I. constructions suitable for operation up to 16 bar. The water flow through the valve shall be regulated by the rotation of brass slipper between the main and the by pass ports. It shall be possible to rotate the brass slipper, manually, through 360° and interchange the main and the common ports, to facilitate installation at site. All internals of the valves shall be rust-proof and the 'O' rings shall be of EPDM/NITRILE.

The valve actuator shall be electronic type with brushless DC motor. The actuator's angle of rotation shall be 90°

A Test Point shall be installed at the inlet and outlet of each pump, balancing valve and heat exchange equipment like Chiller, Condenser, Cooling Tower, Water Cooling Coil, Boiler. Test Points shall also be provided at different locations in the water pipe line to facilitate pressure measurement.

Test Point shall be of brass construction, 1/4" BSP with NEOPRENE sealing bushes and shall be provided with screwed cover.

TECHNICAL SPECIFICATIONS

CONTROLS VALVE AND ACCESSORIES

1. TEMPERATURE GAUGE (THERMOMETER)

Shall be stem type with centigrade & Fahrenheit scales Temperature gauge shall be of the separate able socket type and shall have extended brass stem, where required, for insulated pipes. Temperature gauge shall be installed at water supply and return at air handling units, chillers & condensers as shown on the Drawings. Range of scales shall be 30-120 °F (0-50 °C) for air conditioning applications.

2. PRESSURE GAUGES

Shall be installed on suction and discharge of pumps, supply & return at air handling units, inlet and outlet at chillers, and condensers and cooling towers and included in Schedules of Quantities. Suction side gauges at pumps shall be compound gauges with 100mm dia of the range 0-75 cm (0-30 inches) mercury vacuum and 0-4 kg. Per sq.cm (0-60 ps) pressure discharge side gauges at pumps and at all other locations shall be 100 mm dia. Of the range 0.5 kg. Per sq.cm. (0-60 psi) pressure, gauges shall be connected to the pipes by GI nipple, elbow, ball valve etc. as required for gauge protection during testing. Range of scale shall be (0-200 psi). Gauges shall be connected to the pipes by GI nipple, ball valve, elbow etc.

3. FLOW SWITCHES

Sockets or necessary arrangements to be made by HVAC Contractor for bellow type flow switches shall be provided in condensing water outlet and chilled water outlet at the water chilling machines, and at the water cooled condensing units for refrigeration load. The flow switch shall prevent the compressor from starting unless the water flow is established in condensing water lines, and chilled water flow is established chilled water lines.

4. EXPANSION TANK

The outer skin of the tank shall be insulated with 25 mm thick self adhesive Trocellene make foam insulation with aluminium foil on one side.

The inner skin of the tank shall be white.

TECHNICAL SPECIFICATIONS

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. The detailed specifications of the materials are listed under respective sub heads.

- | | | | |
|-----|-------------------------------|---|---------------------------------------|
| 2.1 | Chilled Water Pipe Insulation | : | Expanded Polystyrene. |
| 2.2 | Duct Insulation | : | Closed cell nitrile insulation |
| 2.3 | Acoustic Insulation | : | Resin Bonded Fibre glass in roll form |
| 2.4 | Equipment Insulation | : | Expanded Polystyrene. |

3. CHILLED WATER PIPE INSULATION (TYPE-I)(PLANT ROOM PIPING)

3.1.1 The PUF insulation for chilled water piping, pump, expansion tank etc. shall be carried out from rigid Expanded Polystyrene foam having a 'K' value of 0.018 W/mK. at mean temperature of 10°C and a density of 18- 20 kg/cubm.

3.1.2 The thickness of the insulation for chilled water pipes shall be 50 MM upto 200 mm dia. And shall be 75 mm for pipes above 250 mm dia and above.

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

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

3.2 Duct Insulation

3.2.1 The materials for duct insulation shall be sheets of closed cell nitrile/elastomeric insulation. The density of insulation shall not be less than 50 kg/cubm and material shall be in the form of sheets of uniform thickness. The 'K' value at 20°C. shall not be less than 0.037 W/mK.

3.2.2 The thickness of duct insulation shall be as follows :

- | | | |
|----|-----------------------------|---------------|
| a. | Duct in conditioned space | - 13 mm thick |
| b. | Duct in unconditioned space | - 25 mm thick |

3.3 Acoustic Treatment

3.3.1 The material for acoustic treatment of ducts, 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 boards of uniform density. The 'k' value at 10°C shall not be less than 0.03 W/mK. 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.

TECHNICAL SPECIFICATIONS

ELECTRICAL WORK

1. CONTROL PANEL, MOTORS AND SWITCHGEARS

General :- The motor and switch gears required for various items shall generally be as per specifications given below. All electric motors shall be suitable for 3 phase, 50 Hz, 415 + 10% - 15% Volts A.C. supply.

2. L.T. ELECTRIC PANEL BOARDS

- 2.1 The Main L.T. Panel board shall be extendible type on both sides, having in it all switches, starters & accessories and shall be completely factory pre-wired. It shall be suitable for voltage systems up to 500 volts, 3 phase, 50 Hz, 4 wire supply capable of functioning satisfactorily in temperatures of 45⁰C and rupturing capacity not below 31 MVA at 415 Volts.
- 2.2 The boards shall be fabricated from 2.0 mm thick, cold rolled M.S. Sheets. The front opening door panels shall be from 2 mm thick, cold rolled M.S. Sheets. Suitable stiffeners shall be used in fabricating the housing. All steel members shall first be degreased, then descaled using dilute sulphuric acid and a suitable phosphating process then the boards shall be given powder coated finish in siemens grey colour. The switch board shall be dust proof and vermin proof. The panel shall generally conform to IS 8623 (full conformity not called for). It shall be flush in front and back. The panel shall have front and rear access.
- 2.3 Cable compartment of adequate size shall be provided in the main distribution board for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in cable compartment to support cables. All in-coming and outgoing switch terminals shall be brought out to terminal blocks in cable compartments.
- 2.4 Items such as ammeters, switches etc. shall be located close to the corresponding switchgear and otherwise all items shall be arranged in a neat symmetrical pattern.
- 2.5 The doors of the switch compartments and cable access shall be hinged type and that of bus-bars shall be fixed type.
- 2.6 The panel mounted lock shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.
- 2.7 All panel doors shall have synthetic rubber gaskets with good ageing, compression and resistance characteristics.
- 2.8 All the breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in OFF position.
- 2.9 Defeat arrangement shall be provided for deliberate inspection of switch/ breaker without having to switch OFF the unit.
- 2.10 All the units pertaining to a motor shall be incorporated in one cabin i. e switch, starter, CTS ammeter, current operated MPRD-2 single phasing preventor, indicating lamps etc.
- 2.11 A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enameled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.
- 2.12 Every starter/contactors etc. shall be controlled by an isolating device of adequate rating as listed later.
- 2.13 A voltmeter and ammeter shall be provided to indicate incoming voltage and along with rotary phase selection switches.

- 2.14 Ammeters shall be provided for incoming current to all motors of 10 HP (7.5 KW) and higher ratings.
- 2.14.1 Ammeters for all the motors up to 50 HP (37.5 KW) shall be direct reading type.
- 2.14.2 Ammeters for motors of 50 HP (37.5 KW) and above shall be operated with a selector switch.
- 2.15 LED type indicating lamps in approved colours shall be provided for the 3 phases and for status of all controlled devices.
- 2.16 All the switchgear shall be earthed to the earth bus.
- 2.17 Earth shall be extended for each compartment to the door by means if a flexible, insulated copper conductor with crimped legs on either side.
- 2.17.1 Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.
- 2.17.2 Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.
- 2.18 Etched plastic name plates shall be provided for all the incoming, outgoing switchgears, ammeter, voltmeter etc.
- 2.19 All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code.
- 2.20 The power wiring from the circuit/air breakers to the starters shall be carried out using colour coded, PVC insulated copper conductors crimped with lugs.
- 2.21 The out going wires of starters shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.

Important Note

All Panel fabrication drawings shall be got approved, before the start of the fabrication work.

3. BUS BARS

- 3.1 The Bus Bar shall be mounted in a separate compartment in the Panel Board.
- 3.2 The Bus Bars and interconnections shall be of aluminium strips unless otherwise specified.
- 3.3 The Bus Bar shall have rectangular cross - section of (1) mm² per Amp. rating for full load current in the 3 phases as well as for neutral and should be extendable, if mounted horizontally.
- 3.4 The Bus Bars shall be insulated with heat shrink sleeves and colour coated. They should be supported on supports made of glass fibre reinforced thermosetting compound at regular intervals sufficient to withstand the force of any short circuit.

4. CIRCUIT BREAKERS

The panel and the bus bars plus outgoing of all devices shall be protected by different types of circuit breakers as described below and conforming to specification as given later on:

S.No.	Type	Upto 40 Amp.	63 A	80 to 200 A	Above 200 to 400 A	Above 630 A
1.	Incoming	MCB	MCCB	MCCB	MCCB	ACB
2.	Outgoing	MCB	MCB	MCCB	MCCB	ACB

4.1 Air Circuit Breaker (ACB)

- 4.1.1 The air Circuit Breakers shall be Draw out type conforming to I.S: 13947 (Part 2) 1993.
- 4.1.2 The ACB shall be complete with solid state overload, short circuit and earth fault protection with adjustable settings.
- 4.1.3 Each ACB shall have 4 'NO' and 4 'NC' potential free auxiliary contacts, in addition to those required for its internal operating mechanisms.
- 4.1.4 There shall be suitable indicators for OPEN/CLOSE/SERVICE/TEST and Spring charged positions.
- 4.1.5 It shall be possible to close the door in Test position.
- 4.1.6 Castle Key and/or other interlocking devices shall be provided as required.

4.2 Moulded Case Circuit Breakers (MCCB)

- 4.2.1 The MCCB shall have TP + NL and be suitable for simultaneous manual opening and closing with rotary operating handle.
- 4.2.2 The ON/OFF/TRIP positions shall be clearly marked and easily visible to an operator and confirm to latest IS: 13947-1993.
- 4.2.3 There shall be fixed/adjustable tripping devices with inverse time characteristics for overload and short circuit protection.
- 4.2.4 Suitable Interlocking mechanism shall be provided, where required.
- 4.2.5 All MCCB shall have phase barrier & extension terminals as required.

4.3 Miniature Circuit Breakers (MCB)

- 4.3.1 The MCB shall have quick make/break contacts with a heat resistant housing, having high Impact strength and confirm to IS 8828-1996.
- 4.3.2 The contacts shall be of silver nickel alloy.
- 4.3.3 The MCB shall permit over load for short duration, as required for Inductive loads and the breaking capacity shall not be less than 10 KA at 415 Volt A.C.
- 4.3.4 It shall be equipped with overload and short circuit protection devices and shall be suitable for DIN mounting.

4.4 Isolator Switches

- 4.4.1 Isolator switches are to be provided for equipment located outdoors or for those located in separate enclosure, other than those Nos. having the Electric Panel.
- 4.4.2 The Isolator Switch should be of Rotary Load Break type with a weather proof sheet steel enclosure. Its rating shall be same as the outgoing device in the Electric Panel.

5. CONTACTORS

All non inductive loads shall be provided with suitable sized magnetic contactors.

- 5.1 The contactors shall have 3/4 poles plus a minimum 2 'NO' and 2 'NC' contacts. All contacts shall be of solid silver.

- 5.2 The No volt coil shall generally be suitable for 220 Volts + 10%, - 15% (wide band type) A.C. supply except when specified or required otherwise.

6. STARTERS

- 6.1 The type of starters to be provided for the motors shall be as follows :

6.1.1 Squirrel Cage motors : up to 7.5 HP (5.6 KW) Direct on Line Type

6.1.2 Squirrel Cage motors : Above 7.5 HP (5.6 KW) Automatic Star Delta Type

- 6.1.3 All starters shall have auxiliary contacts for interlocking different machines, connecting indicating lights, controls, alarms, etc.

- 6.1.4 All starters shall be provided with separate single phasing preventors.

- 7.1 Subsidiary panels shall be provided for equipment located away from the plant room, such as air handling units, blower etc.

- 7.2 The construction of these panel should be similar to the main panel and shall have all related accessories, except when specified.

- 7.3 The sub panel shall be wall hung type and as compact as possible.

- 7.4 Panel fabrication drawings shall be got approved before fabrication.

8. SQUIRREL CAGE MOTORS

- 8.1 The squirrel cage motors shall be either screen protected or totally enclosed fan cooled, depending on the application and as stated in "schedule of equipment". All motors shall conform to IS 325/1978, IS : 1231 for foot mounted motors and IS:2223 for flange mounted motors.

- 8.2 The stator windings shall be with class 'B' insulation.

- 8.3 Motors shall be provided with ball/ roller bearings. Bearings shall have ample capacity to deal with any axial thrust. Suitable grease nipple shall be provided for re-greasing the bearings.

- 8.4 Motors shall be provided with a cable box for terminating the PVC insulated, PVC sheathed armoured aluminium cables.

TECHNICAL SPECIFICATIONS

FANS

1. GENERAL INSTRUCTIONS

Supply, testing & commissioning of JetVent System for underground parking.

2. JETVENT FAN UNIT

2.1 Composed

The fan should be furnished as factory assembled. Having characteristic as high performance of ventilation with small air volume. Each unit shall consist of inlet bell mouth with protective screen, silencer both inlet and outlet discharge nozzle, terminal box and mounting arm.

2.2 Fan

High efficiency Aerofoil section blade shall have smoothed hub and clam- plate for adjustable pitch angle flexibility. The impellers shall be of precision die-cast to offer thin Aerofoil sections for low generation of noise levels.

Aerofoil Fan impellers shall have a aerodynamic section blade to optimise the efficiency of performance and minimise the generation of noise. The thin sections shall be obtained by precision die cast.

Precision die cast Aluminium hub and clamp-plate shall be equally spaced, fully adjustable, high pressure die cast Aerofoil section blades.

All rotating Aluminium components shall be X-ray examined prior to machining to assure quality and suitable for operation at 300 Deg C for two hour.

3. CASINGS

Either a long cased form complete with an externally mounted pre-wired electrical terminal box, or short cased for duct or plate installation.

Casings shall be spun from sheet steel with integral pre-drilled flanges, fully welded seams and hot-dipped galvanised after manufacture for excellent durability.

4. MOTORS :

4.1 Squirrel cage type, insulated to class H with Class F temperature rise, bearings lubricated with wide temperature grease, keyed shaft. The motors shall have Class C3 fit bearings, lubricated with wide temperature range grease. **To comply with BS5000 Pt 99 and IEC 34-a, Weatherproof to IP55.** (Overheat protection shall be provided on single-phase motors).

4.2 Speed operation by Delta/Star reconnection shall be available on three phase motor up-to frame size F22. Two speeds can be obtained by reconnecting a single winding via six winding terminals to give two separate pole numbers Integral pre-wired capacitor on most single phase fans.

4.3 Terminal Box

The wire to the motor shall be enclosed with fiberglass tube for fire protection. It shall be sealed with fire rated sealant and all internal wiring and components tested to relevant standard.

4.4 Non-Overloading

The fans shall have a non-overloading characteristic; the peak power input. To occur within the range of normal operating pressures and be always exceeded by the motor rating.

5. FIXINGS

All fixings to be protected with zinc coating to provide corrosion resistance.

The jet fans should be fitted with IP 55 motors as a standard and should come with 2 years ex-works warranty.

All JETVENT fans shall be supplied for a one off emergency operation at temperatures up to 300 Deg C for two hour and suitable for continuous operating range –40 degree Celsius to + 50 degree Celsius.

6. ANCILLARIES for JETVENT Fan as required.

- Mounting Feet
- Impeller and Motor Side Guards
- Two Silencers of length 710 mm (Minimum) with or without pod
- 2-speed switch type MDS3.10
- Air Operated Dampers
- Matching Flanges
- Bellmouth Inlets
- Flexible Connectors
- Vibration Isolators

TECHNICAL SPECIFICATION

CAR PARK JET FAN

Product Specification			
Actual Duty	1.8/0.9m³/s (32/8N)	Electrical Supply	380-420volts 50Hz 3 Phase
Fan Diameter	355 mm	Rated Motor Power	1.1/0.14 kW
Fan Speed	2/4 Pole 2840/1420 rpm	Full Load Current	2.38/0.63A
Noise level at 1 mt distance at free field condition (d BA)	52 (d BA)	Starting Current	13.1/3.2 A
Form of Running	B	Start Type	Direct on Line
Fan Casing	Long Cased	Winding Type	POLE CHANGING
Motor Frame Size	(P) 1D80	Absorbed Power	1 Kw/0.13 kw
High Temp. Cat.	300 Deg C/2		
Special Features			

TECHNICAL DATA
(To be filled in by bidders)

1. AIR HANDLING UNIT :

Manufacturer
Model
Material/Gauge
Casing
Fans....Make...../Dia -----
Drains Pan with InsulationMaterial.....Thickness

Type of bearing
Type-of vibration isolation
Overall dimensions

Cooling Coils

Make
Material of tubes
Dia of tubes (inch)
Fins/inch
No. of rows
No. Circuits

Filters

Make
Filter medium
Material of frame work
Thickness

Motors

Manufacturer
Type
Class of Insulation
Electrical Characteristics
Motor speed RPM
Method of Starting
Starter manufacturer

2. PUMP SETS :

Manufacturer		
Type		
Model	Chiller	Condenser

Capacity (US GPM)
Head (Ft.)
Efficiency (%)
Pump RPM
B.H.P.
Motor H.P.
Full Load current (amps)
Current characteristics
Starting current (Amps)
Type of Starter
Starter make (manufacturer)
Impeller material
Impeller Diameter (mm.)
Suction/Discharge dia (mm.)

Type of Bearing
Vibration Isolation
Operation Weights (Kg.) Approx.
Size: L mm
W mm
H mm

Characteristics graph to be submitted

3. COOLING TOWER :

Manufacturer
Type
Model
Heat rejection at 83 F Wet Bulb
Water flow rate (US GPM)
Range F
Approach F
Casing material
Basin material
Eliminators material
Piping material and size
Mechanical equipment support
Fill material
Ladder Material
Fan dia and RPM

Fan Motor
Type
HP
RPM
Make
Electrical Characteristics
Starter - Make, Type

Drift Loss %
Evaporative Loss %
Operating Weight Kg
Overall dimensions Ft.
(Height & Diameter)

4. CONTROLS

A. 2 way modulating Valves for Air Handling Units

- a. Make of valve
- b. Model
- c. Modutrol Motor make
- d. Modutrol Motor model
- e. Voltage of Motor
- f. Transformer provided
- g. Selected Cv
- h. Valve linkage make and Model

B. Thermostats for Air Handling Units :

- a. Make
- b. Model
- c. Range
- d. Differential
- e. Temperature settings
- f. Electrical characteristics

C. Additional controls Make and Model No. of Following Controls/Instruments.

- a. Expansion Valve
- b. Float switch
- c. Flow Switch
- d. Pressure Gauges
- e. Thermometer
- f. HP Cutout
- g. LP Cutouts
- h. Oil Pressure Switch
- i. Anti-Freeze Thermostat
- j. Operating Thermostat

5. MS PIPE

- a. Make
- b. Class
- c. Wall thickness of pipes

6. VALVES: Make/Material

- a. Balancing valves
- b. Butterfly valves
- c. Gate Valve make
- d. Globe valve make
- e. Check valve make
- f. Ball valves
- g. Pot Strainer
- h. Y-strainer

7. GRILLERS/DIFFUSERS/DAMPERS

- a. Make, Materials and Gauge
 - i. Fire dampers
 - ii. Grilles
 - iii. Linear grilles
 - iv. Diffusers
 - v. Slot Diffusers
 - vi. Duct Dampers

8. INSULATION :

- a. Manufacturer
- b. Duct Acoustic lining material
- c. Duct insulation material
- d. Pipe insulation material - premoulded
- e. Thermal conductivity
- f. Density - Pipe sections
- Duct Insulation

9. ELECTRICAL ACCESSORIES :

Make and Model No. for the following.

- a. Main Electrical panel
- b. Air Circuit Breaker
- c. MCCB and HRC fuses
- d. Rotary switches
- e. Auto-transformer starter
- f. Star Delta Starter

- g. Direct on line starter
- h. Contactors
- i. Overloads
- l. Single phase preventors
- m. Push Buttons
- n. Ammeter & Voltmeter
- o. Relays
- p. Indication Lamps
- q. Cables
- r. Wires

MAHINDRA WORLD CITY, JAIPUR

TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS

LIST OF APPROVED MAKES

(Following makes are acceptable if they conform to the specifications)

Description of Item	Approved Makes	Make Proposed	
		In Tender	Alternate
Split Casing Pumps			
Split Casing Pumps	ITT / Grundfoss / Armstrong		
Logic controller /Differential Pressure Sensor/ Transmitter	ITT / Grundfoss / Armstrong		
Cooling Towers	Advance /Paharpur /Mihir/ Bell		
Air Handling Units/ Fans/ Air washer/Kitchen Scrubber			
Air Handling Unit (Double Skin) /	Caryaire/ Savair/ Zeco/ Edgetech / Divine/ Emerald		
AHU fan Section (Single Skin) for, Exhaust, staircase & lift pressurisation	Caryaire/ Savair/ Zeco/ Edgetech / Divine/ Emerald/Airflow		
Cooling Coil for AHU's	Carryair/ Saveair / Zeco / Edgetech		
Fans			
Imported centrifugal Fan AMCA approved (Blower forward curved) for AHU,, staircase & lift pressurisation	Nikotra/ Comfrei/ Kruger		
Axial Flow Fan	Fantech/Airoviant / Flaktwoods /Krugar		
Jet fans – for ductless ventilation of basements	Fanttech /Systemaire (Sweden)/ Flaktwoods		
Air Washer (Wetting Pads)/ Package Airwasher	Roots Cooling/ Emerald/ Zeco		
Electrical Equipment			
Electrical Panel Board/ Motor Control Centre (Power Coated)	Tricolite/ Triton/ Vidyut Control Pvt. Ltd./ Advance panel/ Advance Power/ Khokar		
Electric Motor (TEFC)	Siemens/ Crompton/ Kirloskar/ ABB/ BharatBijli		
Starters/ Switch gear	Siemens/ L&T/ Group Schneider (MG) France		
Miniature Circuit Breaker (MCB)	Siemens/ MDS Legrand/ Hager (L&T)		
Moulded Case Circuit breaker (MCCB)	Siemens/ L&T/ GE Power/ Group Schneider (MG)NS		
Air Circuit Breaker (ACB)	Siemens/ L&T/ GE Power/ Group Schneider (MG)NW		
Push Button Starter	Siemens/ L&T/Group Schneider (MG)		
Auxiliary Relays/ Contactors	Siemens/ L&T/ Group Schneider (MG) France		
Line Type Fuse	Siemens/ L&T/GE		
Timer	Siemens/ L&T/GE		

Description of Item	Approved Makes	Make Proposed	
		In Tender	Alternate
Terminal Block	Elmax		
Voltmeter/ Ammeter (Digital)	Automatic Electric/ L&T/ Siemens / Enercon		
Indicating Lamps (LED Type)/ Push Button	Siemens/ L&T/ Vashnio		
Single Phase Preventor (Current Base)	L&T/ Minlec		
Overload Relays with built in single phase preventer	L&T/ Minlec/Siemens/Group Schneider (MG) France		
Selector Switches/ Toggle Switch	Siemens/ L&T/ Kaycee		
Change over switch	Siemens/ L&T/ HH Elcon/ HPL-Socomech		
Protection Relay	Alstom/ L&T/ Siemens		
Cables & Accessories			
Control Cables	Batra Henly/ Skytone/ Universal/ Delton/KEI		
XLPE / PVC Insulated Aluminium Conductor Armoured Power Cables	Skytone/ Universal/ Delton/NICCO/RPG Asian/KEI		
PVC Insulated Copper Conductor Stranded Flexible Wires	Finolex/ National Cables - NC/ polycab/ Skytone		
PVC Conduit & Accessories (ISI Approved)	BEC/ Precision/ D Plast/ Polypack		
Ducting & Grilles			
Grilles/ Diffusers	Caryaire/ Ravistar		
Fire Dampers	Caryaire/ Ravistar / Airflow		
Fire Dampers motors	Belimo/Seimens		
Factory fabricated duct	Rolastar/ Techno fabriduct/Zeco		
Duct flange	Rolastar/ Techno fabriduct/Zeco		
Pipes & Fittings			
GI pipe Medium Class	Jindal Hissar/ TATA		
MS Pipe (up to 200 mm Dia)	Jindal Hissar/ TATA		
MS Pipe (Above 200 mm upto 450 mm)	Jindal Maharastra/SAIL/ Mukut Steel/ Lalit Steel		
MS Pipe (Above 450 mm Dia factory Rolled)	SAIL/ Mukut Steel/ Lalit Steel		
Flexible Pipe Connection	Resistoflex/ Kanwal		
Valves			
Butterfly Valves	Audco/ Advance/ Castle		
Non Return Valves/ Check Valves	Audco/ Advance / Casle		
Balancing Valves	TA / Danfoss /Advance Valve / Casle		
Ball / Gate	Rapid Cool/ Sant/ Leader		
Ball valve with Y-Strainer (Fan Coil Units)	Rapid Cool/ Sant/ Leader		
Pot / Y Strainer	Emerald/ Sant		
Suction guide	Anergy/Sevcon		
Accessories/ Controls			
Pressure Gauges	H.Guru/ Fiebig/ Dwyer		

Description of Item	Approved Makes	Make Proposed	
		In Tender	Alternate
Thermometers (with brass encasing)	Emerald/ Taylor		
Flow Switch	Anergy/ Rapid cool		
Automatic Air Vent	Anergy/ Rapid cool		
Auto Air Vent Valve	Rapid Control/ Anergy		
Two way Modulating valve for AHU	Honeywell/ Siemens/Danfoss		
Room Thermostat/ AHU & FCU Thermostat	Honeywell/ Siemens/Danfoss/ Anergy		
Energy Meter (BTU meter)	Siemens/Danfoss / Anergy		
Insulation			
Expanded Polystyrene (TF Quality)(Pre-moulded pipe section / slab)	Thermolloyd/ Beard Sell/ Styrene Packagings/ DEBS Products/ P R Pakaging/ Coolite/ Indian Pakaging Services		
Cross Linked Polyethylene / nitrile	Trocellen/Supreme / Paramount		
Glass Wool	Owens Corning/ U.P. Twiga		
Miscellaneous			
Anchor fastners	Cannon/Hilti/ Fisher		
Vibration Isolator	Resistoflex/ Dunlop		
Welding Rods	Advani/Victor (oven dried before use)		
V belt	Dunlop/Fenner/Hilton		

BILLOFQUANTITIES

MAHINDRA WORLD CITY, JAIPUR
TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS
SCHEDULE OF QUANTITIES
SUMMARY OF COSTS

Sub Head	Description	Value Rs
I.	Equipment	Rs.
II.	Air Distribution	Rs.
III.	Water Piping	Rs.
IV.	Insulation	Rs.
V.	Ventilation	Rs.
VI.	Electrical	Rs.
VII.	BMS	Rs.
VIII.	Minor Civil Works	Rs.
TOTAL		Rs

Rupees (in words)

Signature of Tenderer

MAHINDRA WORLD CITY, JAIPUR**TENDER FOR LOW SIDE AIR-CONDITIONING & VENTILATION SYSTEM WORKS****SCHEDULE OF QUANTITIES****Note:**

1. Please fill up rate both in figures and words in the Rate column by putting the rate figure first.
2. Please total up Sub Head wise and carry forward to Summary of Costs
3. Site is situated in **SEZ**. Rates to be quoted shall be exclusive of all taxes, duties & free delivery at site

Sl No. Description	Qty	Unit	Rate Rs. P.	Amount Rs. P.
SUB HEAD I - EQUIPMENT				
1.1 Supply of Water Chilling Machine of 600 TR capacity comprising of centrifugal compressor/s with open/hermetic motor, suitable for 400 + - 10% volts, 3-phase, 50 cycles power supply with an insulated shell and tube type chiller, shell and tube type water- cooled condenser, vibration isolation mountings, refrigerant piping and system control wiring complete with accessories as required, automatic and Safety controls along with microprocessor control panel and variable frequency drive The chiller package shall be installed on a fabricated mild steel frame assembled to form a compact assembly.	3 nos		FREE SUPPLY	
DUTY:				
Chilled water leaving temp - 44F (6.6 C)				
Chilled water entering temp- 54 F (12.2 C)				
Condenser water entering temp- 89 F (31.7 C)				
Condenser water leaving temp- 98 F (36.6C)				
Chiller Fouling Factor - 0.0001msq.h.C/kcal				
Condenser Fouling Factor - 0.00015 msq.h.C/kcal				
Refrigerant - HFC (R134a)				
1.2 Port clearance, transportation to site, installation, testing and commissioning of above.	3 nos	each		
2 Pumps:				
2.1 End Suction, Split-casing centrifugal pump-sets, factory tested for rated duty and efficiency, complete with motor, common base frame coupling and V.I. pads for circulation of condenser water.				
The pumps shall be suitable for operation on 400+/-10% volts, 50Hz,3-phase AC power supply and shall suit following duty				
Water flow rate = 6800 lpm (1800 usgpm)				
Head = 21.3 M (70.0 Ft. of water-column)				
Motor rating = 50 HP, RPM 1450, TEFC-IP-55				
1 No. PUMPSET TO REMAIN STANDBY				
2.2 End Suction, Split-casing centrifugal pump-sets, factory tested for rated duty and efficiency, complete with motor,	3 nos	each		

	common base frame coupling and V.I. pads for circulation of Primary water.	
	The pumps shall be suitable for operation on 400+/-10% volts, 50Hz,3-phase AC power supply and shall suit following duty	
	Water flow rate = 5450 lpm (1440 usgpm) Head = 12.2 M (40.0 Ft. of water-column) Motor rating = 20 HP, RPM 1450, TEFC-IP-55 1 No. PUMPSET TO REMAIN STANDBY	3 nos each
2.3	End Suction, Split-casing centrifugal pump-sets, factory tested for rated duty and efficiency, complete with motor, common base frame coupling and V.I. pads for circulation of Secondary water.	
	The pumps shall be suitable for operation on 400+/-10% volts, 50Hz,3-phase AC power supply and shall suit following duty	
	Water flow rate = 5450 lpm (1440 usgpm) Head = 10.0 M (33.0 Ft. of water-column) Motor rating = 20 HP, RPM 1450, TEFC-IP-55 1 No. PUMPSET TO REMAIN STANDBY	3 nos each
2.3.1	Pump Logic Controller suitably interfaced with one 20 HP adjustable frequency drive.	1 no. each
2.3.2	20 HP Adjustable frequency drive suitably interfaced with other system components. Hand/ auto macro designed for pumping application.	2 nos each
2.3.3	Parallel Pumping software duly downloaded	1 Lot
2.3.4	DP sensor/transmitter	2 nos each
2.3.5	Interfacing amongst all components & compatibility of I/O signals for open protocol.	1 Lot
2.4	END SUCTION, Split-casing centrifugal pump-sets, factory tested for rated duty and efficiency, complete with motor, common base frame coupling and V.I. pads for circulation of Tertiary water of Block A2.	
	The pumps shall be suitable for operation on 400+/-10% volts, 50Hz,3-phase AC power supply and shall suit following duty	
	Water flow rate = 5450 lpm (1440 usgpm) Head = 9M (30.0 Ft. of water-column) Motor rating = 20 HP, RPM 1450, TEFC-IP-55 1 No. PUMPSET TO REMAIN STANDBY	2 nos each
2.4.1	Pump Logic Controller suitably interfaced with one 20HP adjustable frequency drive.	1 no. each
2.4.2	15 HP Adjustable frequency drive suitably interfaced with other system components. Hand/ auto macro designed for pumping application.	1 no. each

2.4.3	Parallel Pumping software duly downloaded	1	Lot
2.4.4	DP sensor/transmitter	2 nos	each
2.4.5	Interfacing amongst all components & compatibility of I/O signals	1	Lot
2.4.6	Temperature sensor for Tertiary Zone pumping system	1 no.	each
2.5	End Suction, Split-casing centrifugal pump-sets, factory tested for rated duty and efficiency, complete with motor, common base frame coupling and V.I. pads for circulation of Tertiary water of Block B1. The pumps shall be suitable for operation on 400+/-10% volts,50Hz,3-phase AC power supply and shall suit following duty Water flow rate = 4540 lpm (1200 usgpm) Head = 7.6 M (25.0 Ft. of water-column) Motor rating = 15 HP, RPM 1450, TEFC-IP-55 1 No. PUMPSET TO REMAIN STANDBY	2 nos	each
2.5.1	Pump Logic Controller suitably interfaced with one 15 HP adjustable frequency drive.	1 no.	each
2.5.2	15 HP Adjustable frequency drive suitably interfaced with other system components. Hand/ auto macro designed for pumping application.	1 no.	each
2.5.3	Parallel Pumping software duly downloaded	1	Lot
2.5.4	DP sensor/transmitter	2 nos	each
2.5.5	Interfacing amongst all components & compatibility of I/O signals	1	Lot
2.5.6	Temperature sensor for Tertiary Zone pumping system	1 no.	each
3	<p>Cooling Towers</p> <p>Induced Draft FRP type cooling-towers with FRP fans and sump, galvanised steel ladder, complete with TEFC sq.cage IP-55 motors suitable for outdoor installation with necessary protection.</p> <p>Each cooling tower Of 600 TR capacity shall be suitable for following duty conditions :</p> <p>Water flow rate 1800 usgpm Ambient wet bulb temp - 83F(28.3C) Water temp. In - 98 F (36.6C) Water temp. out - 88 F (31.1 C) Cooling-towers as described above and as per specifications</p>	2 nos	each

4 Air Handling Units, Fan Coil Units

SI No	AHU	CFM	TR (S)	TR (M)	Motor H.P	Line size	QTY	Unit	Rate	Amount
4.1	BLOCK B1									
4.1.1	GROUND FLOOR									
a)	G1&G2(Horizontal Floor mounted)	22000	42	43	15	80	2	nos		
b)	ATRIUM(Horizontal Floor mounted)	7500	20	20	5	40	1	nos		
4.1.2	FIRST FLOOR									
a)	F1&F2 (Horizontal Floor mounted)	17000	35	38	12.5	80	2	nos		
b)	PASSAGE(Horizontal Floor mounted)	3000	7.5	7.5	3	40	1	nos		
4.1.3	SECOND FLOOR									
a)	S1&S2 (Horizontal Floor mounted)	17000	35	38	12.5	80	2	nos		
b)	PASSAGE(Horizontal Floor mounted)	3000	7.5	7.5	3	40	1	nos		
4.1.4	THIRD FLOOR									
a)	T1&T2 (Horizontal Floor mounted)	17000	35	38	12.5	80	2	nos		
b)	PASSAGE(Horizontal Floor mounted)	3000	7.5	7.5	3	40	1	nos		
4.1.5	FOURTH FLOOR									
a)	F1&F2 (Horizontal Floor mounted)	20000	41	44	15	80	2	nos		
b)	PASSAGE(Horizontal Floor mounted)	3000	7.5	7.5	3	40	1	nos		
4.2	BLOCK A2									
4.2.1	GROUND FLOOR									
a)	G1 (Horizontal Floor mounted)	24700	53	52	20	80	1	nos		
b)	G2 (Horizontal Floor mounted)	16350	36	35	12.5	80	1	nos		
c)	G3 (Horizontal Floor mounted)	11200	25	25	7.5	50	1	nos		
d)	PASSAGE (Horizontal Ceiling susp)	2000	5	5	2	32	1	nos		
4.2.2	FIRST FLOOR						1	nos		
a)	F1 (Horizontal Floor mounted)	18850	43	47	12.5	80	1	nos		
b)	F2 (Horizontal Floor mounted)	14000	35	37	10	80	1	nos		
c)	F3 (Horizontal Floor mounted)	7500	16	18	5	65	1	nos		
d)	ATRIUM(Horizontal Floor mounted)	12000	24	20	10	80	1	nos		
4.2.3	SECOND FLOOR									
a)	S1 (Horizontal Floor mounted)	18850	48	52	12.5	80	1	nos		

b)	S2 (Horizontal Floor mounted)	14000	35	37	10	80	1	nos		
c)	S3 (Horizontal Floor mounted)	13300	29	33	10	80	1	nos		
d)	PASSAGE (Horizontal Ceiling susp)	2000	5	5	2	32	1	nos		
4.2.4	THIRD FLOOR									
a)	Th1 (Horizontal Floor mounted)	20900	52	54	15	80	1	nos		
b)	Th2 (Horizontal Floor mounted)	16000	39	42	10	80	1	nos		
c)	Th3 (Horizontal Floor mounted)	15300	38	38	10	80	1	nos		
d)	PASSAGE (Horizontal Ceiling susp)	2000	5	5	2	32	1	nos		

TOTAL SUB-HEAD I carried over to Summary

SUB HEAD II - AIR DISTRIBUTION

1	Supply, fabrication, installation, testing and balancing of		
1.1	machine made GSS ducts, complete with volume control dampers, quadrants, guide vanes etc.		
a)	24G	800 sq m	per sq m
b)	22G	200 sq m	per sq m
c)	20G	200 sq m	per sq m
d)	18G	100 sq m	per sq m
1.2	Supply, fabrication, installation, and testing of flexible connections made out of fire resistant flexible double canvas sleeve	28 set	per set
1.3.a)	Supply, installation, testing and commissioning of motorised fire dampers of at least 90 minute fire rating with factory fitted sleeve of 18 gauge -	18 sq m	per sq m
1.3.b)	Actuators spring return for above	28 nos	each
1.4	Supply, installation, testing and balancing of powder coated extruded aluminium grilles / diffusers as under		
a)	Fixed bar supply cum return linear grilles	Rate only	per sq m
b)	Linear grilles	Rate only	per sq m
c)	Square/ Round Supply diffusers with aluminium dampers	Rate only	per sq m
d)	Square/ Round Return diffusers without dampers	Rate only	per sq m
e)	Opposed blade, powder coated, double louvers, supply air rectangular aluminium grilles with adjustable, key operated aluminium volume control dampers	10 sq m	per sq m
f)	Opposed blade, powder coated, double louvers, return air rectangular aluminium grilles without dampers	2 sq m	per sq m
g)	Fresh air grilles of powder coated M.S. with stove enameled m.s. damper, birdscreen and cowl	5 sq m	per sq m
h)	Opposed blade, powder coated, dampers for AHU's included with cost of AHU	Rate only	per sq m
i)	Opposed blade dampers of G.I. in duct collars of continuous grills	Rate only	per sq m

TOTAL SUB-HEAD II carried over to Summary

SUB HEAD III - WATER PIPING

- 1 Providing and fixing in position following M.S.Heavy class pipes cut to required lengths and installed with all welded joints with necessary fittings like bends, elbows, tees and reducers etc. including flanges :
- | | | | |
|----|-----------|-------|-------|
| a) | 900mm dia | 150 m | per m |
| b) | 750mm dia | 570 m | per m |
| c) | 600mm dia | 10 m | per m |
| d) | 500mm dia | 10 m | per m |
| e) | 400mm dia | 10 m | per m |
| f) | 300mm dia | 60 m | per m |
| g) | 250mm dia | 210 m | per m |
| h) | 200mm dia | 10 m | per m |
| i) | 150mm dia | 120 m | per m |
| j) | 125mm dia | 300 m | per m |
| k) | 100mm dia | 110 m | per m |
| l) | 80mm dia | 280 m | per m |
| m) | 65mm dia | 50 m | per m |
| n) | 50mm dia | 150 m | per m |
| o) | 40mm dia | 150 m | per m |
- 2 Providing and fixing in position following Balancing valves of specified make:
- | | | | |
|----|------------|--------|------|
| a) | 300 mm dia | 3 nos | each |
| b) | 250mm dia | 3 nos | each |
| c) | 150mm dia | 3 nos | each |
| d) | 125mm dia | 4 nos | each |
| e) | 100mm dia | 4 nos | each |
| f) | 80mm dia | 25 nos | each |
| g) | 65mm dia | 2 nos | each |
| h) | 50mm dia | 2 nos | each |
| i) | 40mm dia | 5 nos | each |
| j) | 32mm dia | 8 nos | each |
- 3 Providing and fixing in position following Butterfly valves of specified make:
- | | | | |
|----|-----------|--------|------|
| a) | 250mm dia | 8 nos | each |
| b) | 150mm dia | 5 nos | each |
| c) | 125mm dia | 8 nos | each |
| d) | 100mm dia | 8 nos | each |
| e) | 80mm dia | 40 nos | each |
| f) | 65mm dia | 4 nos | each |
| g) | 50mm dia | 4 nos | each |
| h) | 40mm dia | 10 nos | each |
| i) | 32mm dia | 16 nos | each |
- 4 Providing and fixing in position following Gate valves of specified make:
- | | | | |
|----|----------|--------|------|
| a) | 50mm dia | 20 nos | each |
| b) | 40mm dia | 20 nos | each |
- 5 Providing and fixing in position following Non-return valves :
- | | | | |
|----|-----|-------|------|
| a) | 300 | 3 nos | each |
|----|-----|-------|------|

b)	250	9 nos	each
6	Providing and fixing in position 100mm dia industrial pressure gauges	80 nos	each
7	Providing and fixing in position V-Form Emerald industrial thermometers	60 nos	each
8	Providing and fixing in position GI medium class pipes installed with all screwed joints with necessary fittings such as elbows, tees and reducers etc.for condensate drain		
a)	50mm dia	200 m	per m
b)	40mm dia	250 m	per m
9	Supply and installation and testing of following flexible connections for inlet and outlet of condenser and chilled water pumps :		
a)	300	6 nos	each
b)	250	18 nos	each
10	Providing and fixing in position following Y- Strainers of specified make:		
a)	250mm dia	4 nos	each
b)	150mm dia	1 nos	each
c)	100mm dia	4 nos	each
d)	80mm dia	22 nos	each
e)	65mm dia	2 nos	each
f)	50mm dia	2 nos	each
g)	40mm dia	5 nos	each
h)	32mm dia	6 nos	each
11	Modulating mixing valve of line size given below and proportioning thermostat		
a)	80 MM DIA	23 nos	each
b)	65 MM DIA	1 nos	each
c)	50 MM DIA	1 nos	each
d)	40 MM DIA	5 nos	each
e)	32 MM DIA	2 nos	each
12	Supply, installation, testing, commissioning of 1.2M x 1.2M x 1.2M high expansion tank of M.S complete with All fittings such as float valve, drain, makeup, overflow Connections and duly insulated.	2 nos	each
13	Supply, installation, testing, commissioning of Pot Strainer 300 dia with 1 mm thick SS basket having 3mm dia perforations. Pot strainer shall be about 1300mm high with basket of 750 dia and 580 mm high	2 nos	each
14	AIR SEPARATOR of dia 550 mm	1 no.	each
15	BTU METERS		
a)	Billing Software and convertor	1 no.	each
b)	Pairs of temperature sensors	2 sets	per sets
c)	Integrat0rs	2 nos	each

- | | | |
|----|--------------------------|------------|
| d) | Flow meter of 250 mm dia | 1 no. each |
| e) | Flow meter of 100 mm dia | 1 no. each |

TOTAL SUB-HEAD III carried over to Summary

SUB HEAD IV – INSULATION

1	Supply and application of :	
1.1	Thermal insulation for supply air ducts with 13mm thick close cell cross linked polyethylene fire retardant insulation laminated with metalised foil, with all joints duly sealed with self adhesive insulating tape	600 sq m per sq per m
1.2	Acoustic lining of ducts with 25mm fibre-glass covered with glass cloth and finished with 28 gauge perforated aluminium sheet as per specifications.	400 sq m per sq per m
1.3.1	Supply and application of 75mm thick, TF quality pre-moulded expanded polystyrene pipe sections duly wrapped, and plastered over chicken wire netting as per specifications	
a)	900mm dia	150 m per m
b)	750mm dia	420 m per m
c)	600mm dia	10 m per m
d)	500mm dia	10 m per m
e)	400mm dia	10 m per m
f)	300mm dia	60 m per m
g)	250mm dia	140 m per m
1.3.2	Supply and application of 50mm thick, TF quality pre-moulded expanded polystyrene pipe sections duly wrapped, and plastered over chicken wire netting as per specifications	
a)	200mm dia	10 m per m
b)	150mm dia	380 m per m
c)	125mm dia	480 m per m
d)	100mm dia	250 m per m
e)	80mm dia	350 m per m
f)	65mm dia	30 m per m
g)	50mm dia	150 m per m
h)	40mm dia	100 m per m
1.4	Drain pipe, AS above but with 25mm thick pipe sections	
a)	50mm dia	200 m per m
b)	40mm dia	250 m per m
1.5	PUMPS/VALVES	1 Lot

TOTAL SUB-HEAD IV carried over to Summary

SUB HEAD V - VENTILATION

1	Supply, installation, testing, commissioning of AHU section with centrifugal fan, motor and G.I. body for toilet exhaust to handle 9000 cu.m / hr against 25 mm static pressure with 3 H.P. motor including basement toilet.	3 nos each
2	Supply, installation, testing, commissioning of AHU section with centrifugal fan, motor and G.I. body for toilet exhaust to handle 15000 cu.m / hr against 25 mm static pressure with 5H.P. motor	3 nos each
3	AHU casing of G.Isheet metal complete with DIDW fan with motor and drive and inlet air filters for following duty : 15,000 cu.m /hr against 25mm static pressure with 7.5H.P 3-ph motor on common base for stairwel pressurisation	5 nos each
4	AHU casing of G.Isheet metal complete with DIDW fan with motor and drive and inlet air filters for following duty : 7,000 cu.m /hr against 25mm static pressure with 5 H.P 3-ph motor on common base for Liftwel pressurisation	5 nos each
5	Air washer with single skin housing, 200 mm thick cellular pads,pump,blower, motor and filters to handle 11000 cu.m/ hr of air against 20mm external static complete with mounted electrical panel for plant room ventilation	2 nos each
6	Air washer with single skin housing, 300 mm thick cellular pads,pump,blower, 15H.P.motor and filters to handle 45000 cu.m/ hr of air against 20mm external static complete with mounted electrical panel for D.G room air cooling.	3 nos each
7	1000 dia Axial flow fan, direct driven, long casing, having cast aluminium alloy adjustable blades with 15 H.P., 1450 rpm motor to handle 45000 cu.m/ hr of air against 30mm static for D.G.room exhaust	Rate only each
8	Basement Exhaust	
a)	Axial flow fan, direct driven, long casing, having cast-aluminium alloy, adjustable pitch blades with 25H.P. 1450 rpm TEFC motor to handle 47500 cu.m/ hr of air against 20mm static complete with M.S.stand	33 nos each
b)	Jet fans 355 mm dia,each with 1.2/ 0.28kW, 400V, 3-phase, 50Hzpower supply,twin speed motor of one hour fire rating at 300 deg.C,as per specifications.	55 nos each
c)	CO sensors	20 nos each
d)	Electrical Panel	1 nos each
e)	PLC Panel & CFD Analysis	1 nos each

- f) Electrical wiring for total system in 4 core 2.5 sq mm
copper in conduit 500 m per m

TOTAL SUB-HEAD V carried over to Summary

SUB HEAD VI - ELECTRICALS

- 1 Design, manufacture, supply, erection, connecting, testing and commissioning of cubicle, indoor mounting type, dead front, dust and vermin proof, floor mounting sheet steel clad switch- board suitable for use at 400V, 3-phase,4-wire,50Hz system and to withstand a symmetrical fault level of 50 ka at 400 volts

Switch board shall be suitable for cable entry at top or bottom. Complete switch board shall be factory assembled and tested,with Bus-bar of 2000A rating and shall be complete with :

1 nos each

Incomer

- 1.1 3 Nos. 1250A TPN ACB
2 Nos. 1250A TPN ACB bus coupler with castel key
1600A Ammeter with ASS - 1 Set
0-500V voltmeter with VSS - 1 Set
1250/5A CT's
Control Fuse
Phase Indication Light - 1 Set with protection fuse & Outgoings as under -
- 1.2 600 TR Centrifugal chillers - 3 No.s
1000A TPN ACB - 3 No each with
1600A Ammeter with ASS - 1 Set
1600/5A CT's- 1 Set
ON/OFF/TRIP Indication Light with protection fuse
- 1.3 Condenser water pumps of 50 HP - 3Nos
125A TPN MCCB, 35 KA - 3 No each with
Over Load Relay - 1 No (suitable rating)
Single Phase Preventor - 1 No
Power Contactor - 3 Nos (Suitable Rating)
On Delay Timer - 1 No
150A Ammeter with ASS - 1 Set
Start/ Stop Push Button - 1 Set
150/5A CT's- 1 Set
ON/OFF/TRIP Indication Light with protection fuse
- 1.4 Chilled water pumps Primary of 20 HP - 3Nos
63A TPN MCCB, 35 KA - 3 No each with
Over Load Relay - 1 No (suitable rating)
Single Phase Preventor - 1 No
Power Contactor - 3 Nos (Suitable Rating)
On Delay Timer - 1 No
150A Ammeter with ASS - 1 Set
Start/ Stop Push Button - 1 Set
150/5A CT's- 1 Set
ON/OFF/TRIP Indication Light with protection fuse
- 1.5 Chilled water pumps Secndry of 20 HP - 3Nos
63A TPN MCCB, 35 KA - 3 No
- 1.6 Cooling tower motors of 10H.P- 2 No
32A TP MCCB (Motor Duty), 10 KA - 2 No each with
Over Load Relay - 1 No (suitable rating)
Single Phase Preventor - 1 No

	Power Contactor - 3 Nos (Suitable Rating)	
	On Delay Timer - 1 No	
	30A Ammeter with ASS - 1 Set	
	Start/ Stop Push Button - 1 Set	
	ON/OFF/TRIP Indication Light with protection fuse	
1.7	Plant room air washer 3 H.P. 2 No. 32A TP MCCB (Motor Duty), 10 KA - 2 No	
2	Isolators for cooling tower motors on terrace	2 nos each
3	AHU (2 H.P/3HP. motor) panels consisting of : 16A TP MCB, 10KA (Motor Duty)- 1 no. Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor with 2Nos NO/NC contact - 1 Nos 10A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	7 nos each
4	AHU (5 H.P. motor) panels consisting of : 16A TP MCB, 10KA (Motor Duty)- 1 no. Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor with 2Nos NO/NC contact - 1 Nos 10A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	1 nos each
5	AHU panels (7.5 H.P motor) consisting of : 32A TP MCB (Motor Duty), 10 KA - 1 No 8-12A Over Load Relay - 1 No Single Phase Preventor - 1 No Power Contactor Suitable rating with 2nos NO/NC contacts- 3 nos. 30A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	1 nos each
6	AHU panels (10 H.P motor) consisting of : 32A TP MCB (Motor Duty), 10 KA - 1 No Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor Suitable rating with 2nos NO/NC contacts- 3 Nos On Delay Timer - 1 No 30A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	5 nos each
7	AHU panels (12.5 - 15 H.P motor) consisting of : 32A TP MCB (Motor Duty), 10 KA - 1 No Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor Suitable rating with 2nos NO/NC contacts- 3 Nos On Delay Timer - 1 No 30A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	13 nos each
8	AHU panels (20 H.P. motor) consisting of : 63A TP MCB (Motor Duty), 10 KA - 1 No Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No	

	Power Contactor Suitable rating with 2nos NO/NC contacts- 3 Nos On Delay Timer - 1 No 30A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	1 nos each
9	I/C 63A TP MCCB (Motor Duty), - 1 No with Al. Bus bar 0-100A Ammeter with ASS - 1 Set 100/5A CT's- 1 Set ON/OFF/TRIP Indication Light with protection fuse Outgoings 32A TP MCB- 2 No for 20 H.P. TERTIARY PUMPS for block A2	1 nos each
10	I/C 63A TP MCCB (Motor Duty), - 1 No with Al. Bus bar 0-100A Ammeter with ASS - 1 Set 100/5A CT's- 1 Set ON/OFF/TRIP Indication Light with protection fuse Outgoings 32A TP MCB- 2 No for 15 H.P. TERTIARY PUMPS for block B1	1 nos each
11	TOILET EXHAUST AHU- SECTION (3 H.P. motor) panel consisting of : 16A TP MCB, 10KA (Motor Duty)- 1 no. Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor with 2Nos NO/NC contact - 1 Nos 10A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	3 nos each
12	TOILET EXHAUST AHU- SECTION (5 H.P. motor) panel consisting of : 16A TP MCB, 10KA (Motor Duty)- 1 no. Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor with 2Nos NO/NC contact - 1 Nos 10A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	3 nos each
13	LIFTWEL PRESSURISATION AHU- SECTION (5 H.P. motor) panel consisting of : 16A TP MCB, 10KA (Motor Duty)- 1 no. Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor with 2Nos NO/NC contact - 1 Nos 10A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	5 nos each
14	STAIRCASE PRESSURISATION AHU SECTION panels (7.5 H.P motor) consisting of : 32A TP MCB (Motor Duty), 10 KA - 1 No 8-12A Over Load Relay - 1 No Single Phase Preventor - 1 No Power Contactor Suitable rating with 2nos NO/NC contacts- 3 nos. 30A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	5 nos each

15	DG ROOM EXHAUST panels (15 H.P motor) consisting of : 32A TP MCB (Motor Duty), 10 KA - 1 No Over Load Relay - 1 No (suitable rating) Single Phase Preventor - 1 No Power Contactor Suitable rating with 2nos NO/NC contacts- 3 Nos On Delay Timer - 1 No 30A Ammeter with ASS - 1 Set Phase Indication Light with protection fuse	Rate only each
16	Power and control cables on wall/cable tray including clamps, spacers, saddles, terminating identification etc. for chillers, pumps, condenser water coolers, air-handling units and interlocking control wiring including earthing and cable -trays of following size : (All cables shall be of 1100 volts grade, PVC insulated Sheathed aluminium conductor armoured cables XLPE)	
a)	3.5 Core conductor - 240 sq.mm	350 m per m
b)	3.5 Core conductor - 50 sq.mm	150 m per m
c)	3.5 Core conductor - 25 sq.mm	50 m per m
d)	4 Core conductor - 16 sq.mm	350 m per m
e)	4 Core conductor - 10 sq.mm	100 m per m
f)	4 Core conductor - 6 sq.mm	500 m per m
g)	4 Core conductor - 4 sq.mm	800 m per m
h)	4 Core conductor - 2.5 sq.mm (COPPER)	400 m per m
i)	2 Core copper conductor 1.5 sq.mm (COPPER)	1600 m per m

TOTAL SUB-HEAD VI carried over to Summary

NOTE:

- 1 Incoming power in 3-phase and neutral along with double earth shall be brought upto the main electrical panel in plant room by other agency.
- 2 Incoming power in 3-phase and neutral along with main earthing shall also be brought upto each AHU room by other agency.
- 3 Single phase power supply terminating in 15A 3-pin socket shall also be provided by other agency within 3-meters of each Fan-coil unit, 3-phase
- 4 Supply on each panel of fresh air, smoke exhaust, Ventilation in basements, Pressurization panel on Terrace and single phase supply near Toilet-Exhaust fans on Terrace shall also be brought up by other agency.

SUB HEAD VII - BMS

1	BMS - Building management system complete with a PC and printer.		
A	Software and Operator Workstation		
1	Host PC comprising P4 processor, 2.0 GHz, 512 MB RAM, 40 GB HDD, 3.5" 1.4MB FDD, 52X CD RoM drive, 19" SVGA color monitor, keyboard, mouse and pre-loaded windows NT / 2000 operating system and anti virus software, 132 column 300 cps dot matrix printer (Standard Compaq / IBM make)	1 nos	each
2	UL listed Necessary Software Packages containing Building Management & Control Software Programmes with Dynamic Graphics complete including calibration of temperature sensor/ transmitter.	1 nos	each
B	Supervisory Controllers		
1	Supervisory Controller Unit capable of supervising all the DDC controllers, Integrators and execution of system-wide functions	1 nos	each
C	Microprocessor based DDC Controller with housing panels		
1	For Chilled water system - Chillers, CHW & CDW pumps, Cooling Towers	2 nos	each
2	For Air Handling Units	28 nos	each
3	For Electrical and DG sets	4 nos	each
4	For Plumbing and Fire Fighting System	4 nos	each
5	For Lifts and Escalator Systems	1 nos	each
D	Field instruments		
1	Immersion Temperature sensor for Chilled water system	8 nos	each
2	Temperature sensor for return temperature monitoring	8 nos	each
3	Ambient air temperature and humidity sensor	1 nos	each
4	Differential pressure switch for AHU blower run status	36 nos	each
5	Current relay for fans & pumps run status	15 nos	each
6	Level switch for tanks	2 nos	each
7	Flame proof Level switch for fuel tanks	4 nos	each
8	Voltage Transducer for DG Battery monitoring	4 nos	each
9	Water Pressure Transducer	2 nos	each
E	Other Miscellaneous components / devices		
1	Integrators for Chillers, DG PLC system microprocessors etc.	1 nos	each
F	Cabling and Conduiting (Approximate Quantities)		
1	Communication Cabling, 3 core x 1.0 sq. mm	750 m	per m
2	Signal Cabling, 2 core x 1.0 sq. mm.	4,200 m	per m
3	Power Cabling, 3 core x 1.0 / 1.5 sq. mm	300 m	per m
4	Conduiting (with MS conduit) - size 20 mm	4,500 m	per m

TOTAL SUB-HEAD VII carried over to Summary

SUB HEAD VIII - MINOR CIVIL WORKS

- | | | |
|---|---|-------|
| 1 | Minor civil works such as breaking and making good of walls / partitions etc. | 1 Lot |
|---|---|-------|

TOTAL SUB-HEAD VIII carried over to Summary

LIST OF DRAWINGS

Sl No.	Drawing Title	Drawing No.
1.	Chilled & Condensor Water Schematic	HVAC-101
2.	Typical Floor HVAC Equipment & Cutout Layout	HVAC-A12
3.	Typical Floor HVAC Equipment & Cutout Layout	HVAC-B12
