Tender

For

Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Volume-I

NIT & Prequalification Document

December’ 2012

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

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

Tender No. HSCC/ AIIMS/ CCU/2012/03
**All India Institute of Medical Sciences**
Ansari Nagar, New Delhi

**INVITATION FOR TENDER**

**HSCC/BU-II/AIIMS/2012/12**

Date: 14.12.2012

Bids are invited on behalf of Director, All India Institute of Medical Sciences, Ansari Nagar, New Delhi from eligible contractor/firms for the following works:

<table>
<thead>
<tr>
<th>Tender No.</th>
<th>Name &amp; description of work</th>
<th>Estimated cost (Rs.)</th>
<th>Completion period of work (months)</th>
<th>Date of issue of tender document from</th>
<th>Last date of submission (at HSCC Office, Noida)</th>
<th>Bid Security amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSCC/AIIMS/CCU/2012/02</td>
<td>Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi</td>
<td>Rs. 3.74 Crores.</td>
<td>04 Months</td>
<td>18.12.2012 to 02.01.2013 upto 13:00 hrs</td>
<td>02.01.2013 upto 14:30 hrs Opening at 15:00 hrs.</td>
<td>Rs. 7.48 Lakhs</td>
</tr>
<tr>
<td>HSCC/AIIMS/PL/2012/03</td>
<td>Augmentation of Plumbing work of existing P.C. &amp; Teaching Block at AIIMS, New Delhi</td>
<td>Rs. 85 Lakhs.</td>
<td>05 Months</td>
<td>19.12.2012 to 03.01.2013 upto 13:00 hrs</td>
<td>03.01.2013 upto 14:30 hrs Opening at 15:00 hrs.</td>
<td>Rs. 1.70 Lakhs</td>
</tr>
</tbody>
</table>

For further details regarding eligibility, bid security, purchase and submission of tender document, please refer detailed advertisement and tender documents made available at HSCC website [www.hsccltd.co.in](http://www.hsccltd.co.in) and AIIMS website [www.aiims.edu](http://www.aiims.edu). Pre bid meeting will be held on 26.12.2012 for both the works. Prospective bidders are advised to regularly scan through HSCC/AIIMS websites as corrigendum/amendments etc., if any, will be notified only on the HSCC websites and no separate advertisement will be made for this.

*GM Project, HSCC (I) Ltd.*
NOTICE INVITING TENDER - Detailed

Bids are invited on behalf of Director-All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi from eligible contractors/firms for the following works:

<table>
<thead>
<tr>
<th>Package No.</th>
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Complete set of tender documents comprising prequalification document (Volume I), General Conditions of contract (Volume-II), Instructions to Bidders & Specific conditions of contract (Volume III), Technical specifications (Volume IV), Bill Of Quantities (Volume V) & Tender Drawings (Volume VI) has been made available at HSCC website www.hsccltd.co.in and AIIMS website www.aiims.edu. Interested applicants may download the same.

The interested applicants/firms may also check their eligibility for the tender. Interested applicants/firms may see the complete set of tender documents which have been kept at dispatch counter of HSCC Corporate office, at E-6(A), Sector-1, Noida. Contractors/firms may also purchase the complete set of tender documents comprising of Vol. I, II, III, IV, V and VI (tender drawings) in person from the office of HSCC (I) Ltd, Noida on any working day as mentioned above on written request mentioning the name & description of work package wise against a non refundable fee of Rs. 5,000/- (for each package) through Cash/demand draft in favour of HSCC (I) Ltd. NOIDA payable at NOIDA or download the tender documents from said websites and submit complete set of tender documents (Vol-1 to VI) along with the tender document fee of Rs. 5000/- through demand draft including bid security. However in case of downloading of tender documents from websites it will be the responsibility of applicants/firms to ensure that complete tender documents has been downloaded. Interested applicants/firms may like to attend the pre bid meeting which shall be held at HSCC Corporate office, Noida on 26.12.2012 at 1100hrs for Package No.1 & at 1130 hrs for Package No.2. The tender document containing volume-I to VI shall be submitted package wise separately complete in all respect along with requisite amount of bid security in favour of HSCC (I) Ltd Noida on or before due date and time as mentioned above. HSCC/AIIMS reserves the right to accept or reject any application without assigning any reason or incurring any liability whatsoever. Prospective bidders are advised to regularly scan through AIIMS/HSCC web site as corrigendum/amendments etc., if any, will be notified on the AIIMS/HSCC web site and separate advertisement will not be made for this.

GM(Projects), HSCC (I) Ltd
INSTRUCTIONS FOR DOWNLOADING OF TENDER DOCUMENTS FROM INTERNET AND ITS SUBMISSION

1. The tender documents for the Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi can be obtained from the HSCC website http://www.hsccltd.co.in and AIIMS website www.aiims.edu. And the offers can be given on the same subject to the conditions given below which shall be carefully studied by the intending bidders and offers submitted accordingly.

2. The tender documents shall be carefully downloaded from the website and the same shall be printed carefully, The tender documents so downloaded shall be complete in all respects, which shall be the sole responsibility of the bidder(s), and the HSCC/AIIMS shall not be liable for any mistakes/loss or corruption of data in the downloading and/ or printing. The end of each volume of the tender documents should marked in bold letter as “END OF VOLUME – X” (where “X” is the Volume Number) on a separate page in the uploaded document, which may be checked while downloading the tender documents to ensure that the complete tender documents has been downloaded. The tenderer(s) must also compare the document as printed with the document as uploaded on the website. The tenderer(s) shall sign the undertaking given in ANNEXURE – VIII failing which the offer given by them shall be summarily rejected.

3. A master copy of the document downloaded from the website mentioned above shall be kept at HSCC Head Office, E-6A, Sector -1, Noida -201301, (U.P.). In case of any discrepancy between the tender document printed and submitted by the bidder after downloading form the website and the Master Copy, the later shall prevail and shall be binding on the tenderer(s). The offer received shall be deemed to have been submitted on the document as uploaded and appearing in the website mentioned above whose Master Copy is kept in the office of tender inviting authority.

4. The tenderer(s) shall print the documents on good quality, white A4 size paper on any quality Laser Printer.

5. The cost of tender document of as mentioned in the notice inviting tender shall be enclosed with the Envelope No.1 of the offer as a Demand Draft payable in favor of “HSCC (I) Ltd. NOIDA payable at NOIDA as cost of tender. The cost of tender document shall not be clubbed with the earnest money deposit. The tenders submitted without the requisite cost of tender documents inappropriate form shall not be considered.

6. The tender shall be filled up after careful study of the document and the site and any clarification required may be obtained from the tender inviting authority whose address is given in the tender document.

7. The tenderer(s) downloading the documents from internet must keep themselves updated through the website from which the tender document is downloaded regarding corrigenda, if any, to the same website. The offers received without such corrigenda published are liable to be rejected.

8. Any willful changes/deletion/addition in printing carried out in the tender documents shall be viewed very seriously, whether detected at the time of opening/award of work, and the same may result in penal action including banning of further business with the defaulting tenderer(s). In addition, the tenderer(s) are liable to be prosecuted for the same as per law.

9. The Tenderer(s) or his authorized representative shall be original on each page of the downloaded tender document.

Signature of Tenderer(s)
PACKAGE-I

INSTRUCTION TO APPLICANTS

PROJECT NAME: Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Completion period: within 4 (Four) Calendar months

EMPLOYER/CLIENT: All India Institute of Medical Sciences, (AIIMS), Ansari Nagar, New Delhi

1. Scope of Bid :

1.1 For & on behalf of All India Institute of Medical Science (AIIMS), New Delhi (The Employer/Client), HSCC (I) Ltd (The Consultant) invites sealed bids from eligible contractors/firms for above works details as under

1.2 Brief Details :

Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi. including PHE, Electrical, HVAC, Fire fighting, & other internal/external services and its maintenance during the defect liability period including preparation of shop drawings for all services”

Estimated Cost : Rs.3.74 crores

Time of Completion : Four (4) months

Above works to be executed for All India Institute of Medical Sciences (AIIMS) at Ansari Nagar, New Delhi

1.3 Tender is open to all agencies / firms having sound background and Specialisation in carrying out similar works.

2.0 SUBMISSION OF APPLICATION:

2.1 Application for tender must be submitted complete in all respect in sealed envelopes which must be either delivered by hand or by registered mail, at GM (Projects) HSCC (India) Ltd, Plot No. 6(A), Block-E, Sector-1, NOIDA, U.P.-201301, so as to reach not later than designated date & time and be clearly marked “Application for tender for “Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi”
2.2 The name and mailing address of the Applicant should be clearly marked on the envelope.

2.3 All the information asked for pre-qualification and bids shall be answered in the ENGLISH language by all the agencies/firms.

2.4 Failure to provide information in the stipulated format enclosed or to provide timely clarification or substantiation of the information supplied (considered essential to evaluate the Applicant’s qualification) shall result in disqualification of the Applicant.

3.0 MINIMUM PRE-QUALIFICATION CRITERIA:

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

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

(a). Experience should be in the name of the bidding company and not in subsidiary/associate company/Group Company etc.

(b). Average Annual Financial Turnover during the last three financial years i.e. 2009-10, 2010-11 & 2011-12 should be at least 100% of the estimated cost.

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

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

or

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

or

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

(d). Any one *similar Completed work of minimum 40% of estimated value should be completed in a period of eight (08) months.

Execution of speedy specialized hospital work alongwith hospital services & high class finishes are essence of requirement of this work.
*”Similar work” shall mean execution of hospital work along with requisite hospital services including Civil, Electrical, HVAC, Plumbing, computer wiring & signage’s etc.

A Certificate from client for completion of work(s) must be submitted along with application. Own works / Certification of the agencies shall not be considered for prequalification.

3.3 The firm should submit an affidavit duly notarized that they have not abandoned any work of Union Government/State Governments/PSU’s etc. during the last 5 years. They should also submit an affidavit that they have not been blacklisted, debarred, declared non performer or expelled by Union Government/State Governments/PSU’s etc. during the last 5 years.

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

3.5 Financial Capabilities: The Applicant should submit Audited Balance Sheets for the last three financial years i.e. 2009-10, 2010-11 & 2011-12. The applicant should not have incurred any loss in more than two years during the last five years ending 31st March 2012 (Fill enclosed ANNEXURE-III).

3.8 Minimum Solvency Requirement:
A solvency certificate from applicant’s Bank (Nationalized/Scheduled) that applicant is solvent for 30% of the Project Estimated Cost. The certificate should be not more than one year old.

3.7 Deleted

4.0 PERSONNEL, EQUIPMENT AND FINANCIAL CAPABILITIES

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

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

5.0 EXPERIENCE OF EXECUTING OF PROJECTS OF SIMILAR NATURE & COMPLEXITY

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

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

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

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

6.4 The contractor will indemnify HSCC/AIIMS/Principle employer/client, as the case may be, against all penal action that may be levied/effectected by any concerned authority for default in any labour regulation/PF/ESI and other statutory requirements of the relevant Acts/Laws related to the work of the contract and will bear the legal charges, if any, and will pay the legal charges/dues directly to the concerned authority.

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

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

8.0 The applicants are advised to visit the site to get first-hand information as regards its approach, accessibility, working conditions, site conditions, availability of labour and material etc. and other matters affecting cost and work. All costs incurred in connection with submission of the pre-qualification application shall be borne by the applicant irrespective of the outcome.

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

10.0 The competent authority to pre-qualify shall have the power to relax any condition/criterion for pre-qualification if it considers expedient to do so.
11.0 Even though the agency meets all the criteria, the Employer / Consultant reserves the right to accept or reject any applicant/disqualify any agency without assigning any reason whatsoever.

12.0 UPDATING QUALIFICATION INFORMATION

12.1 Applicants shall be required to update the financial information used for Pre-Qualification as and when asked for and at the time of submitting their bids, to confirm their continued compliance with the pre-qualification criteria and verification of information provided. Free issued cement & steel shall be considered to arrive final completed project cost.

13.0 GENERAL

13.1 Only agencies / firms who have been pre-qualified under this procedure will be considered for further opening of bid. Firm may submit only one bid for any work. If a firm submitting more than one bid all bids of the party will be rejected.

13.2 The Employer / Consultant reserves the right to:

(a) Reject or accept any application without assigning any reason or incurring any liability thereof
(b) Cancel the tendering process and reject all applications
(c) Split the works into different packages if required
(d) Amend the scope and value of any contract under this project.

13.3 Joint venture companies or experience of any work done in joint venture shall not be considered.

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

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

GM (Projects)
For & on behalf of HSCC (I) Ltd.
LETTER OF APPLICATION

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

Date: ______________

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

Sirs,

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

---------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------- its maintenance during the Defect Liability period

<table>
<thead>
<tr>
<th>Pre-Qualification Number</th>
<th>Client Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSCC/ AIIMS/ CCU/2012/03</td>
<td>All India Institute of Medical Science (AIIMS), New Delhi</td>
</tr>
</tbody>
</table>

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

   (a) the applicants legal status

   (b) the principal place of business

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

   (d) application form no. 1 to 6

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

<table>
<thead>
<tr>
<th>General, Personnel, Technical and Financial Enquiries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact 1 :</td>
</tr>
<tr>
<td>Telephone 1 :</td>
</tr>
<tr>
<td>Contact 2 :</td>
</tr>
<tr>
<td>Telephone 2 :</td>
</tr>
</tbody>
</table>

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

(a) Bids submitted by applicants will be subject to verification of all information submitted at the time of bidding.

(b) Your agency reserves the right to:

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

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

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

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

<table>
<thead>
<tr>
<th>Sealed &amp; Signed</th>
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</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>For and on behalf of</td>
</tr>
</tbody>
</table>
APPLICATION FORM NO. 1

GENERAL INFORMATION

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

<table>
<thead>
<tr>
<th></th>
<th>Name of firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Head office address</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Telephone</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Fax</td>
<td>E-mail No.</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Place of incorporation/ Registration</th>
<th>Year of incorporation/ registration</th>
</tr>
</thead>
</table>

Authorized Signatory of bidder
APPLICATION FORM NO. 2

STRUCTURE AND ORGANIZATION

1. Name & address of the applicant

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

3. Legal status of the applicant (attach copies of original document defining the legal status)
   (a) An individual
   (b) A proprietor firm
   (c) A firm in partnership
   (d) A Limited Company or Corporation.

4. Particulars of registration with various Government bodies (attach attested photocopy)
   Organisation /Place of registration    Registration No.

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

6. Designation of individuals authorised to act for the organisation

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

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

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

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

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

Authorized Signatory of bidder
APPLICATION FORM NO. 3

ANNEXURE - I

PERSONNEL CAPABILITIES

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Designation</th>
<th>Total Number</th>
<th>Number available for this work</th>
<th>Name</th>
<th>Qualification</th>
<th>Professional experience</th>
<th>Remarks</th>
</tr>
</thead>
</table>

Authorized Signatory of bidder
EQUIPMENT CAPABILITIES

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Equipment</th>
<th>Nos.</th>
<th>Capacity or Type</th>
<th>Age</th>
<th>Condition</th>
<th>Remarks</th>
</tr>
</thead>
</table>

Authorized Signatory of bidder
**APPLICATION FORM NO. 5**

**ANNEXURE - III**

**FINANCIAL CAPABILITIES (Rs. In lacs)**

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Annual Turn Over in Indian Rupees (or equivalent to Indian Rupees) as per Audited Balance Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2010</td>
<td>Rs.</td>
</tr>
<tr>
<td>2010-2011</td>
<td>Rs.</td>
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<tr>
<td>2011-2012</td>
<td>Rs.</td>
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</table>

Average Annual Turnover over the past three years | Rs.  

<table>
<thead>
<tr>
<th>Financial Information in Rs. Equivalent</th>
<th>For year 2007-08</th>
<th>For year 2008-2009</th>
<th>For year 2009-2010</th>
<th>For year 2010-2011</th>
<th>For year 2011-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total Assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Current Assets</td>
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<td>3. Total Liabilities</td>
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<td>4. Current Liabilities</td>
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<td>5. Profit before Tax</td>
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<td>6. Profit after Tax</td>
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<tr>
<td>7. Net Worth</td>
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**NOTE : The above data is to be supported by audited balance sheets**

1. Attach copies of audited balance sheets duly certified by the chartered accountant for all three years (2009-2010, 2010-2011 & 2011-12). Audited Balance sheet should mention the membership number of chartered accountant issued by ICAI along with full address.

2. Attach recent solvency certificate from bankers

**Authorized Signatory of bidder**
APPLICATION FORM NO. 6

ANNEXURE - IV

EXPERIENCE OF COMPLETION OF PROJECTS OF SIMILAR NATURE & COMPLEXITY

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

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of work / project and location</th>
<th>Owner or sponsoring organization</th>
<th>Cost of work in Lakhs</th>
<th>Date of commencement as per contract</th>
<th>Stipulated date of completion</th>
<th>Actual date of completion</th>
<th>Name and address/ telephone number of officer to whom reference may be made</th>
<th>Remarks</th>
</tr>
</thead>
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NOTE : Please attach supporting documents (completion certificates along with order copies) for the above information

Authorized Signatory of bidder
APPLICATION FORM NO. 7

Litigation Details
Court Cases/arbitration

ANNEXURE - V

Name of Bidder

<table>
<thead>
<tr>
<th>Year</th>
<th>Name of the work</th>
<th>Name of the Client, with Address</th>
<th>Title of the court Case/Arbitration</th>
<th>Detail of the Court/Arbitrator</th>
<th>Status Pending/Decided</th>
<th>Disputed Amount (Current Value, the equivalent) in case of Court Cases/arbitration</th>
<th>Actual Awarded Amount (Rs) in decided Court Cases/arbitration</th>
</tr>
</thead>
<tbody>
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Authorized Signatory of bidder
# Check-List

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| 2    | Experience | During last seven years  
- Similar work completed, 3 nos. of value not less than 40% of the estimated cost  
- Similar work completed, 2 Nos. of value not less than 50% of the estimated cost  
- One Similar work completed of value not less than 80% of the estimated cost  
- Any one *similar Completed work of minimum 40% of estimated value should be completed in a period of eight (08) months. | | |
| 3    | Personnel Capabilities | List of suitable qualified and experienced personnel in relevant field | | |
| 4    | Equipment Capabilities | List of equipment required and proposed to be deployed & source of such equipments | | |
| 5    | Financial Capability | ▪ Net worth positive for all the three years  
▪ Profit earning for all the three years | | |
| 6    | Solvency Certificate | Solvency certificate from applicant’s bank for 30% of the estimated project cost. | | |
| 7    | Abandoning / Blacklisting | Information regarding not abandoned /Black listing for any work of Union Govt./State Govt./PSU’s etc. during last 5 years | | |
| 8    | PQ document fee, in case down loaded from web site | | | |

*Authorized Signature of Bidder with stamp*
ANNEXURE – VIII

Bidders submitting their bids using tender documents downloaded from the websites mentioned above should enclose the tender document fee in the form prescribe above in Envelope no.1 of their bids along with Certificate as per format given at ANNEXURE-VIII of this Volume I of the tender documents failing which the bid shall be rejected.

CERTIFICATE
(Only for bidders using tender documents downloaded from website)

We certify that the tender documents (Volume I, II, III, IV, V & VI) submitted by us along with our bid for _____(tender no.)_______ _____(name of work)__________________ are downloaded from HSCC website (www.hsccltd.com) and AIIMS website (www.aiims.edu) and is same in content and form (verbatim).

We also undertake that any deviation, if detected at any stage, would entitle AIIMS/HSCC to reject our bid/tender/offer and take suitable penal action against us. In any such an eventuality, the decision of AIIMS/HSCC shall final and the same would be legally binding on us.

Signature & seal of the Tenderer
END OF VOLUME - I
Tender

For

Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Volume-II

(General Conditions of Contract)

GCC

December’ 2012

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

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

Tender No. HSCC/ AIIMS/ CCU/2012/03
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GENERAL CONDITIONS OF CONTRACT
Definitions and Interpretation

1.1 Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise requires:

(a) i. "Employer/Principal Employer" means the persons named as such in Volume - II of these Conditions and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.

ii. "Consultant" means the HSCC (India) Ltd. known as Chairman-Cum- Managing Director, HSCC(India) Ltd, and his successors in office and assignees acting for and on behalf of the employer.

iii. "Engineer" means the person appointed by HSCC to act as Engineer for the purposes of the contract and named as such in Part II of these Conditions.

iv. "Engineer's Representative" means a person appointed from time to time by the Engineer under Sub-Clause 2.2.

v. "Contractor" means an individual or firms (proprietary or partnership) whether incorporated or not, that has entered into contract (with the employer) and shall include his / its heirs, legal representatives, successors and assigns, successors in interest of individuals or persons. Composing such firms or successors of such firms or the permitted assigns of such individual or firms. Changes in the constitution of the firm, if any shall be immediately notified to the employer, in writing and approval obtained for continued performance of the contract.

vi. "Subcontractor" means any person named in the Contract as a Subcontractor for a part of the Works or any person to whom a part of the Works has been subcontracted by the contractor with the consent of the Engineer and the legal successors in title to such person, but not any assignee of any such person.

(b) i. "Contract" means these conditions (Volume I and II), the Specification, the Drawings, the Bill of Quantities, the Tender, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).
ii. "Specification" means the specification of the Works included in the Contract and any modification thereof or addition thereto made under Clause 51.1 & 51.2 or submitted by the Contractor and approved by the Engineer.

iii. "Drawings" means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.

iv. "Bill of Quantities" means the priced and completed bill of quantities forming part of the Tender.

v. "Tender" means the Contractor's priced offer to the Employer for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance. The word Tender is synonymous with "Bid" and the words "Tender Documents" with "Bidding Documents".

vi. "Letter of Acceptance" means the formal acceptance by the HSCC of the Tender.


viii. "Appendix to Tender" means the appendix comprised in the form of Tender annexed to these Conditions.

(c) i. "Commencement Date" means the date upon which the Contractor receives the notice to commence the works as issued by the Engineer pursuant to Clause 41.1.

ii. "Time for Completion" means the time for completing the execution of and passing the Tests on Completion of the Works or any Section or part thereof as stated in the Contract (or as extended under Clause 44.1, 44.2 & 44.3) calculated from the Commencement Date.

(d) i. "Tests on Completion" means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor which are to be made by the Contractor before the Works or any Section or part thereof are taken over by the employer.

ii. "Taking-Over Certificate" means a certificate issued pursuant to Clause 48.1 to 48.4.
(e) i. "Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.

ii. "Retention Money" means the aggregate of all monies retained by the Employer pursuant to Sub-Clause 60.1 (h) or 60.5.

(f) i. "Works" means the Permanent Works and the Temporary Works or either of them to be executed in accordance with the contract.

ii. "Permanent Works" means the permanent works to be executed (including Plant) in accordance with the Contract.

iii. "Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.

iv. "Plant" means machinery, apparatus and the like intended to form or forming part of the Permanent Works.

v. "Contractor's Equipment" means all appliances and things of whatsoever nature (other than Temporary Works) required for the execution and completion of the Works and the remedying of any defects therein, but does not include Plant, materials or other things intended to form or forming part of the Permanent Works.

vi. "Section" means a part of the Works specifically identified in the Contract as a Section.

vii. "Site" means the places provided by the Employer where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the Site.

(g) i. "Cost" means all expenditure properly incurred or to be incurred, whether on or off the Site, including overhead and other charges properly allowable there but does not include any allowance for profit.

ii. "Day" means calendar day.

iii. "Foreign Currency" means a currency of a country other than that in which the Works are to be located.

iv. "Writing" means any hand-written, type-written, or printed communication, including telex, cable and facsimile transmission.

1.2 Header and Marginal Notes
The headings and marginal notes in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

1.3 Interpretation

Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.

1.4 Singular and Plural

Words importing the singular only also include the plural and vice versa where the context requires.

1.5 Notices, Consents, Approvals, Certificates and Determinations.

Wherever in the Contract provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in writing and the words "notify", "certify" or "determine" shall be construed accordingly.

ENGINEER AND ENGINEER'S REPRESENTATIVE

2.1 Engineer's Duties and Authority

(a) The Engineer shall carry out the duties specified in the Contract.

(b) The Engineer may exercise the authority specified in or necessarily to be implied from the Contract, provided, however, that if the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before exercising any such authority particulars of such requirement shall be set out in part II of these Conditions. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority exercised by the Engineer.

2.2 Engineer's Representative

(a) The Engineer's Representative shall be appointed by and be responsible to the Engineer and shall carry out such duties and exercise such authority
as may be delegated to him by the Engineer under Sub-Clause 2.2 (b).

**Engineer's Authority to Delegate**

(b) The Engineer may from time to time delegate to the Engineer's Representative any of the duties and authorities vested in the Engineer and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing and shall not take effect until a copy thereof has been delivered to the Contractor.

2.3 **Communication Given by Engineer's Representative**

Any communication given by the Engineer's Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. Provided that:

(a) any failure of the Engineer's Representative to disapprove any work, materials or Plant shall not prejudice the authority of the Engineer to disapprove such work, materials or Plant and to give instructions for the rectification thereof;

(b) if the Contractor questions any communications of the Engineer's Representative he may refer the matter to the Engineer who shall confirm, reverse or vary the contents of such communication.

2.4 **Appointment of Assistants**

The Engineer or the Engineer's Representative may appoint any number of persons to assist the Engineer's Representative in the carrying out of his duties under Sub-Clause 2.2. He shall notify to the Contractor the names, duties and scope of authority of such persons. Such assistants shall have no authority to issue any instructions to the Contractor save in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, Plant or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been by the Engineer's Representative.

2.5 **Instructions in Writing**

Instructions given by the Engineer shall be in writing, provided that if for any reason the Engineer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer, whether before or after carrying out of the instruction shall be deemed to be an instruction, within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Engineer any oral instruction of the Engineer and such confirmation is not contradicted in writing within 7 days by the Engineer, it shall
be deemed to be an instruction of the Engineer.

The provisions of this Sub-Clause shall equally apply to instructions given by the Engineer's Representative and any assistants of the Engineer or the Engineer's Representative appointed pursuant to Sub-Clause 2.4.

2.6 Engineer to Act Impartiality

Wherever, under the Contract, the Engineer is required to exercise his discretion by:

(a) giving his decision, opinion or consent, or
(b) expressing his satisfaction or approval, or
(c) determining value, or
(d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor he shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances. Any such decision, opinion, consent, expression of satisfaction, or approval, determination of value or action may be opened up, reviewed or revised as provided in Clause 67.1 to 67.4.

ASSIGNMENT AND SUBCONTRACTING

3.1 Assignment of Contract

The Contractor shall not, without the prior consent of the Consultant (which consent, shall be at the sole discretion of the Consultant), assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by:

(a) a charge in favour of the Contractor's bankers of any monies due or to become due under the Contract, or
(b) assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable. The provision of labour as piece work basis shall not deemed to be subcontracting under this clause.

4.1 Sub-Contracting

The Contractor shall not subcontract the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not subcontract any part of the Works without the prior consent of the Engineer. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and
he shall be responsible for the acts, defaults and neglects of a Subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen.

Provided that the Contractor shall not be required to obtain such consent for:

(a) the provision of labour, or
(b) the purchase of materials which are in accordance with the standards specified in the Contract, or

4.2 Assignment of Sub-Contractors Obligations

In the event of a Subcontractor having undertaken towards the Contractor in respect of the work executed, or the goods, materials, Plant or services supplied by such Subcontractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period under the Contract, the Contractor shall at any time, after the expiration of such Period, assign to the Employer, at the Employer's request and cost, the benefit of such obligation for the unexpired duration thereof.

CONTRACT DOCUMENTS

5.1 Language/s and Law

(a) The language in which the Contract documents shall be drawn up, is English.

(b) The country the law of which shall apply to the Contract and according to which the Contract shall be construed is India.

5.2 Priority of Contract Documents

The several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:

1. Requirements/ Description of Schedule of Quantities/BOQ
2. Particular Technical specification
3. Additional specifications of contract
4. Specific condition of contract
5. Drawings
6. General conditions of contract
7. C.P.W.D Specifications
8. Indian standard specifications of B.I.S.

6.1 Custody and Supply of Drawings and Documents
The Drawings shall remain in the sole custody of the Engineer, but two copies thereof shall be provided to the Contractor free of charge. The Contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the Contract, the Drawings, Specification and other documents provided by the Employer or the Engineer shall not, without the consent of the Engineer, be used or communicated to a third party by the Contractor. Upon issue of the Defects Liability Certificate (Clause 62.1), the Contractor shall return to the Engineer all Drawings, Specifications and other documents provided under the Contract.

The Contractor shall supply to the Engineer four copies of all Drawings, Specifications and other documents submitted by the Contractor and approved by the Engineer in accordance with Clause 7.1 to 7.3, together with a reproducible copy of any material which cannot be reproduced to an equal standard by photocopying. In addition the Contractor shall supply such further copies of such Drawings, Specification and other documents as the Engineer may request in writing for the use of the Employer, who shall pay the cost thereof.

6.2 One Copy of Drawings to be kept on Site

One copy of the Drawings, provided to or supplied by the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and by any other person authorised by the Engineer in writing.

6.3 Disruption of Progress

The Contractor shall give notice to the Engineer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Engineer within 60 days or such other reasonable time as may be decided by the Engineer. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

6.4 Delay and Cost of Delay of Drawings

If, by reason of any failure or inability of the Engineer to issue, within a time reasonable in all the circumstances, any drawing or instruction for which notice has been given by the Contractor in accordance with Sub-Clause 6.3, the Contractor suffers delay then the Engineer shall, after due consultation with the Employer and the Contractor, determine only extension of time to which the Contractor is entitled under Clause 44.1 to 44.3.

6.5 Failure by Contractor to Submit Drawings

If the failure or inability of the Engineer to issue any drawings or instructions is caused in whole or in part by the failure of the Contractor to submit Drawings,
Specification or other documents which he is required to submit under the Contract, the Engineer shall take such failure by the Contractor into account when making his determination pursuant to Sub-Clause 6.4.

7.1 **Supplementary Drawings and Instructions**

The Engineer shall have authority to issue to the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remediing of any defects therein. The Contractor shall carry out and be bound by the same.

7.2 **Permanent Works Designed by Contractor**

Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall submit to the Engineer, for approval:

(a) such drawings, specifications, calculations and other information as shall be necessary to satisfy the Engineer as to the suitability and adequacy of that design, and

(b) operation and maintenance manuals together with drawings of the relevant part of the Permanent Works as completed, in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust the Permanent Works incorporating that design. The Works shall not be considered to be completed for the purposes of taking over in accordance with Clause 48.1 to 48.5 until such operation and maintenance manuals, together with drawings on completion, have been submitted to and approved by the Engineer.

7.3 **Responsibility Unaffected by Approval**

Approval by the Engineer, in accordance with Sub-Clause 7.2, shall not relieve the Contractor of any of his responsibilities under the Contract.

**GENERAL OBLIGATIONS**

8.1 **Contractor's General Responsibilities**

The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), execute and complete the Works and remedy any defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labour, materials, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects, so far as the
necessity for providing the same is specified in or is reasonably to be inferred from the Contract. The contractor shall promptly notify the Employer and the Engineer of any error, omission, fault or any other defect in the design of or specifications for the works which he discovers when reviewing the contract documents or in the process of execution of the works.

8.2 Site Operations and Methods of Construction

The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.

9.1 Contract Agreement

The Contractor shall, if called upon so to do, enter into and execute the Contract Agreement, to be prepared and completed at the cost of the Contractor, in the form annexed to these Conditions with such modification as may be necessary.

10.1 Performance Security

The Contractor shall provide security for his proper performance of the Contract to the Employer within 28 days after the receipt of the Letter of Acceptance. The performance security shall be in the form of bank guarantee. The amount of the bank guarantee shall be 5 percent of the Contract Price. It shall be issued by a Nationalised bank of India. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing.

Without limitation to the provisions of the preceding paragraph, whenever the Engineer determines an addition to the Contract Price as a result of a change in cost and/or legislation or as a result of a variation amounting to more than 25 percent of the Contract Price, the Contractor, at the Engineer's written request, shall promptly increase the value of the performance security by an equal percentage.

Failure of the successful bidder to lodge the required bank guarantee shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security, in which event the Engineer may make the award to the next lowest evaluated bidder or, if there are no other bidders, call for new bids.

10.2 Period of Validity of Performance Security

The performance security shall be valid until the Contractor has executed and
completed the Works and remedied any defects therein in accordance with the Contract. No claim shall be made against such security after the issue of the Defects Liability Certificate in accordance with Sub-Clause 62.1 and such security shall be returned to the Contractor within 14 days of the issue of the said Defects Liability Certificate.

10.3 Costs of Securities

The cost of complying with the requirements of this clause shall be borne by the Contractor.

11.1 Inspection of Site

The Consultant shall have made available to the Contractor, before the submission by the Contractor of the Tender, such data on hydrological and sub-surface conditions as have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works but the Contractor shall be responsible for his own interpretation thereof.

The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself (so far as is practicable, having regard to considerations of cost and time) before submitting his Tender, as to:

(a) the form and nature thereof, including the sub-surface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of work and materials necessary for the execution and completion of the Works and the remedying of any defects therein, and

(d) the means of access to the Site and the accommodation he may require.

And in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.

Data made available by the Employer in accordance with sub-clause 11.1 above shall be deemed to include data listed elsewhere in the contract as open for inspection at the office of the Hospital Services Consultancy Corporation, Plot no. 6A, Block - E, Sector -1, Noida (U.P.)-201 301.

12.1 Sufficiency of Tender

The Contractor shall be deemed to have based his Tender on the data made available by the Consultant and on his own inspection and examination, all as
The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

12.2 Adverse Physical Obstructions or Conditions

If, however, during the execution of the Works the Contractor encounters physical obstructions or physical conditions, other than climatic conditions on the Site, which obstructions or conditions were, in his reasonable opinion, not foreseeable by an experienced contractor, the Contractor shall forthwith give notice thereof to the Engineer. On receipt of such notice, the Engineer shall, if in his opinion such obstructions or conditions could not have been reasonably foreseen by an experienced contractor, after due consultation with the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3 and

(b) the amount of any costs which may have been incurred by the Contractor by reason of such obstructions or conditions having been encountered, which shall be added to the Contract Price.

And shall notify the Contractor accordingly. Such determinations shall take account of any instruction which the Engineer may issue to the Contractor in connection therewith, and any proper and reasonable measures acceptable to the Engineer which the Contractor may take in the absence of specific instructions from the Engineer.

13.1 Work to be in Accordance with Contract

Unless it is legally or physically impossible, the Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer's instructions on any matter, whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions only from the Engineer or subject to the provisions of Clause 2.1 to 2.6, from the Engineer's Representative.

14.1 Programme to be Submitted

The Contractor shall, within 28 days after the date of the Letter of Acceptance,
submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works. The Contractor shall, whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.

14.2 Revised Programme

If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under Sub-Clause 14.1 the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion.

14.3 Cash Flow Estimate to be Submitted

The Contractor shall, within 28 days after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer.

14.4 Contractor not Relieved of Duties or Responsibilities

The submission to and consent by the Engineer to such programs or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

15.1 Contractor's Superintendence

The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorised representative approved of by the Engineer, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorised representative shall receive, on behalf of the Contractor, instructions from the Engineer or, subject to the provisions of Clause 2.1 to 2.6, the Engineer's Representative.

If approval of the representative is withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.
If the Contractor's authorised representative is not in the opinion of the Engineer fluent in English, the contractor shall have available at site at all times an interpreter competent to ensure the proper transmission of instructions and information.

16.1 Contractor's Employees

The Contractor shall provide on the Site in connection with the execution and completion of the Works and the remedying of any defects therein:

(a) only such technical assistants as are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the Works, and

(b) such skilled, semi-skilled and un-skilled labour as is necessary for the proper and timely fulfilling of the Contractor's obligations under the Contract.

16.2 Engineer at Liberty to Object

The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence on Site is otherwise considered by the Engineer to be undesirable, and such person shall not be again allowed upon the Works without the consent of the Engineer. Any person so removed from the Works shall be replaced as soon as possible.

A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of English or the contractor shall have available at site at all times a sufficient number of competent interpreters to ensure a proper transmission of instructions and information.

The contractor is encouraged to the extent practicable and reasonable to employ staff and labourers from sources within India.

17.1 Setting-out

The Contractor shall be responsible for:

(a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing,

(b) the correctness, subject as above mentioned, of the position, levels dimensions and alignment of all parts of the Works, and
the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

If, at any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required to do so by the Engineer, shall, at his own cost, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly.

The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the Works.

The Contractor shall give to the Engineer not less than 72 (seventy two) hours notice of his intention to set out or give levels for any part of the Works so that timely arrangement may be made for checking or issuing instructions. He shall indicate therein by which date the information, if any is required by him.

18.1 Boreholes and Exploratory Excavation

If, at any time during the execution of the works the Engineer requires the contractor to make bore-holes or to carry out exploratory excavations in excess of the requirements specified elsewhere in the contract, such requirement shall be the subject of an instruction in accordance with clause 51.1 & 51.2, unless an item or a provisional sum in respect of such work is included in the Bill of Quantities.

19.1 Safety, Security and Protection of the Environment

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:

(a) have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons, and

(b) provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others, and
(c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods or operation.

(d) Screen all lights provided by the Contractor so as not to interfere with any signal light on the railways or with any traffic or signal lights of any local authority.

20.1 Care of Works

The Contractor shall take full responsibility for the care of the Works and materials and Plant for incorporation therein from the Commencement Date until the date of issue of the Taking-Over Certificate for the whole of the Works, when the responsibility for the said care shall subject to clause 20.1(b) pass to the Employer, Provided that:

(a) if the Engineer issues a Taking-Over Certificate for any Section or part of the Permanent Works the Contractor shall cease to be liable for the care of that Section or part from the date of issue of the Taking-Over Certificate, when the responsibility for the care of that Section or part shall pass to the Employer, and

(b) the Contractor shall take full responsibility for the care of any outstanding Works and materials and Plant for incorporation therein which he undertakes to or is otherwise required to finish during the Defects Liability Period until such outstanding Works have been completed pursuant to Clause 49.1 to 49.4.

20.2 Responsibility to Rectify Loss of Damage

If any loss or damage happens to the Works, or any part thereof, or materials or Plant for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Sub-Clause 20.4, the Contractor shall, at his own cost, rectify such loss or damage so that the Permanent Works conform in every respect with the provisions of the Contract to the satisfaction of the Engineer. The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under Clause 49.1 to 49.4 and 50.1.

20.3 Loss or Damage Due to Employer's Risk

In the event of any such loss or damage happening from any of the risks defined in Sub-Clause 20.4, or in combination with other risks, the Contractor shall, if and to the extent required by the Engineer, rectify the loss or damage and the
Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly. In the case of combination of risks causing loss or damage any such determination shall take into account the proportional responsibility of the Contractor and the Employer.

20.4 Employer's Risks

The Employer's risks are:

(a) (i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(ii) rebellion, revolution, insurrection, or military or usurped power, or civil war,

(iii) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,

(iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speed,

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

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

(d) any operation of the forces of nature (insofar as it occurs on the site) which an experienced contractor:

(i) could not have reasonably foreseen, or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:

(A) prevent loss or damage to physical property from occurring by taking appropriate measures, or

(B) insure against.

21.1 Insurance of Works and Contractor's Equipment

The Contractor shall, without limiting his or the Employer's obligations and
responsibilities under Clause 20.1 to 20.4, insure:

(a) the Works, together with materials and Plant for incorporation therein, to the full replacement cost and it being understood that such insurance shall provide for compensation to be payable to rectify the loss or damage incurred.

(b) an additional sum of 15 percent of such replacement cost, or as may be specified in Part II of these Conditions, to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature, and it being understood that such insurance shall provide for compensation to be payable to rectify the loss or damage incurred.

(c) the Contractor's Equipment and other things brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

The insurance under clause 21.1 shall be issued by an insurance company which has been determined by the contractor to be acceptable to the Consultant.

21.2 Scope of Cover

The insurance in paragraphs (a) and (b) of Sub-Clause 21.1 shall be in the joint names of the Contractor and the Employer and shall cover:

(a) the Employer and the Contractor against all loss or damage from whatsoever cause arising (including natural calamities, earthquake, subsidence, landslide, rock slide, flood, storm, cyclone, fire, theft, burglary, strike, riot, sabotage, terrorism), other than as provided in Sub-Clause 21.4, from the commencement date until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any Section or part thereof as the case may be, and

(b) the Contractor for his liability:

(i) during the Defects Liability Period for loss or damage arising from a cause occurring prior to the commencement of the Defects Liability Period, and

(ii) for loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49.1 to 49.4 and 50.1.

It shall be the responsibility of contractor to notify the Insurance Company of any change in the nature and extent of the works and to ensure the adequacy of the Insurance cover at all times during the period of contract.

21.3 Responsibility for Amounts not Recovered
Any amounts not insured or not recovered from the insurers shall be borne by the Employer or the Contractor in accordance with their responsibilities under Clause 20.1 to 20.4.

21.4 Exclusions

There shall be no obligation for the insurance in Sub-Clause 21.1 to include loss or damage caused by the risks listed under sub clause 20.4 para a (i) to (iv).

If the Contractor receives instructions from the Employer to insure against War Risk, such insurance if normally available shall be effected, at the cost of the Employer, with an Insurance Company acceptable to the Consultant and shall be in the joint names of the contractor and the Employer.

22.1 Damage to Persons and Property

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of:

(a) death of or injury to any person, or

(b) loss or damage to any property (other than the Works) :

Which may arise out of or in consequence of the execution and completion of the Works and the remedying of any defects therein, and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, subject to the exceptions defined in Sub-Clause-22.2.

22.2 Exceptions

The "exceptions" referred to in Sub-Clause 22.1 are:

(a) the permanent use or occupation of land by the Works, or any part thereof,

(b) the right of the Employer to execute the Works, or any part thereof, on, over, under, in or through any land,

(c) damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with the Contract.

(d) death of or injury to persons or loss of or damage to property resulting from any action or neglect of the Employer, his agents, servants or other contractors, not being employed by the Contractor, or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or, where the injury or damage was contributed to by the Contractor, his servants or agents, such part of the
said injury of damage as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the injury or damage.

22.3 Indemnity by Employer

The Employer shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the exceptions defined in Sub-Clause 22.2.

23.1 Third Party Insurance (Including Employer's Property)

The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause 22.1 to 22.3, insure, in the joint names of the Contractor and the Employer, against liabilities for death of or injury to any person (other than as provided in Clause 24.1 to 24.2) or loss of or damage to any property (other than the Works) arising out of the performance of the Contract other than the exceptions defined in paragraphs (a), (b) and (c) of Sub-Clause 22.2.

23.2 Minimum Amount of Insurance

Such insurance shall be for at least the amount stated in Appendix to Tender.

23.3 Cross Liabilities

The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and to the Employer as separate insured.

24.1 Accident or Injury to Workmen

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman other than for death or injury resulting from any act or default of the Employer, his agents or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

24.2 Insurance Against Accident to Workmen

The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the Works. Provided that, in respect of any persons employed by any
Subcontractor, the Contractor's obligations to insure as aforesaid under this Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Consultant, when required, such policy of insurance and the receipt for the payment for current premium.

25.1 Evidence and Terms of Insurance

The Contractor shall provide evidence to the Consultant as soon as practicable after the respective insurance have been taken out but in any case prior to the start of work at the Site that insurance required under the Contract have been effected and shall, within 84 days of the Commencement Date, provide the insurance policies to the Employer. When providing such evidence and such policies to the Employer, the Contractor shall notify the Engineer of so doing. Such insurance policies shall be consistent with the general terms agreed prior to the issue of the Letter of Acceptance. The Contractor shall effect all insurance for which he is responsible with insurers and in terms approved by the Consultant.

25.2 Adequacy of Insurance

The Contractor shall notify the insurers of changes in the nature, extent or programme for the execution of the Works and ensure the adequacy of the insurance at all times in accordance with the terms of the Contract and shall, when required, produce to the Consultant the insurance policies in force and the receipts for payment of the current premiums.

25.3 Remedy on Contractor's Failure to Insure

If the Contractor fails to effect and keep in force any of the insurance required under the Contract, or fails to provide the policies to Consultant within the period required by Sub-Clause 25.1, then and in any such case the Employer may effect and keep in force any such insurance and pay any premium as may be necessary for that purpose and from time to time deduct the amount so paid from any monies due or to become due to the Contractor, or recover the same as a debt due from the Contractor.

25.4 Compliance with Policy Conditions

In the event that the Contractor or the Employer fails to comply with conditions imposed by the insurance policies effected pursuant to the Contract, each shall indemnify the other against all losses and claims arising from such failure.

The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to, the insurance referred to in Clauses 21.1 to 21.4, 23.1 to 23.3 and 24.1 to 24.2) with insurers from India.
26.1 **Compliance with Statutes Regulations**

The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provision of:

(a) any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution and completion of the Works and the remediing of any defects therein, and

(b) the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works, and the Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such provision.

Provided always that the Employer shall be responsible for obtaining any planning, zoning or other similar permission required for the Works to proceed and shall indemnify the Contractor in accordance with Sub-Clause 22.3.

27.1 **Fossils**

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same. If, by reason of such instructions, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and

(b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly.

28.1 **Patent Rights**

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceeding for or on account of infringement of any patent right, design trademark or name or other protected rights in respect of any Contractor's Equipment, materials or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses.
whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or Specification provided by the Engineer.

28.2 Royalties

Except where otherwise stated, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

29.1 Interference with Traffic and Adjoining Properties

All operation necessary for the execution and completion of the Works and the remedying of any defects therein shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with:

(a) the convenience of the public, or
(b) the access to, use and occupation of public or private road, railway and any other right of way and footpaths to or of properties whether in the possession of the Employer or of any other person.

The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, arising out of, or in relation to any such matters insofar as the Contractor is responsible therefor.

If any plant (floating or otherwise) belonging to or hired by the Contractor or any sub-contractor or any person employed by the Contractor or by any sub-contractor or any materials or things therein or therefrom sink from any cause whatsoever, it shall immediately be reported by the Contractor to the competent authorities and the Engineer's Representative, and Contractor shall forthwith, at his cost raise and remove any such plant, materials or things or otherwise deal with the same as the Engineer may direct.

The fact that such sunken plant, materials or things are insured or have been declared a total loss or do not represent any further value shall not absolve the Contractor from his obligations under this Clause to raise and remove the same. Until such sunken plant or materials or things have been raised and removed, the Contractor shall set such buoys and display at night such lights and do all such things for the safety as may be required by the competent authorities or by the Engineer's Representative.

In the event of the Contractor not carrying out the obligations imposed on him by this Clause, the Employer may cause to set buoy and display at night light on such plant and raise and remove the same without prejudice to the right of the Employer to hold the Contractor liable and all expenses and consequences thereon and incidental thereto shall be borne by the Contractor and shall be recoverable from him as a debt by the Employer or may be deducted by the
Employer from any moneys due or which may become due to the Contractor.

30.1 **Avoidance of Damage to Roads**

The Contractor shall use every reasonable means to prevent any of the roads or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his Subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of materials, Plant, Contractor's Equipment or Temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such roads and bridges.

30.2 **Transport of Contractor's Equipment or Temporary Works**

Save insofar as the Contract otherwise provides, the Contractor shall be responsible for and shall pay the cost of strengthening any bridges or altering or improving any road communicating with or on the routes to the Site to facilitate the movement of Contractor's Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all claims for damage to any such road or bridge caused by such movement, including such claims as may be made directly against the Employer, and shall negotiate and pay all claims arising out of such damage.

If it is found necessary for the Contractor to move one or more loads of heavy constructional plant and equipment, materials or preconstructed units or parts of units of work over roads, highways, bridges on which such oversized and overweight items are not normally allowed to be moved, the Contractor shall obtain prior permission from the concerned authorities. Payments for complying with the requirements, if any, for protection of or strengthening of the roads, highways or bridges shall be made by the Contractor and such expenses shall be deemed to be included in his contract price.

30.3 **Transport of Materials or Plant**

If, notwithstanding Sub-Clause 30.1, any damage occurs to any bridge or road communicating with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer, as soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim. Where under any law or regulation the hauler of such materials or Plant is required to indemnify the road authority against damage the Employer shall not be liable for any costs, charges or expenses in respect thereof or in relation thereto. In other cases the Employer
shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto. Provided that if and so far as any such claim or part thereof is, in the opinion of the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount determined by the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount, determined by the Engineer, after due consultation with the Employer and the Contractor, to be due to such failure shall be recoverable from the Contractor by the Employer and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly. Provided also that the Employer shall notify the Contractor whenever a settlement is to be negotiated and, where any amount may be due from the Contractor, the Employer shall consult with the Contractor before such settlement is agreed.

30.4 Waterborne Traffic

Where the nature of the Works is such as to require the use by the Contractor of waterborne transport the foregoing provisions of this Clause shall be construed as through "road" included a lock, dock, sea wall or other structure related to a waterway and "vehicle" included craft, and shall have effect accordingly.

31.1 Opportunities for other Contractors

The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to:

(a) any other contractors employed by the employer and their workmen,

(b) the workmen of Employer, and

(c) the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the employer may enter into in connection with or ancillary to the Works.

31.2 Facilities for other Contractors

If, however, pursuant to Sub-Clause 31.1 the Contractor shall, on the written request of the Engineer:

(a) make available to any such other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible, or

(b) permit the use, by any such, of Temporary Works or Contractor's
Equipment on the Site,

(c) provide any other service of whatsoever nature for any such, the Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly.

32.1 Contractor to keep Site Clear

During the execution of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or depose of any Contractor's Equipment and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

33.1 Clearance of Site on Completion

Before the issue of any Taking-Over Certificate the Contractor shall clear away and remove from that part of the Site to which such Taking-Over Certificate relates all Contractor's Equipment, surplus material rubbish and Temporary Works of every kind, and leave such part of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such materials, Contractor's Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

34.1 Labour

The contractor shall make his own local or other arrangement for the engagement of all labour local or other.

The Contractor and his sub contractors shall abide by the local laws and regulations governing labour applicable from time to time.

Engagement of Labour

The Contractor shall make his own arrangements for the engagement of all labour, local or otherwise, and, save insofar as the Contract otherwise provides, for the transport, housing, feeding and payment thereof.

Supply of Water

The contractor shall, so far as is reasonably practicable, having regard to local
conditions, provide on the Site, to the satisfaction of the Engineer's Representative, an adequate supply of drinking and clear water for the use of the Contractor's and the Engineer's staff and work people, Sub-Contractors and site visitors.

**Alcoholic Liquor or Drugs**

The Contractor shall not import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his sub-contractors, agents or employees.

**Arms and Ammunition**

The Contractor shall not give, barter or otherwise dispose off to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

**Festivals and Religious Customs**

The Contractor shall in all dealings with labour in his employment have due regard to all recognised festivals, days of rest and religious or other customs.

**Epidemics**

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

**Disorderly Conduct, etc.**

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighbourhood of the works against the same.

**Observance of Legislation etc.**

The Contractor shall at all times during the continuance of the Contract comply fully with all existing Acts, regulations and bylaws including all statutory amendments and re-enactments and acts that may be passed in future either by the state or the Central Government or local authority, including, Indian Workmen's Compensation Act, Contract Labour (Regulation and Abolition) Act 1970 and Equal remuneration Act 1976. Factories Act, Minimum Wages Act provident fund regulations employees provident Fund Act and schemes made
under same Act, Health and Sanitary Arrangements for workmen, Insurance and other benefits and shall keep the Employer indemnified in case any action is commenced for contravention by the contractor. If the Employer is caused to pay or reimburse any amounts for non-observance of the provisions of this clause on the part of the contractor the Engineer shall have the right to deduct from any moneys due to the contractor or recover from the contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the Employer. All registration and station inspection fees if any in respect of his work pursuant to the contract shall be to the account of the contractor.

**Fair Wages :**

The Contractor shall pay the labours engaged by him on the work not less than a fair wage, which expression shall mean, whether or time or piecework, the respective rates of wages as fixed by the public works department as fair wages for the area payable to the different categories of labourers or those notified under the Minimum wages act for corresponding employees of the Employer whichever may be higher.

The Contractor shall notwithstanding the provisions of any contract to the contrary, cause to be paid a fair wage to the labourers indirectly engaged on the works including any labour engaged by subcontractors in connection with the said works as if the labourer has been immediately employed by him.

**Notices :**

The Contractor shall before he commences the work display and correctly maintain in a clean and legible condition at a conspicuous place on the Site notices in English and in a local language spoken by the majority of the workers, stating therein the rate of wages which have been fixed as fair wages and the hours of work for which such wages are earned and send a copy of such notices to the Engineer.

**Wage Records :**

The contractor shall maintain records of wages and other remuneration paid to his employees in such form as may be convenient and to the requirements of the Employer/Engineer and the conciliation officer (Central) Ministry of Labour, Government of India, or such other authorised person appointed by the Central or State Government and the same shall include the following particulars of each worker:

i) Name, works number and grade
ii) Rate of daily or monthly wage.
iii) Nature of work on which employed
iv) Total number of days worked during each wage period.
v) Total amount payable for the work during each wage period.
vi) All deductions made from the wage with details in each case of the
ground for which the deduction is made.

vii) Wage actually paid for each wage period.

The contractor shall provide a wage slip for each worker employed on the works.

The wage record and wage slips shall be preserved for at least 12 months after the last entry.

**Inspection of Wage Records**

The Contractor shall allow inspection of the aforesaid wage records and wage slip to the Engineer and to any of his workers or to his agent at a convenient time and place after due notice is received, or to the Employer or any other person authorised by him on his behalf.

The Employer and the Engineer or any other person authorised by them on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the Fair Wages Clause. He shall also have the power to investigate into any complaint regarding any default made by the Contractor or sub-contractor in regard to such provision.

The Employer shall have the right to deduct from the moneys due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non payment of the aforesaid fair wage, except on account of any deductions that may be permissible under any law for the time being in force.

**Representation of Parties**

(i) A workman shall be entitled to be represented in any investigation or enquiry under this Clause by :-

   (a) An officer of a registered trade union of which he is a member.

   (b) An officer of a federation of trade Union to which the Trade Union referred to in pervious Sub-clause is affiliated.

   (c) Where the Worker is not a member of any registered Trade Union, by an officer of a registered Trade Union connected with or by any other workman employed in the industry in which the workers is employed.

(ii) The contractor or sub-contractor shall be entitled to be represented in any investigations or enquiry under this clause by an officer of an Association of Employers of which he is a member.

(iii) No party shall be represented by a legal practitioner in any investigation.
or enquiry under this clause, unless all parties agree.

**Safety Provisions**

The Contractor shall comply with all the precautions as required for the safety of the workman by the I.L.O Convention (NO.62) as far as they are applicable to the Contract. The Contractor shall provide all necessary safety appliances, gears like goggles, helmets, masks, etc. to the workmen and the staff.

The Contractor shall be responsible for observance by his sub-Contractors of the foregoing provisions.

**Footwear**

The Contractor shall at his own expense provide footwear for all labour engaged on concrete mixing work and all other type of work involving the use of tar, cement, etc. to the satisfaction of the Engineer or his Representative, and on his failure to do so the Employer shall be entitled to provide the same and recover the cost from the Contractor.

The Contractor shall deliver to the Engineer's Representative at his office on the Site a return in detail in such form and at such intervals as the Employer / Engineer may prescribe showing the supervisory staff and the numbers of the several classes of labour from time to time employed on the Site.

### 35.1 Returns of Labour, etc.

The Contractor shall, if required by the Engineer, deliver to the Engineer's Representative, or at his office, a return in detail in such form and at such intervals as the Engineer may prescribe showing the supervisory staff and the number of the several classes of labour from time to time employed by the Contractor on the site and such information respecting constructional plant as the Engineer's Representative may require.

The Contractor shall file all labour returns in detail to the respective authorities / statutory bodies as prescribed under law applicable at the work site and inform the Employer / Engineer with copies of such returns directly filed.

**MATERIALS, PLANTS AND WORKMANSHIP**

### 36.1 Quality of Materials, Plant and Workmanship

All materials Plant and workmanship shall be

(a) of the Respective kinds described in the Contract and in accordance with the Engineer's instructions, and

(b) subjected from time to time to such tests as the Engineer may require at
the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.

The Contractor shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or plant and shall supply samples of materials, before incorporation in the Works, for testing as may be selected and required by the Engineer.

The contractor is encouraged to the extent practicable and reasonable, to use plant and material from sources within India.

36.2 Cost of Samples

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

36.3 Cost of Test

The cost of making any test shall be borne by the Contractor if such test is

(a) clearly intended by or provided for in the Contract, or

(b) particularised in the Contract (in cases only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfil) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

36.4 Costs of Tests not provided for

If any test required by the Engineer which is

(a) not so intended by or provided for, or

(b) (in the cases above mentioned) not so particularised, or

(c) though so intended or provided for, required by the Engineer to be carried out at any place other than the Site local test house or the place of manufacture, fabrication or preparation of the materials or Plant tested.

Shows the materials, Plant or workmanship not to be in accordance with the provision of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor, but in any other case Sub- Clause 36.5 shall apply.
36.5 Engineer's Determination Where Tests not provided for

Where, pursuant to Sub-Clause 36.4, this Sub-Clause applies the Engineer shall, after due consultation with the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and shall notify the Contractor accordingly.

37.1 Inspection of Operations

The Engineer, and any person authorised by him, shall at all reasonable times have access to the Site and to all workshops and places where materials or Plant are being manufactured, fabricated or prepared for the Works and the Contractor shall afford every facility for and every assistance in obtaining the right to such access.

37.2 Inspection and Testing

The Engineer shall be entitled, during manufacture, fabrication or preparation to inspect and test the materials and Plant to be supplied under the Contract. If materials or Plant are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Engineer to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract.

37.3 Dates for Inspection and Testing

The Contractor shall agree with the Engineer on the time and place for inspection or testing of any materials or Plant as provided in the Contract. The Engineer shall give the Contractor not less than 24 hours notice of his intention to carry out the inspection or to attend the tests. If the Engineer, or his duly authorised representative, does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Engineer, proceed with the tests, which shall be deemed to have been made in the presence of the Engineer. The Contractor shall forthwith forward to the Engineer duly certified copies of the test readings. If the Engineer has not attended the tests, he shall accept the said readings as accurate or instruct the tests to be repeated at the Employer's cost to enable him to decide.

37.4 Rejection

If at the time and place agreed in accordance with Sub-Clause 37.3, the materials or Plant are not ready for inspection or testing or if, as result of the inspection or testing referred to in this Clause, the Engineer determines that the materials or Plant are defective or otherwise not in accordance with the Contract, he may
reject the materials or Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer's objections with reasons. The Contractor shall then promptly make good the defect or ensure that rejected materials or Plant comply with the Contract. If the engineer so request, the test of rejected materials or Plant shall be made or repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the tests shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employee and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

37.5 Independent Inspection

The Engineer may delegate inspection and testing of materials or Plant to an independent inspector. Any such delegation shall be effected in accordance with Sub-Clause 2.4 and for this purpose such independent inspector shall be considered as an assistant of the Engineer. Notice of such appointment (not being less than 14 days) shall be given by the Engineer to the Contractor.

38.1 Examination of Work before Covering up

No part of the Work shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any such part of the Works which is about to be covered up or put out of view and to examine foundations before any part of the work is placed thereon. The Contractor shall give notice to the Engineer whenever any such part of the Works or foundations is or are ready or about to be ready for examination and the engineer shall unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such part of the Works or of examining such foundations.

38.2 Uncovering and Making Opening

The Contractor shall uncover any part of the Works or make opening in or through the same as the Engineer may from time to time instruct and shall reinstate and make good such part. If any such part has been covered up or put out of view after compliance with the requirement of Sub-Clause 38.1 and is found to be executed in accordance with the Contract, the Engineer shall, after due consultation with the Contractor, determine the amount of reinstating and making good the same, which shall be added to the Contract Price, and shall notify the Contractor accordingly. In any other case all costs shall be borne by the Contractor.

39.1 Removal of Improper Work, Materials or Plant

The Engineer shall have authority to issue instructions from time to time, for:
(a) The removal from the Site, within such time or times as may be specified in the instruction, of any materials or Plant which, in the opinion of the Engineer, are not accordance with the Contract,

(b) The substitution of proper and suitable materials or Plant, and

(c) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which, in respect of

   (i) materials, Plant or workmanship, or

   (ii) design by the Contractor or for which he is responsible, is not, in the opinion of the Engineer, in accordance with the Contract.

39.2 Default of Contractor in Compliance

In case of default on the Contractor in carrying out such instruction within the time specified therein or, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall, after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly.

SUSPENSION

40.1 Suspension of Work

The Contractor shall, on the instructions of the Engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer. Unless such suspension is

   (a) otherwise provided for in the Contract, or

   (b) necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible, or

   (c) necessary by reason of extra-ordinary climatic conditions on the Site, or

   (d) necessary for the proper execution of the Works or for the safety of the Works or any part thereof (save to the extent that such necessity arises from any act or default by the Engineer or the Employer or from any of the risks defined in Sub-Clause 20.4), Sub-Clause 40.2 shall apply.

40.2 Engineer's Determination following Suspension
Where, pursuant to Sub-Clause 40.1, this Sub-Clause applies the Engineer shall, after due consultation with the Contractor determine

(a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and

(b) the amount, which shall be added to the Contract Price, in respect of the cost incurred by the Contractor by reason of such suspension.

And shall notify the Contractor accordingly.

40.3 Suspension lasting more than 84 Days

If the progress of the Works or any part thereof is suspended on the written instructions of the Engineer and if permission to resume work is not given by the Engineer within a period of 84 days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of Sub-Clause 40.1, the Contractor may give notice to the Engineer requesting permission, within 28 days from the receipt thereof, to proceed with the Works or that part thereof in regard to which progress is suspended. If, within the said time, such permission is not granted, the Contractor may, but is not bound to, elect to treat the suspension, where it affects part only of the Works, as an omission of such part under Clause 51.1 to 51.2 by giving a further notice to the Engineer to that effect, or, where it affects the whole of the Works, treat the suspension as an event of default by the Employer and terminate his employment under the Contract in accordance with the provisions of Sub-Clause 69.1, whereupon the provisions of Sub-Clause 69.2 and 69.3 shall apply.

COMMENCEMENT AND DELAYS

41.1 Commencement of Works

The Contractor shall commence the Works as soon as is reasonably possible after the receipt by him of a notice to this effect from the Engineer, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceed with the works with due expedition and without delay.

42.1 Possession of Site and Access Thereto

Save insofar as the Contract may prescribe:

(a) the extent of portions of the Site of which the Contractor is to be given possession from time to time, and
(b) the order in which such portions shall be made available to the Contractor and subject to any requirement in the Contract as to the order in which the Works shall be executed,

The Employer will, with the Engineer's notice to commence the Works, give to the Contractor possession of

(c) so much of the Site, and

(d) such access as, in accordance with the Contract, is to be provided by the Employer,

as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause 14.1 to 14.4, if any, and otherwise in accordance with such reasonable proposals as the Contractor shall, by notice to the Engineer make. The Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with such programme or proposals, as the case may be.

(e) All water including rain water which may accumulate on the site during the progress of the works or in trenches or excavations, shall be removed promptly from the site to the satisfaction of engineer and at the cost of contractor.

42.2 Failure to Give Possession

If the Contractor suffers delay and/or incurs costs from failure on the part of the Employer to give possession in accordance with the terms of Sub-Clause 42.1, the Engineer shall, on the request of the contractor and submission of the details and documentary proof, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and

(b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly.

42.3 Wayleaves and Facilities

The Contractor shall bear all costs and charges for special or temporary wayleaves required by him in connection with access to Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works.
43.1 **Time for Completion**

The whole of the Works and, if applicable, any Section required to be completed within a particular time as stated in the Appendix to Tender, shall be completed, in accordance with the provisions of Clause 48.1 to 48.4, within the time stated in the Appendix to Tender for completion of the whole of the Works or the Section (as the case may be), calculated from the Commencement Date, or such extended time as may be allowed under Clause 44.1 to 44.3.

44.1 **Extension of Time for Completion**

In the event of

(a) the amount or nature of extra or additional work, or

(b) any cause of delay referred to in these Conditions by reference to clause 44.1 to 44.3, or

(c) exceptionally adverse climatic conditions, or

(d) any delay, impediment or prevention by the Employer, or

(e) other special circumstances which may occur, other than through a default of or breach of contract by the Contractor or for which he is responsible,

being such as fairly to entitle the contractor to extension of time for completion of the works or any section or part thereof, the Engineer shall after due consultation with the contractor, and subject to clause 44.2 determine the amount of such extension and shall notify the contractor accordingly.

44.2 **Contractor to Provide Notification and Detailed/Particulars**

The Engineer is not bound to make any determination under clause 44.1 unless the Contractor has

(a) within 28 days after such event has arisen notified the Engineer, and

(b) within 28 days, or such other reasonable time as may be agreed by the Engineer, after such notification submitted to the Engineer detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

44.3 **Interim Determination of Extension**

Provided also that where an event has continuing effect such that it is not practicable for the Contractor to submit detailed particulars within the period of 28 days referred to in Sub-Clause 44.2 (a), he shall nevertheless be entitled to an
extension of time provided that he has submitted to the Engineer interim particulars at intervals of not more than 28 days and final particulars within 28 days of the end of the effects resulting from the event. On receipt of such interim particulars, the Engineer shall, without undue delay, make an interim determination of extension of time and on receipt of the final particulars the Engineer shall review the circumstances and shall determine an overall extension of time in regard to the event in consultation with the Contractor and shall notify the Contractor of the determination. No final review shall result in a decrease of any extension of time already determined by the Engineer.

45.1 Restriction Working Hours

Subject to any provision to the contrary contained in the Contract, none of the Works shall save as hereinafter provided, be carried on during the night or on locally recognised days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer. Provided that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by multiple shift.

46.1 Rate of Progress

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to enable the contractor to complete the execution of and passing the tests on completion of the Works or such section by the time for completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as complete the execution of and passing the tests on completion of the Works or such section by the time for completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Clause, involve the employer in additional supervision costs, such costs shall, after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become to the Contractor and the Engineer shall notify the Contractor accordingly.

47.1 Liquidated Damages for Delay

If the Contractor fails to complete the execution of and passing the test on completion of the works or any section by the time for completion, in accordance with Clause 48.1 to 48.4, within the relevant time prescribed by Clause 43.1, then the Contractor shall pay to the Employer the relevant sum stated in the Appendix
to Tender (Appendix - B) as liquidated damages for such default and not as a penalty (which sum shall be the only monies due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant Time for Completion and the date stated in a Taking-Over Certificate of the whole of the Works or the relevant Section, subject to the applicable limit stated in the Appendix to Tender (Annexure - B). The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the contract.

47.2 Reduction of Liquidated Damages

If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking-Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the reminder of the Works or of that Section shall, for any period of delay after date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The Provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

48.1 Taking-Over Certificate

When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer, accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking-Over Certificate in respect of the Works. The Engineer shall, within 21 days of the date of delivery of such notice, either issue to the Contractor, a Taking-Over Certificate, stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work which in the Engineer's opinion, is required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such Taking-Over Certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

48.2 Taking-Over of Sections or Parts

Similarly, in accordance with the procedure set out in Sub-Clause 48.1, the Contractor may request and the Engineer shall issue a Taking-Over Certificate in
respect of:

(a) any Section in respect of which a separate Time for Completion is provided in the Appendix to Tender, or

(b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and, otherwise than as provided for in the Contract, occupied or used by the Employer, or

(c) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contract or has not been agreed by the Contractor as a temporary measure).

48.3 Substantial Completion of Parts

If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contract, the engineer may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of the whole of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defects Liability Period.

48.4 Surfaces Requiring Reinstatement

Provided that a Taking-Over Certificate given in respect of any Section or part of the Permanent Works before completion of the whole of the Works shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Taking-Over certificate shall expressly so state.

If the Contractor is prevented from carrying out the Tests on Completion by a cause for which the employer or the Engineer or other contractors employed by the Employer are responsible, the employer shall subject to clause 7.2 (b) be deemed to have taken over the Works on the date when the Tests on Completion would have been completed but for such prevention. The Engineer shall issue a Taking-Over Certificate accordingly. Provided always that the Works shall not be deemed to have be taken over if they are not substantially in accordance with the Contract.

If the Works are taken over under this Sub-Clause the Contractor shall nevertheless carry out the Tests on Completion during the Defects Liability Period. The Engineer shall require the Tests to be carried out by giving 14 days notice.

Any additional costs to which the Contractor may be put, in making the Tests on Completion during the Defects Liability Period, shall be added to the Contract.
DEFECTS LIABILITY

49.1 Defects Liability Period

In these Conditions the expression "Defects Liability Period" shall mean the defects liability period named in the Appendix to Tender, calculated from:

(a) the date of completion of the Works certified by the Engineer in accordance with Clause 48.1 to 48.4 or clause 63.1; or

(b) in the event of more than one certificate having been issued by the Engineer under Clause 48.1 to 48.4, the respective dates so certified.

49.2 Completion of Outstanding Work and Remedying Defects

To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall:

(a) complete the work, if any, outstanding on the date stated in Taking-Over Certificate as soon as practicable after such date and

(b) execute all such work of amendment, reconstruction, and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.

49.3 Cost of Remedying Defects

All work referred to in Sub-Clause 49.2 (b) shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the engineer, due to:

(a) the use of materials, Plant or workmanship not in accordance with the Contract, or

(b) where the Contractor is responsible for the design of part of the Permanent Works, any fault in such design, or

(c) the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.

If, in the opinion of the Engineer, such necessity is due to any other cause, he
shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly, with a copy to the Consultant.

49.4 **Contractor's Failure to Carry out Instructions**

In case of default on the part of the Contractor in carrying out such instruction within a reasonable time, the consultant shall be entitled to employ and pay other persons to carry out the same and if such work, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly.

The Provisions of this Clause shall apply to all replacements or renewals of Plant carried out by the Contractor to remedy defects and damages as if the replacements and renewals had been taken over on the date they were completed.

The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reason of a defect or damage. If only part of the Works is affected the Defects Liability Period shall be extended only for that part. In neither case shall the Defects Liability Period extend beyond 2 years from the date of taking over.

When the progress in respect of Plant has been suspended under clause 40.1 to 40.3, the Contractor's obligations under this Clause shall not apply to any defects occurring more than one year after the Time for Completion established on the date of the Letter of Acceptance.

50.1 **Contractor to Search**

If any defects, shrinkage or other fault in the Works appears at any time prior to the end of the Defects Liability Period, the Engineer may instruct the Contractor, to search under the directions of the Engineer for the cause thereof. Unless such defect, shrinkage or other fault is one for which the Contractor is liable under the Contract, the Engineer shall, after due consultation with the Contractor, determine the amount in respect of the costs of such search incurred by the Contractor, which shall be added to the Contract Price and shall notify the Contractor accordingly. If such defect, shrinkage or other fault is one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case remedy such defect, shrinkage or other fault at his own cost in accordance with the provisions of Clause 49.1 to 49.4.

**ALTERATIONS, ADDITIONS AND OMISSIONS**

51.1 **Variations**
The Engineer shall make any variation of the form, or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

(a) increase or decrease the quantity of any work included in the Contract,

(b) change the character or quality or kind of any such work.

(c) change the levels, lines, position and dimensions of any part of the Works,

(d) execute additional work of any kind necessary for the completion of the Works

(e) change any specified sequence or timing of construction of any part of the Works.

No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 52.1 to 52.4. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the contractor.

51.2 Instructions for Variations

The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities as per approved drawings issued for construction.

52.1 Valuation of Variations

All variations referred to in Clause 51.1 to 51.2 and any additions to the Contract Price which are required to be determined in accordance with Clause 52.1 to 52.4 (for the purposes of this Clause referred to as "varied works"), shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the Engineer with the Contractor, suitable rates or prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such rates or prices as are, in his opinion, appropriate based on CPWD norms and shall notify the Contractor accordingly. Until such time as rates or prices are agreed or fixed, the Engineer shall
determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.1 to 60.14.

52.2 Power of Engineer to Fix Rates

Provided that if the nature or amount of any varied work relative to the nature or amount of the whole of the Works or to any part thereof, is such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the Works is, by reason of such varied work, rendered inappropriate or inapplicable, then after due consultation by the Engineer with the Contractor, a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other rate or price as is, in his opinion, appropriate and shall notify the Contractor accordingly. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.1 to 60.14.

The quoted rates for all the items shall be firm, fixed and binding on the contractor irrespective of any variation of quantities stated in the contract upto ±50% variation of the contract value as a whole. In case the contract value varies beyond ±50%, the item rates of only those items whose individual quantities vary beyond ±50% of the quantities mentioned in the contract shall be considered for change in rates. The rates of such items shall be worked out on the basis of market rate analysis and only applicable to the quantities beyond ±50%. In the event of disagreement between the Engineer and the Contractor on these rates, the Engineer shall fix such rates and prices as are in his opinion appropriate and shall notify the Contractor accordingly. Provided also that no varied work instructed to be done by the Engineer pursuant to Clause 51.1 to 51.2 shall be valued under Sub-Clause 52.1, or under this Sub-Clause unless, within 14 days of the date of such instruction and, other than in the case of omitted work, before the commencement of the varied work, notice shall have been given either:

(a) by the Contractor to the Engineer of his intention to claim extra payment or a varied rate or price, or

(b) by the Engineer to the Contractor of his intention to vary a rate or price.

52.3 Variations Exceeding 50 percent

If, on the issue of the Taking-Over Certificate for the whole of the Works, it is found that as a result of:

(a) all varied work valued under Sub-Clause 52.1 and 52.2, and

(b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding Provisional Sums, dayworks and adjustments of price made under Clause 70.1 to 70.3,

but not from any other cause, there have been additions to or deductions
from the Contract Price which taken together are in excess of 50 percent of the "Effective Contract Price" (which for the purposes of this Sub-Clause shall mean the Contract Price, excluding Provisional Sums and allowance for day works, if any) then and in such event (subject to any action already taken under any other Sub-Clause of this Clause), after due consultation by the Engineer with the Employer and the Contractor, there shall be added to or deducted from the Contract Price such further sum as may be agreed between the Contractor and the Engineer or, failing agreement, determined by the Engineer as being fair and reasonable having regard to the Contractor's Site and general overhead costs of the Contract. The Engineer shall notify the Contractor of any determination made under this Sub-Clause. Such sum shall be based only on the amount by which such additions or deductions shall be in excess of 50 per cent of the Effective Contract Price.

52.4 Daywork

The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on a daywork basis. The Contractor shall then be paid for such varied work under the terms set out in the daywork schedule included in the Contract and at the rates and prices affixed thereto by him in the Tender.

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to prove the amounts paid and, before ordering materials, shall submit to the Engineer quotations for the same for his approval.

In respect of such of the Works executed on a daywork basis, the Contractor shall, during the continuance of such work, deliver each day to the Engineer an exact list in duplicate of the names, occupation and time of all workmen employed on such work and a statement, also in duplicate, showing the description and quantity of all materials and Contractor's Equipment used thereon or therefor other than Contractor's Equipment which is included in the percentage addition in accordance with such daywork schedule. One copy of each list and statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor.

At the end of each month the Contractor shall deliver to the Engineer a priced statement of the labour, materials and Contractor's Equipment, except as aforesaid, used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer considers that for any reason the sending of such lists or statements by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorise payment for such work, either as daywork, or being satisfied as to the time employed and the labour, materials and Contractor's Equipment used on such work, or at such value therefor as shall, in his opinion, be fair and reasonable.
PROCEDURE FOR CLAIMS

53.1 Notice of Claims

Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any clause of these Conditions or otherwise, he shall give notice of his intention to the Engineer, within 28 days after the event giving rise to the claim has first arisen.

53.2 Contemporary Records

Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, on receipt of a notice under Sub-Clause 53.1, inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

53.3 Substantiation of Claims

Within 28 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonable require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effect resulting from the event. The Contractor shall, if required by the Engineer so to do, copy to the Employer all accounts sent to the Engineer pursuant to this Sub-Clause.

53.4 Failure to Comply

If the Contractor fails to comply with any of the provisions of this Clause in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer or any arbitrator or arbitrators appointed pursuant to Sub-Clause 67.3 assessing the claim considers to be verified by contemporary records (whether or not such records were brought to the Engineer's notice as required under Sub-Clause 53.2 and 53.3).
53.5 Payment of Claims

The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to Clause 60.1 to 60.14 such amount in respect of any claim as the Engineer, after due consultation with the Contractor, may consider due to the Contractor provide that the Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient particulars to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor for any determination made under this Sub-Clause.

CONTRACTOR'S EQUIPMENT, TEMPORARY WORKS AND MATERIALS

54.1 Contractor's Equipment, Temporary Works and Materials, Exclusive use for the Works

All Contractor's Equipment Temporary Works and materials by the Contractor shall when brought on to the site, be deemed to be exclusively intended for the execution of the works and the contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent of the Engineer. provided that consent shall not be required for vehicles engaged in transporting any staff labour, contractor's equipment, temporary works, plant or materials to or from the site.

54.2 Employer Not Liable for Damage

The Employer shall not at any time be liable, save as mentioned in Clauses 20.1 to 20.4 and 65.1 to 65.8, for the loss of or damage to any of the said Contractor's Equipment, Temporary Works or materials.

54.3 Customs Clearance

The Employer will use his best endeavours in assisting the Contractor, where required, in obtaining clearance through the Customs of Contractor's Equipment, materials and other things required for the Works.

54.4 Re-export of Contractor's Equipment

In respect of any Contractor's Equipment which the Contractor has imported for the purposes of the Works, the Employer will use his best endeavours to assist the Contractor, where required, in procuring any necessary Government consent to the re-export of such Contractor's Equipment by the Contractor upon the removal thereof pursuant to the terms of the Contract.
54.5 **Conditions of Hire Contractor's Equipment**

With a view to securing, in the event of termination under Clause 63.1 to 63.4, the continued availability, for the purpose of executing the Works, of any hired Contractor's Equipment, the Contractor shall not bring on to the Site any hired Contractor's Equipment unless there is an agreement for the hire thereof (which agreement shall be deemed not to include an agreement for hire purchase) which contains a provision that the owner thereof will, on request in writing made by the Employer within 7 days after the date on which any termination has become effective, and on the Employer undertaking to pay all hire charges in respect thereof from such date, hire such Contractor's Equipment to the Employer on the same terms in all respects as the same was hired to the Contractor save that the Employer shall be entitled to permit the use thereof by any other contractor employed by him for the purpose of execution and completion the Works and remediing any defects therein, under the terms of the said Clause 63.1 to 63.4.

54.6 **Costs for the Purpose of Clause - 63.1 to 63.4**

In the event of the employer entering into any agreement for the hire of contractor's equipment pursuant to Sub-Clause 54.5, all sums properly paid by the employer under the provisions of any such agreement and all costs incurred by him (Including stamps duties) in entering into such agreement shall be deemed, for the purpose of clause 63.1 to 63.4, to be part of the cost of executing and completing the works and the remediing of any defects therein.

54.7 **Corporation of Clause in Sub-contracts**

The contractor shall, where entering into any subcontract for execution of any part of the works, incorporate in such subcontract(by reference or other wise) the provisions of this Clause in relation to Contractor's Equipment, Temporary Works or Materials brought on to the Site by the Subcontractor.

54.8 **Approval of Material not Implied**

The operation of this clause shall not be deemed to imply any approval by the engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any materials at any time by the Engineer.

**MEASUREMENT**

55.1 **Quantities**

The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfilment of his obligations under the
56.1 Works to be Measured

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the works in accordance with the Contract and the Contractor shall be paid that value in accordance with clause 60.1 to 60.14. The Engineer shall, when he requires any part of the Works to be measured, give reasonable notice to the Contractor's agent, who shall:

(a) forthwith attend or send a qualified representative to assist the Engineer in making such measurement, and

(b) supply all particulars required by the Engineer

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works. For the purpose of measuring such Permanent Works as are to be measured by records and drawings, the Engineer shall prepare records and drawings as the work proceeds and the Contractor, as and when called upon to do so in writing, shall, within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If the Contractor does not attend to examine such records and drawings and the Contractor does not agree such records and drawings, they shall be taken to be Correct. If, after examination of such records and drawings, the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawings are claimed by him to be incorrect. On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

57.1 Method of Measurement

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

57.2 Breakdown of Lumpsum Items

For the purposes of statements submitted in accordance with Sub-Clause 60.1, the Contractor shall submit to the Engineer, within 28 days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Tender. Such breakdowns shall subject to the approval of the Engineer.
PROVISIONAL SUMS

58.1 Definition of "Provisional Sum"

"Provisional Sums" means a sum included in the Contract and so designated in the Bill of Quantities for the execution of any part of the Works or for the supply of goods, materials, Plant or services, or for contingencies, which sum may be used, in whole or in part, or not at all, on the instruction of the Engineer. The Contractor shall be entitled to only such amounts in respect of the work, supply or contingencies to which such Provisional Sums relate as the Engineer shall determine in accordance with the Clause. The Engineer shall notify the Contractor of any determination made under this Sub-clause.

58.2 Use of Provisional Sums

In respect of every Provisional Sum the Engineer shall have authority to issue instructions for the execution of works or for the supply of goods, materials, Plant or services by:

(a) the Contractor, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 52.1 to 52.4.

(b) a nominated Subcontractor, as hereinafter defined, in which case the sum to be paid to the Contractor therefor shall be determined and paid in accordance with Sub-Clause 59.4.

58.3 Production of Vouchers

The Contractor shall produce to the Engineer all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums, except where work is valued in accordance with rates or prices set out in the Tender.

NOMINATED SUBCONTRACTORS

59.1 Definition of "Nominated Subcontractors"

All specialists, merchants, tradesmen and others executing any work or supplying any goods, materials, Plant or services for which Provisional Sums are included in the Contract, who may have been or be nominated or selected or approved by the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to subcontract shall, in the execution of such work or the supply of such goods, materials, Plant or services, be deemed to be subcontractors to the Contractor and are referred to in the Contract as "nominated Subcontractors".
59.2 Nominated Subcontractors; Objection to Nomination

The Contractor shall not be required by the Employer or the Engineer, or be deemed to be under any obligation, to employ any nominated Subcontractor against whom the Contractor may raise reasonable objection, or who declines to enter into a subcontract with the Contractor containing provision:

(a) that in respect of work, goods, materials, Plant or services the subject of the subcontract, the nominated Subcontractor will undertake towards the Contractor such obligations and liabilities as will enable the Contractor to discharge his own obligations and liabilities towards the Employer under the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities; and

(b) that the nominated Subcontractor will save harmless and indemnify the Contractor from and against any negligence by the nominated Subcontractor, his agents, workmen and servants and from and against any misuse by him or them of any Temporary Works provided by the Contractor for the purpose of the Contract and from all claims as aforesaid; and

(c) approved by the Engineer.

59.3 Design Requirements to be Expressly Stated

If in connection with any Provisional Sums the services to be provided include any matter of design or specification of any part of the Permanent Works or of any Plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Subcontract. The nominated Subcontract shall specify that the nominated Subcontractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities.

59.4 Payments to Nominated Subcontractors

For all work executed or goods, material, Plant or services supplied by any nominated Subcontractor, the contractor shall be entitled to:

(a) the actual price paid or due to be paid by the Contractor, on the instructions of the Engineer, and in accordance with the Subcontract;
(b) in respect of labour supplied by the Contractor, the sum if any, entered in the Bill of Quantities or, if instructed by the Engineer pursuant to paragraph (a) of Sub-clause 58.2, as may be determined in accordance with Clause 52.1 to 52.4;

(c) in respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provisions has been made in the Bill of Qualities for a rate to be set against the relevant Provisional Sum, at the rate inserted by the Contractor against that item or, where no such provision has been made, at the rate inserted by the Contractor in the Appendix to Tender and repeated where provision for such is made in a special item provided in the Bill of Quantities for such purpose.

59.5 Certificates of Payments to Nominated Subcontractors

Before issuing, under Clause 60.1 to 60.14, any certificate, which includes any payment in respect of work done or goods, materials, Plants or services supplied by any nominated Subcontractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials, Plant or services of such nominated Subcontractor have been paid or discharged by the Contractor. If the Contractor fails to supply such proof then, unless the Contractor:

(a) satisfies the Engineer in writing that he has reasonable cause for withholding or refusing to make such payments and

(b) produces to the Engineer reasonable proof that he has so informed such nominated Subcontractor in writing,

the Employer shall be entitled to pay to such nominated Subcontractor direct, upon the certificate of the Engineer, all payments, less retentions, provided for in the nominated Subcontractor and to deduct by way of set-off the amount so paid by the Employer from any sums due or to become due from the Employer to the Contractor.

Provided that, where the Engineer has certified and the Employer has paid direct as aforesaid, the Engineer shall, in issuing any further certificate in favour of the Contractor, deduct from the amount so paid, direct as foresaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

CERTIFICATES AND PAYMENTS

60.1 Monthly Statements
The Contractor shall submit a statement in 3 copies to the Engineer by 7th day of each month for the work executed up to the end of previous month in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. The statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

(a) The estimated contract value of the Temporary and Permanent Works executed up to the end of the month in question, at base unit rates and prices.

(b) The actual value certified for payment for the Temporary and Permanent Works executed up to the end of the previous month, at base unit rates and prices.

(c) The estimated contract value at base unit rates and prices of the Temporary and Permanent Works for the month in question, obtained by deducting (b) from (a);

(d) The value of any variations executed up to the end of the month in question, less the amount certified in the previous Interim Payment Certificate, pursuant to Clause 52.1 to 52.4;

(e) Amounts approved in respect of Daywork executed up to the end of the month in question, less the amount for Daywork certified in the previous Interim Payment Certificate determined from the Day work Schedule of the Bill of Quantities.

(f) Amounts reflecting changes in cost and legislation, pursuant to Clause 70.1 to 70.3.

(g) Any credit or debit for the month in question in respect of materials and Plant for the Permanent Works, under the conditions set forth in Sub-Clause 60.3;

(h) Any amount to be withheld under the retention provisions of Sub-Clause 60.5, determined by applying the percentage set forth in Sub-Clause 60.5 to the amounts due under paragraphs 60.1(c), (e), (f) and (g);

(i) Any amounts to be deducted as repayment of the Advance under the provisions of sub-Clause 60.7; and

(j) Any other sum, to which the Contractor may be entitled under the contract.

(k) 75% of the value of materials delivered to the site for permanent works on signing of the Indenture for secured advance format of which is enclosed at Annexure - A.

(l) The amount to be deducted towards the advance income tax shall be at the rate of two percent and the advance works contract tax at the rate of
nil percent or as per the statutory requirements in this regard.

60.2 **Monthly Payments**

The said statement shall be approved / amended by the Engineer in such a way that, in his opinion, it reflects the amounts due to the Contractor in accordance with the Contract, after deduction, other than pursuant to Clause 47.1 to 47.2, of any sums which may have become due and payable by the Contractor to the Employer. In cases where there is a difference of opinion as to the value of any item, the Engineer's view shall prevail. Within the 7th day of the month following the receipt of the monthly statement referred to in Sub-Clause 60.1, the Engineer shall determine the amounts due to the Contractor and shall issue to the Contractor a certificate herein called "Interim Payment Certificate", certifying the amounts due to the contractor.

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment until the performance security has been provided by the Contractor and approved by the consultant.

60.3 **Materials and Plant for the Permanent Works**

With respect to materials and Plant brought by the Contractor to the Site for incorporation in the Permanent Works, the Contractor shall (i) receive a credit in the month in which these materials and Plant are brought to the site and (ii) be charged a debit in the month in which they are incorporated in the Permanent Works, both such credit and debit to be determined by the engineer in accordance with the following provisions:

(a) no credit shall be given unless the following conditions shall have been met to the Engineer's satisfaction:

i) the materials and Plant are in accordance with specifications for the Works;

ii) the materials and Plant have been delivered to the Site and are properly stored and protected against loss, damage or deterioration;

iii) the Contractor's records of the requirements, order, receipts and use of materials and Plant are kept in a form approved by the engineer, and such records are available for inspection by the Engineer.

iv) the Contractor has submitted a statement of his cost of acquiring and delivering the materials and Plant to the site, together with such documents as may be required for the purpose of evidencing such cost; and
(b) the amount to be credited to the Contractor shall be equivalent of 75 percent of the Contractor's reasonable cost of the materials and Plant delivered to the Site, as determined by the Engineer after review of the documents listed in paragraph (a) (iv) above, as determined by the Engineer;

(c) the amount to be debited to the Contractor for any materials and Plant incorporated into the Permanent Works shall be equivalent to the credit previously granted to the contractor for such materials and Plant pursuant to Sub-Clause(b) above, as determined by the Engineer.

60.4 Place of Payments

Payments to the Contractor by the consultant shall be made in Indian Rupees into a bank account or accounts nominated by the Contractor or by account payee cheque.

60.5 Retention Money

A retention amounting to 10 (Ten) percent of the amounts, determined in accordance with the procedure set out in Sub-Clause 60.1 (h) shall be made by the Engineer in the first and following Interim Payment Certificates, until the amount so retained reaches a limit of retention money (5% of Contract Price) as stated in the Appendix to Tender (Annexure - B).

60.6 Payment of Retention Money

(a) Upon the issue of the Taking-Over Certificate with respect to the whole of the Works, one half of the Retention Money, or upon the issue of a Taking-Over Certificate with respect to a Section or part of the Permanent Works only such proportion thereof as the Engineer determines having regard to the relative value of such Section or part of the Permanent Works, shall be certified by the Engineer for payment to the Contractor.

(b) upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defects Liability Periods having become applicable to different Sections or parts of the Permanent Works pursuant to Clause 48.1 to 48.4, the expression "expiration of the Defects Liability period" shall, for the purposes of this Sub-Clause, be deemed to mean the expiration of the latest of such periods. Provided also that if at such time, there shall remain to be executed by the Contractor any work ordered, pursuant to Clauses 49.1 to 49.4. and 50.1, in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed.
60.7 **Advance Payment**

(a) Deleted

(b) Deleted

(c) Deleted

60.8 **Time of Payment**

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 47.1 to 47.2, be paid by the Employer to the Contractor within 30 days after the Contractor's monthly statement has been submitted to the Engineer for certification or, in the case of the Final Certificate pursuant to Sub-Clause 60.13, within 120 days after the agreed Final Statement and written discharge have been submitted to the Engineer for certification.

60.9 **Correction of Certificates**

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim payment Certificate which has been issued by him, and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.

60.10 **Statement of Completion**

Not later than 84 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer a Statement of Completion with supporting documents showing in detail, in the form approved by the Engineer.

(a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over Certificate;

(b) any further sums which the Contractor considers to be due; and

(c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

Estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall certify payment in accordance with Sub-Clause 60.2 as if the statement of completion were a statement submitted by the contractor under clause 60.1.

60.11 **Final Statement**
Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration a draft final statement with supporting documents showing in detail, in the form approved by the Engineer.

(a) the value of all work done in accordance with the Contract; and

(b) any further sums which the Contractor considers to be due to him under the Contract.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the engineer shall issue an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 67.1 to 67.4. The Final Statement shall be agreed upon settlement of the dispute.

60.12 Discharge

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the contract. Provided that such discharge shall become effective only after payment due under the Final Certificate issued pursuant to Sub-Clause 60.13 has been made and the performance security referred to in Sub-Clause 10.1 has been returned to the Contractor.

60.13 Final Certificate

Within 28 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the employer (with a copy to the Contractor) a Final Certificate stating:

(a) the amount which, in the opinion of the Engineer, is finally due under the Contract, and

(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled under the Contract, other than Clause 47.1 to 47.2, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the
case may be.

60.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters of things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.10.

61.1 Defects Liability Certificate

The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete Works and remedy any defects therein to the Engineer's satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different sections or part of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Clause 49.1 to 49.4 and 50.1, have been completed to the satisfaction of the Engineer. Provided that the issue of the Defects Liability Certificate shall not be condition precedent to payment to the Contractor of the second portion of the Retention Money in accordance with the conditions set out in Sub-Clause 60.3.

62.1 Unfulfilled Obligations

Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfilment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time such Defects Liability Certificate is issued and, for the purpose of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.

REMEDIES

63.1 Default of Contractor

If the Contractor is deemed by law unable to pay his debts as they fall due, or enters into voluntary or involuntary bankrupt, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or becomes insolvent, or makes an arrangement with, or assignment in favour of, his creditors or agrees to carry out the Contract under a committee of inspection of his creditors, or if a receiver, administrator, trustee or liquidator is appointed
over any substantial part of his assets, or if, under any law or regulation relating to reorganisation, arrangement or readjustment of debts proceedings are commenced against the Contractor or resolution passed in connection with dissolution or liquidation or, if any, step are taken to enforce any security interest over a substantial part of the assets of the Contractor, or if, any act is done or event occurs with respect to the Contractor or his assets which under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened Sub-Clause 3.1, or has an execution levied on his goods, or if the Engineer certifies to the Employer, with a copy to the Contractor, that, in his opinion the contractor

(a) has repudiated the Contract, or

(b) without reasonable excuse has failed

(i) to commence the work in accordance with Sub-Clause 41.1, or

(ii) to proceed with the Works, or any section thereof, within 28 days after receiving notice to pursuant to Sub-Clause 46.1, or

(c) has failed to comply with a notice issued pursuant to Sub-Clause 37.4, or an instruction issued pursuant to Sub-Clause 39.1 within 28 days after receiving it, or

(d) despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of the obligation under the Contract, or

(e) has contravened Sub-clause 4.1:

then for the avoidance of doubt the contractor shall be in default of its obligations under this contract and furthermore the Employer may, after giving fourteen days' notice to the Contractor, enter upon the Site and expel the Contractor there from without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Engineer shall certify such completion so as to give effect to clauses 49.1(a) and 63.3. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Plant, Temporary Works and materials which have been deemed to be reserved exclusively for the execution of the Works, under provisions of the Contract, as he or they may think proper, and the Employer may, at any time, sell any of the said Contractor's Equipment, Temporary Works and unused Plant and materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract.
63.2 Valuation at Date of Expulsion

The Engineer, as soon as may be practicable after any such entry and expulsion by the Employer, shall fix and determine ex parte, or by or after reference to the parties or after such investigation or enquiries as he may think fit to make or institute, and shall certify:

(a) what amount (if any) had, at the time of such entry and expulsion, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and

(b) the value of any of the said unused or partially used materials, any Contractor's Equipment and any Temporary Works.

63.3 Payments after Expulsion

If the Employer shall enter upon the site and expel the Contractor therefrom under Clause 63.1, he shall not be liable to pay to the Contractor any further amount (including damages) in respect of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution completion and remedying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Engineer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum (if any) as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

63.4 Assignment of Benefit of Agreement

Unless prohibited by law, the Contractor shall, if so instructed by the Engineer within 14 days of such entry and expulsion referred to in Sub-Clause 63.1, assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purpose of the Contract, which the Contractor may have entered into.

64.1 Urgent Remedial Works

If, by reason of any accident, or failure, or other event occurring to or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Defects Liability Period, any remedial or other work is, in the opinion of the Engineer, urgently necessary for the safety or progress of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other person to carry out such work as the Engineer may consider necessary. If the work or repair so done by the
Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the contract, then all costs consequent thereon or incidental thereto shall after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Engineer, and may be deducted by the employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly. Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable notify the Contractor thereof.

**SPECIAL RISKS**

65.1 No Liability for Special Risks

The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in Sub-Clause 65.2 whether by way of indemnity or otherwise, for or in respect of:

(a) destruction of or damage to the "Works", save to work condemned under the provisions of Clause 39.1 to 39.2 prior to the occurrence of any of the said special risks, or

(b) destruction of or damage to property, whether of the employer or third parties, or

(c) injury or loss of life.

65.2 Special Risks

The special risks are:

(a) the risks defined under paragraphs (a) sub-para (i), (ii), (iii) and (iv) of Sub-Clause 20.4.

65.3 Damage to Works by Specials Risks

If the Works or any materials or Plant on or near or in transit to the Site, or any of the Contractor's Equipment, sustain destruction or damage by reason of any of the said special risks, the Contractor shall be entitled to payment in accordance with the Contract for any Permanent Works duly executed and for any materials or Plant so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for the completion of the Works, to payment for:

(a) rectifying any such destruction or damage to the Works, and

(b) replacing or rectifying such materials or contractor's Equipment and the Engineer shall determine an addition to the Contract Price in accordance
with Clause 52.1 to 52.4 (which shall be the case of the cost of replacement of Contractor's Equipment include the fair market value thereof as determined by the Engineer) and shall notify the Contractor accordingly, with a copy to the Employer.

65.4 Projectile, Missile

Destruction, damage, injury or loss of life caused by the explosion or impact, whenever and wherever occurring, or any mine, bomb, shell, grenade, or other projectile, missile, munition, or explosive of war, shall be deemed to be a consequence of the said special risks.

65.5 Increased Costs arising from Special Risks

Save to the extent that the Contractor is entitled to payment under any other provision of the Contract, the Employer shall repay to the Contractor any costs of the execution of the Works (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39.1 to 39.2 prior to the occurrence of any special risk) which are howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall, as soon as any such cost comes to his knowledge, forthwith notify the Engineer thereof. The Engineer shall, after due consultation with the Contractor, determine the amount of the contractor's costs in respect thereof which shall be added to the Contract Price and shall notify the Contractor accordingly.

65.6 Outbreak of War

If, during the currency of the Contract, there is an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavours to complete the execution of the Works. Provided that the employer shall be entitled, at any time after such outbreak of war, to terminate the Contract by giving notice to the Contractor and, upon such notice being given, the Contract shall, except as to the rights of the parties under this Clause and to the operation of Clause 67.1 to 67.4, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

65.7 Removal of Contractor's Equipment on Termination
If the Contract is terminated under the provision of Sub-Clause 65.6, the Contractor shall with all reasonable dispatch, remove from the Site all Contractor's Equipment and shall give similar facilities to his Subcontractors to do so.

65.8 Payment if Contract Terminated

If the Contract is terminated as aforesaid, the Contractor shall be paid by the Employer insofar as such amounts or items have not already been covered by payments account made to the Contractor, for all work executed prior to the date of termination at the rates and prices provided in the contract and in addition:

a) The amounts payable in respect of any preliminary items referred to in the Bill of Quantities, so far as the Work or service comprised therein has been partially carried out or performed.

b) The cost of materials, plant or goods reasonably ordered for the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials, Plant or goods becoming the property of the Employer upon such payments being made by him.

c) A sum being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure has not been covered by any other payments referred to in this Sub-Clause.

d) Any additional sum payable under the provisions of Sub-Clauses 65.3 and 65.5.

e) Such proportion of the cost as may be reasonable, taking into account payments made or to be made, for work executed, or removal of contractor's equipment under Sub- Clause 65.7 and, if required by the Contractor, return thereof to the Contract's main plant yard in his country of registration or to other destination, at no greater cost.

f) The reasonable cost of repatriation of all the Contractor's staff and workmen employed on or in connection with the Works at the time of such termination.

Provided that against any payment due from the Employer under this Sub-Clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Contractor's Equipment, materials and Plant and any other sums which, at the date of termination, were recoverable by the employer from the Contractor under the terms of the Contract. Any sums payable under this Sub-Clause shall, after due consultation with the Employer and the Contractor, be determined by the Engineer who shall notify the Contractor accordingly.
RELEASE FROM PERFORMANCE

66.1 Payment in Event of Release from Performance

If any circumstance outside the control of both parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either party to fulfil his contractual obligations, or under the law governing the Contract the parties are released from further performance, then the sum payable by the employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under Clause 65.8 if the Contract had been terminated under the provisions of Clause 65.6.

SETTLEMENT OF DISPUTES

67.1 Engineer's Decision

If a dispute of any kind whatsoever arise between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. Not later than the eighty-fourth day after the day on which he received such reference the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Work with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the eighty fourth day after the day on which he received the reference, then either the Employer or the Contractor may, on or before the seventieth day after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of 84 days expired, as the case may be give notice to the other party, with a copy for information to the Engineer of his intention to commence arbitration as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 67.4, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the
Employer and the Contractor and no notice of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the seventieth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

67.2 Conciliation

Where notice of intention to commence arbitration as to dispute has been given in accordance with Sub Clause 67.1, arbitration of such dispute shall not be commenced unless the parties have explored the possibility of conciliation as per the provisions of Part-III of the Arbitration and Conciliation Act, 1996. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

67.3 Arbitration

67.3.1 Any dispute and differences relating to the meaning of the specifications, designs, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof in respect of which:

a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub Clause 67.1 and

b) Conciliation has not been reached as per the provisions of Clause 67.2

Shall be referred to the Sole Arbitration of a person appointed by the Chairman and Managing Director (CMD) of HSCC (I) Ltd. from the panel of Arbitrators approved by All India Institute of Medical Sciences, Ansari Nagar, New Delhi. Such Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of Arbitration duly satisfying the requirements of this clause.

67.3.2 If the Arbitrator so appointed resigns his appointment, is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman and Managing Director aforesaid or in his absence the person discharging the duties of CMD of HSCC (I) Ltd. may appoint a new Arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new Arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

67.3.3 It is a term of the contract that the party invoking the Arbitration shall specify the dispute/differences or questions to be referred to the arbitrator under this clause together with the amounts claimed in respect of each dispute.

67.3.4 The Arbitrator may proceed with the Arbitration ex-parte, if either party, in spite
of a notice from the Arbitrator, fails to take part in the proceedings.

67.3.5 The work under the contract shall continue, if required, during the Arbitration proceedings.

67.3.6 The Arbitrator shall make speaking Award and give reasons for his decision in respect of each dispute/claim alongwith the sums awarded separately on each individual item of dispute or difference or claims. The Arbitrator shall make separate award on each reference made to him.

67.3.7 The award of the Arbitrator shall be final, conclusive and binding on both the parties.

67.3.8 Subject to the aforesaid, the provisions of the Arbitration & Conciliation Act, 1996 or any statutory modifications or re-enactment thereof and the Rules made thereunder and for the time being in force shall apply to the Arbitration proceedings and Arbitrator shall publish his Award accordingly.

67.4 Failure to Comply With Engineer's Decision

Where neither the Employer nor the contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 67.1 and the related decision has become final and binding either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with sub-Clause 67.3 as if the conditions specified in clauses 67.3(a) and (b) had been satisfied with respect to such dispute. The provisions of Sub-Clause 67.1 shall not apply to any such reference.

NOTICES

68.1 Notice to Contractor

All certificates, notices or instructions to be given to the Contractor by the Employer or the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the Contractor's principal place of business or such other address as the Contractor shall nominate for the purpose.

68.2 Notice to Employer and Engineer

Any notice to be given to the Employer or to the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the respective addresses nominated for the purpose in part II of these Conditions.

68.3 Change of Address

Either party may change a nominated address to another address in the Country where the Works are being executed by prior notice to the other party, with a
copy to the Engineer, and the Engineer may do so by prior notice to both parties.

DEFAULT OF EMPLOYER

69.1 Default of Employer

In the event of the Employer:

a) becoming bankrupt or being a company, going into liquidation, other than for the purpose of a scheme of reconstruction or amalgamation, or

b) giving notice to the Contractor that for unforeseen reasons, due to economic dislocation, it is impossible for him to continue to meet his contractual obligations, or

c) if the contractor becomes entitled under Sub-Clause 40.3 to terminate his employment under the contract in accordance with the provisions of this Sub-Clause,

the Contractor shall be entitled to terminate his employment under the contract by giving notice to the Employer, with a copy to the Engineer. Such termination shall take effect 14 days after the giving of the notice.

69.2 Removal of Contractor's Equipment

Upon the expiry of the 14 days notice referred to in Sub-Clause 69.1 the Contractor shall notwithstanding the provisions of Sub-Clause 54.1, with all reasonable despatch, remove from the site all contractor's equipment brought by him thereon.

69.3 Payment on Termination

In the event of such termination the employer shall be under the same obligations to the contractor in regard to payment as if the contract has been terminated under the provisions of clause 65.6, but, in addition to the payments specified in Sub-Clause 65.8 the Employer shall pay to the Contractor the amount of any loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.

69.4 Contractor's Entitlement to suspend Works

Without prejudice to the Contractor's entitlement to interest under Sub-Clause 60.8 and to terminate under Sub-Clause 69.1, the Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the Engineer within 28 days after the expiry of the time stated in Sub-Clause 60.8
within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 28 days' prior notice to the Employer, with a copy to the Engineer, suspend work or reduce the rate of work.

If the contractor suspends work or reduces the rate of work in accordance with the provisions of this Sub-Clause and thereby suffers delay or incurs cost the Engineer shall after due consultation with the Contractor, determine

a) any extension of time to which the contractor is entitled under clause 44.1 to 44.3, and

b) the amount of such costs, which shall be added to the contract price.

And shall notify the Contractor accordingly.

**CHANGES IN COST AND LEGISLATION**

70.1 *Increase or Decrease of Cost*

It shall be added to or deducted from the Contract price such sums in respect of rise or fall in the cost of labour and/ or materials or any other matters affecting the cost of the execution of the works as may be determined in accordance with part II of these conditions.

70.2 *Subsequent Legislation*
If, after the date 28 days prior to the latest date for submission of tenders for the Contract there occur in the country in which the works are being or are to be executed changes to any National or State Statute Ordinance Decree or other Law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such State Statute, Ordinance, Decree, Law, regulation or bye-law which causes additional or reduced cost to the contractor other than under sub-clause 70.1 in the execution of the Contract, such additional or reduced cost shall after due consultation with the employer and the Contractor be determined by the Engineer and shall be added to or deducted from the contract price and the engineer shall notify the Contractor accordingly.

70.3 Other Changes in Cost

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

71.1 Engineer's Authority to Correct Errors

The Engineer shall at the request of either or both parties, or at his own initiative, subject to the provisions of this subclause and with retrospective effect from the date of this Contract have authority to make a determination correcting any manifest error (including for the avoidance of doubt and without prejudice to the generality of the Engineer's authority in this regard any error of spelling, grammar or punctuation and any omission, inclusion or misplacement of text) in any provision of this Contract Provided always that:

(a) The Engineer before making such determination shall by notice to the Employer and the Contractor provide them with a draft thereof and give them a reasonable time in which to comment on the draft.

(b) The Engineer shall in making such determination take into consideration the presumed intentions of the parties, the wording of any provision of the Conditions of Contract for use in connection with Works of Civil Engineering Construction Fifth Edition (June 1973) (Revised January 1979) ("the ICE Conditions of Contract") or of any other standard form of contract upon which the provision to be corrected has been based, and any comments received by the Employer and/or the Contractor on the draft determination provided to them under subclause (a) of this clause.

(c) The Engineer shall provide the Employer and the Contractor with a copy of the determination made by him and

(d) Clause 67.1 to 67.4 shall for the avoidance of doubt apply to any dispute between the Employer and the Contractor in connection with or arising out of the Engineer's determination.

ANNEXURE - A
PROFORMA OF
INDENTURE FOR SECURED ADVANCE OR CREDIT

THIS INDENTURE made this day of __________________________ between
M/s. ________________________________________ (hereinafter called the Contractor) which expression shall where the Context as admits or implies be deemed to include his executors/ administrators and assigns of the one part and AIIMS, New Delhi (hereinafter called the Employer/Engineer) which expression shall where the context so admits or implies be deemed to include its successors and assigns of the other part.

Whereas by an agreement dated __________ (hereinafter called the said agreement) the Contractor has agreed to construct ________ ( the works or the said works).

And whereas the Contractor has applied to the Engineer that he may be or be given credited for materials brought by him to the site of the works subject to the said agreement for use in construction of the works.

NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rs. __________ paid to the Contractor by The Engineer. The receipt where the Contractor hereby acknowledges and of such advance or credited (if any) as may be made to him as aforesaid the Contractor hereby covenants and agrees with The Engineer and declares as follows :-

1. That all sums given as advance or credit by The Engineer to the Contractor as aforesaid shall be employed by the Contractor in or towards the execution of the said works and for no other purpose whatsoever.

2. That the materials for which the advance or credit is given are offered to and accepted by The Engineer as security and are absolutely the Contractor's own property and free from encumbrances of any kind and the Contractor will not make any application for or receive further advance or credit on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor shall indemnify The Engineer against any claims to any materials in respect of which advance or credit has been made to him as aforesaid.

3. That the said materials and all other materials on the security of which any further advance or advances or credit may be given as aforesaid
(hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of The Engineer and in terms of said agreement.

4. That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper safe custody and protection against all risks of the said materials and that until used in the construction as aforesaid the materials shall remain at the site of the said works in Contractor's custody and on his own responsibility and shall at all times be open to inspection by The Engineer. In the event of the materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in greater degree than in due to reasonable use and wear thereof the Contractor will replace the same with other materials of like quality or repair and make good the same as required by The Engineer.

5. That the said materials shall not on any account be removed from the site of the work except with the written permission of The Engineer.

6. That the advance shall be repayable in full when or before Contractor receives payments from The Engineer of the price payable to him for the said works under the terms and provisions of the said agreements. Provided that if any intermediate payments are made to the Contractor on account of work done then on the occasion of each payment The Engineer will be at liberty to make a recovery from the Contractor's bill for such payments by deducting there from the value of the said materials than actually used in the contraction and in respect of which recovery has not been made previously. The value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advance as made under these presents were calculated.

7. That if the Contractor shall at any time make any default in the performance of observance in respect of any of the terms and provisions of the said agreement or of those provisions the total amount of the advance or advances that may still be owing to The Engineer, shall immediately on the happening of such default be repayable by the Contractor to The Engineer together with interest thereon at 12% per annum from the date or respective dates of such advance or advances to the date of payment and with all costs. Damages and expenses incurred by The Engineer in or for the recovery hereof or the enforcement of the security or otherwise by reasons of default of the Contractor and the Contractor hereby covenants and agrees with The Engineer repay and pay the same respective to him accordingly.
8. That the Contractor hereby charges all the said materials with the repayment to The Engineer of all sums advances or credit as aforesaid and all costs. Charges, damages and expenses payable under these presents PROVIDED ALWAYS it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith. The Engineer may at any time thereafter adopt all or any of the following courses as he may deem best:

   a. Seize and utilise the said materials or any part thereof in the completion of the said works in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advance or credit under these presents and crediting the Contractor with the value of work done as if he has carried it out in accordance with the said agreement and the rates thereby provided if the balance is against the Contractor is to pay the same to The Engineer on demand.

   b. Remove and sell by public auction the seized materials or any part thereof and out of the money arising from the sale repay The Engineer under these presents and pay over the surplus (if any) to the Contractor.

   c. Deduct all or any part of the moneys owing from any sums due to the Contractor under said agreement.

9. Except in the event of such default on the part of Contractor as aforesaid, interest or the said advance shall not be payable.

10. That in the event of conflict between the provisions of these presents and the said agreements, the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents, the settlement of which has not been hereinbefore expressly provided for the same shall so far as is lawful be referred to Chairman-cum-Managing Director, HSCC (India) Ltd. or to such person as he may appoint whose decision shall be final and the provisions of the Indian Arbitration Act for the time being in force shall apply to such reference.

IN WITNESS whereof the said The Engineer and the Contractor hereunto set their respective hands and seals the day and year first above written.

Signed sealed and delivered by

Contractor

The Engineer
END OF
VOLUME - II
ALL INDIA INSTITUTE OF MEDICAL SCIENCES (AIIMS), ANSARI NAGAR, NEW DELHI

Tender

For

Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Volume-III

Specific Conditions of Contract (SCC)

December’ 2012

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

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

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ANNEXURE A  Form of Agreement
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INSTRUCTIONS TO BIDDERS

A. General

1.0 Description of Works:

PART-A: Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

The site of work is within the existing campus of All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi.

The scope of work comprising of renovation of the existing CCU at the CN Centre at AIIMS. The scope of work shall also include Electrical works, HVAC works, plumbing & Firefighting works and their maintenance during the defect liability period including & preparation of all detailed shop drawings, obtaining approval from all local authorities, electrical inspector, etc. as required.

1.1 All the terms and conditions, undertakings of PQ documents under which the agency has been pre-qualified for this work will have to be strictly followed and will be treated as part of this tender documents in addition to other terms and conditions of the tender documents.

1.2 The Employer

All India Institute of Medical Sciences (AIIMS), New Delhi shall be the principal Employer / employer / owner for Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi including PHE, electrical, HVAC, fire fighting & detection systems, etc.

All documents relating to Labour License, submission of drawings to statutory authority for obtaining necessary clearance etc is to be signed/endorsed by representative of the Employer.

1.3 In these documents wherever the word Tender/ Tenderer/ Tendering has been used. The same may be considered synonymous with Bid/ Bidder/ Bidding.

1.4 Time for Completion

The successful Bidder shall complete the whole Works within 04 (Four) Calendar months from Engineer’s order to commence the Work.
2.0 **Information to be submitted**

2.1 Bids submitted shall include the following information:

(a) Copies of original documents defining the constitution, legal status, place of registration and principal place of business of the company or firm

(b) A work plan clearly bringing out how the Bidder proposes to carry out the work to achieve the quality and the time schedule

The work plan shall clearly spell out with specific details the following:

i. Detailed programme in the form of a PERT/CPM network clearly bringing out details of start & completion of all important activities and also programme showing material & labour resources related to the above PERT/CPM network.

ii. List of equipment along with details proposed to be used on the Works.

iii. List and bio data of Engineers and other important staff members proposed to be employed on the Works.

iv. Details of new and used shuttering proposed to be employed on the Works.

3.0 **Cost of Bidding**

3.1 The Bidder shall bear all costs associated with the preparation and submission of his Bids and "The Employer" will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

4.0 **Site Visit**

4.1 The Bidder is advised to acquaint himself with the job involved, visit the Site & examine soil/site conditions (No report will be provided by Engineer), climatic conditions, labour, power, water, material availability, transport and communication facilities, environmental regulations, laws and bye-laws of Statutory bodies of Govt. of Delhi
and the Govt. of India and collect all information that will be necessary for preparing the Bid and entering into a Contract.

The cost of visiting the Site and collecting information for the purpose of submission of the Bid shall be to the Bidder's account.

4.2 The Bidder and any of his personnel or agents will be granted permission by the Employer to enter upon the Site for the purpose of such inspection, but only upon the express condition that the Bidder, his personnel or agents will release and indemnify the Employer and Employer's Personnel and agents from and against all liability in respect thereof and will be responsible for personnel injury (Whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expense however caused, which, but for the exercise of such permission would not have arisen.

B. Bid Documents

5.0 Content of Bid Documents

5.1 The Bid Documents comprise the following:

Volume-I = Prequalification Document

Volume II = General Conditions of Contract

Volume III = Specific Conditions of Contract Comprising of:
- Instructions to Bidders
- Additional Specific Conditions of Contract relating to
  (a) General
  (b) Civil, Public Health works
  (C) Electrical works.
  (D) HVAC works
- Sample Forms of Securities
- Sample Form of Agreement

Volume IV = Technical Specifications

Volume V = Bill of Quantities
5.2 The Bidder is expected to examine carefully all instructions, conditions, forms, terms, specifications and drawings in the Bid documents. Failure to comply with the requirements of the Bid Documents will be at the Bidder's own risk.

Bids, which are not substantially responsive to the requirements of the Bid documents, will be rejected. **Bidders are requested to clear their queries before submission of bids and submit bids without conditions.**

6.0 Clarification on Bid Documents

6.1 A interested Bidder requiring any clarifications on the Bid documents may notify the Engineer in writing or by telex or cable at the Engineer's mailing address indicated in the Bid documents. A meeting of the prospective Bidders shall be held at which the Engineer will respond to any request for clarification which he receives within two weeks of the first date of the issue of the Tenders. Written copies of the Engineer's response (including an explanation of the query but without identifying the source of the inquiry) will be sent to all prospective Bidders who have received the Bid documents.

7.0 Amendment of Bid Documents

7.1 At any time prior to the deadline for submission of Bids, the Engineer may for any reason, whether at his own initiative or in response to a clarification requested by the prospective Bidder, modify the Bid documents by amendment.

7.2 The amendment will be sent to all prospective Bidders who have received the Bid documents, to arrive not later than 3 days prior to the original or extended deadline for submission of Bids, in writing or by telex or cable and will be binding upon them. Prospective Bidders should promptly acknowledge receipt thereof by telex or cable to the Engineer.

7.3 In order to afford prospective Bidders reasonable time in which to take an amendment into account in preparing their Bids, the Engineer may, at his discretion, extend the deadline for the submission of Bids.

C. Preparation of Bids
8.0 **Language of Bid**

8.1 The Bid prepared by the Bidders and all correspondence and documents relating to the Bid exchanged by the Bidder and the Engineer shall be written in the English Language.

9.0 **Documents comprising the Bid**

9.1 The Bid to be prepared by the Bidder shall comprise of the following: the prequalification document duly filled with required information including all supporting documents, the Bid and Appendix thereto, the Bid Security, the Bill of Quantities; the Schedules of Supplementary information, and any other materials required to be completed and submitted in accordance with the instructions to Bidders embodied in these Bid documents. The Forms, Bill of Quantities and Schedules provided in these Bid documents shall be used without exception.

9.2 All documents issued for the purpose of Bidding as described in Clause 5.1 and amendments issued in accordance with Clause 7, shall be deemed incorporated in the Bid. Bid Documents prepared and submitted in accordance with Clause 14 and 15 shall be returned by Bidders to the Employer along with the submission of the Bid.

10.0 **Bid Prices**

10.1 The Bidder shall fill the rates against each item of Bill Of Quantities both in words and figures in the blank spaces provided in the respective columns. Item for which no rate or price is entered by the bidder will not be paid for by the employer/Engineer and its price shall be deemed to be included and covered in the others rates and prices in the bill of quantities. The quantity of execution of such item shall be as per requirement and as such there will be no limit. Correction, if any, shall be made by crossing out, initialling, dating, stamping and rewriting. Wherever in any head if the same items are appearing and contractor has quoted different rates, contractor shall be paid the lowest quoted rate for such items.

10.2 All duties, taxes including works contract tax, building & construction/ labour cess etc and other levies payable by the Contractor under the Contract including Contractors profit and over heads etc. or for any other cost shall be included in the rates and prices and the total amount of Bid submitted by the Bidder. The evaluation and comparison of Bids by the Engineer shall be made accordingly.
10.3 The rates and prices quoted by the Bidder shall be fixed for items complete in all respect for the duration of the Contract and not subject to adjustment on any account except as otherwise provided in the conditions of Contract.

10.4 The Bidder shall fill his most competitive rates in the first instance as no negotiations shall be made after opening of the Tenders except if required with the lowest Bidder.

11.0 Bid Validity

11.1 The Bid shall remain valid and open for acceptance for a period of 180 days from the last date fixed for receiving the same.

11.2 In exceptional circumstances prior to expiry of the original Bid validity period, the Engineer may request the Bidder for a specified extension in the period of validity. The request and the responses thereto shall be made in writing or by cable or telex. A Bidder may refuse the request without forfeiting his Bid Security. A Bidder agreeing to the request will neither be required nor permitted to modify his Bid, but will be required to extend the validity of his Bid Security correspondingly.

12.0 Bid Security

12.1 The Bidder shall furnish, as part of his Bid, a Bid Security of the amount of Rs.7,48,000/- (Rupees Seven Lakhs Forty Eight thousand only) having validity period of 180 days from the last date fixed for receiving of bid. No deviation shall be permitted from this.

12.2 The Bid Security shall be in the form of a Demand Draft/Pay Order/Bank Guarantee in favour of M/s HSCC(India) Ltd., Plot-6(A), Block-E, Sector-I, NOIDA, UP-201 301 from any Nationalised bank/Scheduled bank.

12.3 Any Bid not accompanied by an acceptable Bid Security will be straightaway Rejected.

12.4 The Bid Securities of unsuccessful Bidders will be returned as promptly as possible as but not later than 30 days after the expiration of the period of Bid validity prescribed by the Employer.
12.5 The Bid Security of the successful Bidder will be returned upon the Bidder executing the Contract and furnishing the required Performance Security.

12.6 The Bid Security may be forfeited

a) If a Bidder withdraws his Bid during the period of Bid validity.

b) In the case of successful Bidder, if he does not:

   i) enter into the Contract, or
   ii) furnish the necessary Performance Security
   iii) agree to arithmetic corrections made as per terms of Bid documents.
   iv) Submitted any misleading information during prequalification and or tendering process.

13.0 No interest will be payable by the Engineer on the Bid Security amount cited above.

14.0 Format and Signing of Bid

14.1 The Tender shall be filled & signed only by the firm/ corporation in whose name the Tenders have been issued. The Bid shall be typed or written in indelible ink and duly signed by a person or persons duly authorised to being the Bidder to the Contract. Proof of authorization shall be furnished in the form of written Power of Attorney, which shall accompany the Bid.

14.2 All pages of Bid shall be initialled and stamped by the person signing the Bid where entries or amendments have been made.

14.3 The complete Bid shall be without alterations interlining and erasures except those to accord with instruction issued by the Engineer or as necessary to correct errors made by the Bidder in which case such correction shall be initialled by person signing the Bid.

D. Submission of Bid

15.0 Sealing, Marking & Submission

15.1 The Bid shall be submitted in accordance with the procedure detailed herein. Specified documents shall be enclosed in envelope of appropriate size each of which shall be sealed.
(i) Envelope No. 1: Shall contain the Bid Securities as indicated in Clause 12 of these Instructions to Bidders & tender document fee if downloaded.

(ii) Envelope No. 2: Shall contain covering letter and the other Bid documents duly signed including the following:

(a) Power of attorney of person authorised to sign the Bid.

(b) Original Bid documents (all pages) & drawing (Volume I, II, III, IV & VI) duly signed and stamped.

(c) Documents regarding constitution of Bidder as indicated in Clause 2.1 of these Instructions to Bidders.

(d) Certificate of Registration.

(e) All the information as stipulated in clause 2.0 under information to be submitted

(f) Schedule for submission of structural design, drawing and all other shop drawings of civil, sanitary & plumbing, electrical, HVAC etc.

(g) Construction Schedule, PERT Chart and Schedule for manpower to be deployed at Site.

(iii) Envelope No. 3: Shall contain only the Bill of Quantities and rates/prices (Volume V) duly filled in and signed and stamped without any conditions whatsoever. Bids containing any conditions in Envelope No. 3 are liable to be summarily rejected.

The Contractor must fill up price against each item of BOQ (Volume V) both in words and figures in the blank spaces provided in the respective columns. The rates written in words shall prevail in case of any variation between the rates mentioned in figure and words.

Please note that the price should not be indicated in any of the documents enclosed in Envelope no. 1&2. Non-compliance shall entail rejection of the Bid.
No rates to be quoted for the items where nil quantity is mentioned against that item. Indicating NIL quantity does not mean that this item will not be operated in the work. Rate of item quoted under any section of Bill of Quantity is interchangeable and minimum rate quoted for the same item under any section will be taken for payment.

15.2 The Bidder shall seal the Bid.

15.3 All the above three envelopes shall be sealed in a fourth envelope and addressed to The GM (Civil), HSCC (I) Ltd, E-6A, Sector-1, Noida-201301 (UP).

15.4 All the above envelope shall bear the following identification:

Name of work: Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Tender number, Due date and Time.

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

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

16.0 Deadline for Submission of Bids

16.1 Bids must be received by the Engineer, HSCC (India) Ltd., on or before of the designated date & time.

16.2 The Engineer may, at his discretion, extend the deadline for submission of Bids through the issuance of an amendment in accordance with Clause 7 in which case all rights and obligations of the Employer and the Bidders previously subject to the deadlines shall thereafter be subject to the new deadline as extended.

17.0 Late Bids

17.1 Any Bid received by the Employer/Engineer after the prescribed deadline for submission will liable to be rejected and will be returned unopened to the Bidder.

18.0 Modification and Withdrawal of Bid
18.1 The Bidder may modify or withdraw his Bid after Bid submission, provided that modification or notice of withdrawal is received in writing by the Engineer prior to the prescribed deadline for submission of Bids.

18.2 The Bidder's modification or notice of withdrawal shall be prepared, sealed, marked and despatched in accordance with the provisions for the submission of Bids. Notice of withdrawal may also be sent by telex or cable but shall be followed by a signed confirmation copy, postmarked not later than the deadline for submission of Bids.

18.3 No Bid may be modified subsequent to the deadline for submission of Bids.

18.4 No Bid may be withdrawn in the interval between the deadline for submission of Bids and the expiration of the period of validity of the Bid specified. Withdrawal of a Bid during this interval may result in the forfeiture of the Bid Security.

18.5 Subsequent to the expiration of the period of validity of Bids prescribed in the Bid documents, a successful Bidder who has not been notified by the Engineer of the Award of the Contract may withdraw his Bid without penalty.

E. Bid Opening and Evaluation

19.0 Bid Opening

19.1 Bids shall then be opened in the office of HSCC (I) Ltd., at Plot - 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201 301, half an hour after the prescribed time for Bid submission in presence of the Bidders’ representatives who may wish to be present.

Envelope No. 1: Shall be opened first. If the Bid Security & tender document fee (if document downloaded from websites) is not found as prescribed, the Bid shall be summarily rejected.

Envelope No. 2: Shall be opened next. Bids of parties who do not accept the conditions laid above in the Bid documents are also liable to be rejected.

19.2 The Engineer will examine the Bids to determine whether they are complete, whether the requisite bid securities have been furnished, whether the Bids have been properly signed and stamped and whether the Bids are generally in order.
19.3 Telegraphic/ Fax offer will be treated as defective, invalid and rejected. Only detailed complete Bids received prior to the closing time and date of the Bids will be taken as valid.

19.4 The Bidder's names, general technical details, the presence of the requisite Bid Security and such other details as the Engineer, at his discretion may consider appropriate will be announced at the Bid opening.

Envelope No. 3: Shall contain the sealed price Bid (volume-V). Whose bid is found to be generally in order and substantially responsive shall be opened either at the Bid opening or at a subsequent date to be intimated in advance to such eligible Bidders.

19.5 Only summary of prices quoted by the Bidders will be read out.

19.6 The Bid of any Bidder who has not complied with any of the instructions contained herein may not be considered.

20.0 **Process to be Confidential**

20.1 After the public opening of Bids, information relating to the examination, clarification, evaluation and comparisons of Bids and recommendations concerning the Award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process.

20.2 Any effort by the Bidder to influence the Employer/ Engineer in the process of examination, clarification, evaluation and comparison of Bids and decision concerning Award of Contract may result in the rejection of the Bidder's Bid.

21.0 **Clarification of Bids**

21.1 To assist in the examination, evaluation and comparison of Bids, the Engineer may ask Bidders individually for clarification of their Bids, including breakdowns of unit prices. The request for clarification and the response shall be in writing or cable or telex, but no change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction or arithmetical errors discovered by the Engineer during the evaluation of the Bids in accordance with Clause 24 hereof.
22.0 **Determination of Eligibility & Responsiveness**

22.1 The Engineer will determine whether the Bid is substantially responsive to the requirements of the Bid documents.

For the purpose of this Clause, a substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bid documents without any deviation or reservation.

22.2 A Bid, which in relation to the cost estimates of the Engineer is unrealistically priced and which cannot be substantiated satisfactorily by the Bidder may be rejected as non responsive.

23.0 **Correction of Errors**

23.1 Bids, determined to be substantially responsive will be checked by the Engineer for any arithmetical errors in computation and summation. Errors will be dealt by the Engineer as follows:

a) Where there is discrepancy between rates indicated in figures and in words, rates in words will govern.

b) Incorrectly added totals will be corrected.

c) In case of any clerical error between rates indicated in figures and words, the rate in words shall prevail. In case there is any inconsistency between the rate and the value extended (after multiplication with the tender quantity), the rate quoted shall prevail.

23.2 If a Bidder does not accept the correction of errors as outlined above, his Bid will be rejected.

24.0 **Evaluation and Comparison of Bids**

24.1 Only such of the Bids as have been determined to be substantially responsive to the requirements of the Bid documents, in accordance with Clause 22 will be evaluated. Other non-responsive Bids will be rejected.

24.2 Bidders shall note that no preference of any nature will be given to any Bidder notwithstanding any custom, usage or instructions to the contrary.
24.3 Evaluation of the Bids will take into account, in addition to the Bid amounts, the following factors:

a) Arithmetical errors corrected in accordance with Clause 23.

b) Such other factors as the Engineer considers may have a potentially significant impact on Contract execution price and payments.

24.4 Offers, deviations and other factors, which are in excess of the requirements of the Bid documents or otherwise result in the accrual of unsolicited benefits to the Employer, shall not be taken into account in Bid evaluation.

24.5 Price adjustment provisions applying to the period of execution of the Contract shall not be taken into account in Bid evaluation except to the extent specifically stated in the Contract.

F. Award of Contract

25.0 Award Criteria

25.1 Subject to Clause 26, Engineer will Award the Contract after prior approval by the Employer to the Bidder whose Bid has been determined to be eligible and to be substantially responsive to the Bid documents and who has offered the lowest evaluated Bid of the Bill of Quantities calculated considering the sum total of the rates quoted for Bill of quantities (Volume-V), provided further that the Bidder has the capability and resources effectively to carry out the Contract Works.

26.0 Engineer's Right to Accept any Bid, to Reject any or all Bids

26.1 Notwithstanding Clause 25, the Employer/Engineer reserves the right to accept or reject any Bid including the lowest and to annul the Bidding process and reject all Bids, at any time prior to Award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligations to inform the affected Bidder or Bidders of the grounds for the Employer's/Engineer's action.

27.0 Notification of Award

27.1 Prior to the expiration of the prescribed period of Bid validity, the Engineer will notify the successful Bidder by cable or telex or letter
confirmed in writing by registered letter that his Bid has been accepted.

27.2 The notification of Award will constitute the formation of the Contract.

27.3 Upon the furnishing by the successful Bidder of a Performance Security in accordance with the provisions of Clause 29, the Engineer will promptly notify the unsuccessful Bidders that their Bids have been unsuccessful.

28.0 Signing of Agreement

Upon the receipt of the notification of Award by the successful Bidder, the successful Bidder shall fill the Agreement in accordance with form of Agreement included in the Bid documents and submit the same to the Engineer within two weeks of the date of receipt of notification of Award. The Engineer shall return the draft duly approved within one day from the date of receipt of the draft and the successful Bidder shall get the same engrossed, have the correct amount to stamp duly adjudicated by Superintendent of Stamps and thereafter return the same duly signed and executed on behalf of the successful Bidder, all at his own cost within 3 days from the receipt of the approved draft.

29.0 Performance Security

29.1 Within 15 days of receipt of the notification of Award from the Engineer, the successful Bidder shall furnish to the Engineer a Security in the form of a Bank Guarantee from Nationalised/Scheduled bank for an amount of 5 percent of the Contract sum.

The validity of the Performance Security as per the Notification of Award shall be up to the end of the Defect Liability Period with 3 months claim period after expiry of defect liability period.

Performance security for the works to be submitted in the name of respective client / HSCC (I) LTD depending upon the case.

29.2 In cases, where the aggregate of expected Contract payment would at any time exceed the Engineer's estimate of actual work performed by more than the amount of Performance Security specified in Clause 29.1 such Security shall be increased accordingly at the expense of the successful Bidder.
29.3 Failure of the successful Bidder to lodge the required Bank Guarantee shall constitute sufficient grounds for the annulment of the Award and forfeiture of the Bid Security, in which event the Engineer may make the Award to the next lowest evaluated Bidder or, if there are no other Bidders, call for new Bids.

29.4 Performance Security shall be released only after the satisfactory completion of the Defects Liability Period and certification to this effect by the Employer/Engineer.
SPECIFIC CONDITIONS OF CONTRACT

The Conditions of Contract shall be GENERAL CONDITIONS OF CONTRACT in Volume I (hereinafter called the General Conditions) as modified or added to by the following Specific Conditions of Contract, which shall be read and construed with the General Conditions as if they were incorporated therewith.

Insofar as any of the Conditions of Specific Conditions of Contract conflict or be inconsistent with any of the General Conditions, the conditions of Specific Conditions of Contract shall prevail.

30.0 Definitions

a) "EMPLOYER" means All India Institute of Medical Science (AIIMS), NEW DELHI.

b) "Engineer" means GM of HSCC (India) Ltd. or any officer nominated by the Chairman-cum-Managing Director, HSCC (India) Ltd. to act as Engineer from time to time.

c) Site Incharge means the HSCC incharge of work designated by the Engineer.

d) "Month" and "Year" and all dates shall be calculated according to the Gregorian Calendar.

31.0 Insurance of Works

All Insurances referred to in General Conditions shall be effected with an Indian Insurance Company incorporated and registered in India. All insurances and labour license to be submitted within 15 days from notification of Award of work. Depending upon the case, the insurance cover may be required either together for the whole work or separately for both the parts.

32.0 Guarantees

Performance Guarantees, Advance Payment Guarantee, Retention money Guarantee and any insurance policies entered into by the Contractor under the terms of the Contract, shall stipulate that the proceeds of any claim shall be payable to Employers.

33.0 Certificates and Payments:
a) Deleted
b) Deleted
c) Deleted
d) The Contractor shall submit to the Engineer after the end of each month a detailed statement including measurements showing the estimated contract value of the Permanent Works executed up to the end of the month together with particulars of other amounts to which he is entitled under the Contract.

e) The statement shall be submitted on a printed proforma (Prepared at the cost of the Contractor) approved by the Engineer along with soft copy of the same in a CD/Pen drive.

f) The Contractor shall be paid monthly, on the certification of the Engineer, the amount due to him which shall be the sum of the following amounts:

i) Subject to and in accordance with Clause 21 of these Specific Conditions, the estimated value of the Permanent Works executed up to the end of the previous month less retention money named in the Bid, and

ii) 75% of the value of materials expected to be consumed within 3 months of its delivery at Site for Permanent Works on the Site provided the Engineer is satisfied that the amounts for such materials are reasonable bearing in mind the requirements of Works, less deductions, if any as per Clauses 33(f) and 37 of these Specific Conditions and other Contract conditions.

g) Deleted

h) Retention Money

i) With in 15 days of award of work, The contractor shall furnish a bank Guarantee from any nationalised/Scheduled bank for an amount of 2.5%(Two & half) of the contract price in the form approved by the Engineer and having validity upto completion period with a claim period of three months as per format attached at Annexure-F. Further retention money @ 5% (Five) shall be Deducted from each interim certificate from First RA bill subject to a maximum of 2.5 %(Two & half) of the contract price and shall be released after defect liability period.
Alternatively/or

Retention money at the rate of 10% (ten percent) shall be deducted from each interim certificate subject to the maximum of 5% (Five percent) of the contract price after approval by engineer.

i) The Retention Money shall, subject to Clause 60.6 (a) & 60.6 (b) of General Conditions of Contract, become due and shall be paid to the Contractor when the Engineer shall issue the Taking Over certificate notwithstanding that at such time there may be outstanding claims by the Contractor against the Employer, provided always that if at such time there shall remain to be executed by the Contractor any Works ordered during the Defect Liability Period pursuant to Clause 49.1, 49.2, 49.3, 49.4 and 50.1 of the General Conditions hereof, the Employer shall be entitled to withhold payment until the completion of such Works as much of the Retention Money as the Engineer may in his absolute discretion think fit.

j) Payment against each monthly R/A bills upon each of the Engineer's certificates shall be made by the HSCC (I) Ltd. acting for and on behalf of Employer or by the Employer directly within 30 working days after such certificate has been issued by the Engineer.

However, 75% of the estimated amount as determined by the Engineer of the payment due against the monthly running bill shall be paid within 10 (Ten) working days after certification by the Engineer in the approved format and complete in all respects.

k) The Engineer may at any time make any corrections or modifications to any certificate, which shall have been issued by him and shall have power to withhold any certificate if the Works or any parts thereof are not being carried out to his satisfaction.

l) The responsibility for making the payments or meeting other obligations to the Contractor in respect of all Works as certified by the Engineer shall be that of the Employer and not of the Engineer.

m) After completion of work and prior to final payment, the contractor shall furnish to the engineer, a release of claim against the Employer arising out of contract, other than
claims specifically identified, evaluated and excepted from the operation of the release by contractor.

n) Contractor has to submit break up of BOQ rate to facilitate approval of interim payment by the Engineer. However final decision on break up of rates/ part rates to be paid in parts will be taken by Engineer

o) Monthly bill not submitted in approved formats will not be accepted.

34.0 Settlement of Disputes - Arbitration

Sub Clause 67.1, 67.2, 67.3 and 67.4 of G.C.C. shall be followed.

35.0 Address

a. The address of the Employer is as follows:

Superintending Engineer All India Institute of Medical Science, (AIIMS), Ansari Nagar NEW DELHI.

b. The address of the Engineer/representative is as follows

GM (Projects) of HSCC (India) Ltd., plot no. E-6A, Sector-1, Noida

c. The address of the Contractor is


36.0 THE FOLLOWING SHALL BE READ IN ADDITION TO CLAUSE 34.1 TO THE GENERAL CONDITIONS

36.1 Labour

36.1.1 Engagement of Labour

The contractor shall make his own arrangement for engagement of all labour, local or otherwise, and, save insofar as the contract otherwise provides, for the transport, housing, feeding and payment thereof.
36.1.2 Supply of water

The contractor shall provide at his own cost adequate quantity of drinking water on the site to the satisfaction of the Engineer’s Representative for the use of contractor’s and the Engineer’s staff and work people, sub contractor and site visitors.

36.1.3 Alcoholic Liquor or Drugs

The Contractor shall not import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his sub-contractor, agents or employees.

36.1.4 Arms and Ammunition

The Contractor shall not give, barter or otherwise dispose off to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

36.1.5 Festivals and religious Customs

The Contractor shall in all dealing with labour in his employment have due regard to all recognised festivals, days of rest and religious or other customs.

36.1.6 Epidemics

In the event of any outbreak of illness of an epidemic nature, the contractor shall comply with and carry out such regulation, orders and requirements as may be made by the government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

36.1.7 Disorderly Conduct, etc

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighbourhood of the works against the same.

36.1.8 Observation of legislation etc.

The Contractor shall at all times during the continuance of the contract comply fully with all existing Acts, regulation and bylaws including all statutory amendments and re-enactments and acts that may be passed in future either by state or the central Government or local authority, including, Indian Workmen’s
compensation act, contract labour ( Regulation and Abolition ) Act 1970 and equal remuneration Act1976. Factories Act, Minimum wages Act provident fund regulations employees provident fund Act and Schemes made under same act, Health and sanitary arrangements for workmen, Insurance and other benefits and shall keep the employer indemnified in case any action is commenced for contravention by the contractor. If the Employer is caused to pay or reimburse any amount for non-observance of the provision of this clause on the part of the contractor the engineer shall have the right to deduct from any moneys due to the contractor or recover from the contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the Employer. all registration and station inspection fees if any in respect of his work pursuant to the contract shall be to the account of the contractor.

36.1.9 Fair Wages

The contractor shall pay the labours engaged by him on the work not less than a fair wages, which expression shall mean, whether or time or piecework, the respective rates of wages as fixed by the public works department as fair wages for the area payable to the different categories of Labourers or those notified under the minimum wages act for corresponding employees of the employer whichever may be higher.

36.1.10 The contractor shall notwithstanding the provisions of any contract to the contrary, cause to be paid a fair wage to the labourers indirectly engaged on the works including any labour engaged by subcontractor in connection with the said works as if the labourers has been immediately employed by him.

36.1.11 Notices

The Contractor shall before he commences the work display and correctly maintain in clean and legible condition at a conspicuous place on the site notices in English and in a local language spoken by the majority of the workers, stating therein the rate of wages which have been fixed as fair wages and the hours of work for which such wages are earned and send a copy of such notices to the Engineer.

36.1.12 Wage Records

The Contractor shall maintain records of wages and other remuneration paid to his employees in such form as may be
convenient and to the requirement of the Employer/Engineer and the conciliation officer (Central) Ministry of labour, Government of India, or such other authorised person appointed by the central or state government and the same shall include the following particulars of each worker:

I) Name works number and grade
II) Rate of daily or monthly wage.
III) Nature of work on which employed.
IV) Total number of days worked during each wage period.
V) Total amount payable for the work during each wage period.
VI) All deduction made from the wage with details in each case of the ground for which the deduction is made.
VII) Wage actually paid for each wage period.

36.1.13 The contractor shall provide a wage slip for each worker employed on the works.

36.1.14 The wage record and wage slips shall be preserved for least 12 months after the last entry.

36.1.15 Inspection of wage Records

The contractor shall allow inspection of the aforesaid wage records and wage slip to the engineer and to any of his workers or to his agent at a convenient time and place after due notice is received, or to the Employer or any other person authorised by him on his behalf.

36.1.16 The Employer and the Engineer or any other person authorised by them on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observation of the fair wages clause. He shall also have the power to investigate into any complaint regarding any default made by the contractor or sub-contractor in regard to such provision.

36.1.17 The Employer shall have the right to deduct from money due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non payment of the aforesaid fair wage, except on account of any deduction that may be permissible under any law for the time being in force.

36.1.18 Representation of parties

(i) A workman shall be entitled to be represented in
any investigation or enquiry under this clause by :-

(a) An officer of a registered trade union of which he is a member.

(b) An officer of a federation of trade union to which the trade union referred to in previous sub-clause is affiliated.

(c) Where the worker is not a member of any registered trade union, by an officer of a registered Trade union connected with or by any other workmen employed in the industry in which the workers is employed.

(ii) The contractor or sub-contractor shall be entitled to be represented in any investigation or enquiry under this clause by an officer of an Association of Employers of which he is a member.

(iii) No party shall be represented by a legal practitioner in any Investigation or enquiry under this clause, unless all parties agree.

36.1.19 Safety Provision

The contractor shall comply with all the precautions as required for the safety of the workman by I.L.O convention (NO.62) as far as they are applicable to the contract. The contractor shall provide all necessary safety applications, gears like goggles, helmets, masks, etc. to the workmen and the staff. The contractor shall be responsible for observance by his sub contractor of the forgoing provisions

36.1.20 Footwear

The contractor shall at his own expense provide footwear for all labour engaged on concrete mixing work and all other type of work involving the use of tar, cement, etc. to the satisfaction of the Engineer or his Representative, and on his failure to do so the Employer shall be entitled to provide the same and recover the cost from the Contractor.

The contractor shall deliver to the Engineer's representative at his office on the site a return in detail in such form and a such interval as the Employer/Engineer may prescribe showing the supervisory
staff and the number of the several classes of labour from time to time employed on the site.

36.2 Variation in price:

No Variation shall be payable in price on account of labour, material (General), POL and / or any other account. Also no variation/escalation shall be payable on account of time over run if any in completion.

36.2.1 Subsequent Legislation

If, after the date seven days prior to the latest date for submission of Bids for the Works, there occurs changes to any National or State Statute, Ordinance, Decree or other law or any regulation or bye-law of any local or other duly constituted authority or the introduction of any such statute ordinance, etc. which causes additional or reduced cost, the same shall be certified by the Engineer and shall be paid by or credited to the Employer and the Contract Price adjusted accordingly. Notwithstanding the foregoing such additional or reduced cost shall not be separately paid or credited if the same shall already have been taken into account in the indexing of any inputs to the price adjustments formula in accordance with the provisions of Sub-Claus es (1), (2), (3), (4) and (5) of this Clause.

The following items are not to be included in the price adjustment calculations:

a. Liquidated Damages.

b. Retention money withheld and released.

c. Advance payments in the form of loan and their repayments.

d. Value of any additional or varied work valued at current price.

e. Payment to nominated subcontractors included as "Provisional sums" or "Prime cost" items in the Contract Price.

37.0 Taxation
The Contractor shall pay all taxes, duties, levies, work contract tax etc. of the Government provisions of the Income tax Act or as per the advice of the Income Tax Authority. Deduction of Income tax/ Works Contract tax/ other taxes shall be made from each certificate of payment as per the relevant provisions of the Income tax Act or as per the advice of the Income tax Authority/ other Competent Authority.

38.0 Co-ordination Meeting

The Contractor shall be required to attend co-ordination meetings with the Engineer, the Consultant and other Contractors during the period of Contract at any suitable place as instructed by the Engineer. All costs incidental to such interaction shall be to the Contractor's account and no claim will be entertained by the Employer/Engineer on this account. The contractor shall ensure that the meeting is attended only by their officials/ representatives at appropriate level and as directed by Engineer.

38.1 Engineer's visit to site

The contractor/his representative shall be required to be present during periodical site visit of the engineer along with all the drawings and details required by the engineer and make a good vehicle available to the engineer at their own cost during his period of stay in town. The contractor will make all the places accessible for the smooth visit of engineer at site. The contractor will take all permissions and to make all the arrangements for visit of any place or any local authority concerned related to the works.

39.0 Special Applications

39.1 Site Information

The proposed Site for the Renovation of CCU at CN Centre is located at AIIMS, Ansari Nagar, New Delhi.

39.2 Site Development

a) Proper arrangement of security, safety, transportation, manpower, lighting arrangement to be maintained during execution of works at night.
b) For rapid execution of work, contractor has to arrange their own plant and others machinery, tools and tackles needed for the work as given in the submitted PQ document.

c) As directed by Engineer Proper barricading to be made so that surrounding area free from disturbances. The specifications of barricading to be got approved by Engineer. External face of barricading to be nicely painted and written the name of Employer, consultant & project only. No sign board of contractor is allowed unless permitted by engineer in writing.

d) For diversion of under ground services proper arrangement to be made by the contractor with the approval of Engineer.

b) Statutory Requirements

Contractor is responsible for obtaining approval from local electrical inspector & water & Sewer line connection, and others local Statutory bodies including NDMC, DUAC, DFS etc, if any, and any structure made / to be made of work, which is not in the approved plan, by the local authority. All the statutory expenditure incurred towards payment to the local body for getting local Electric inspector, sewer line and water supply connection, any other statutory fees etc for Employer will be reimbursed on the production of proof of payment. The contractor will be promptly extended all assistance in this connection.

39.2.1 Contractor's Working Area

Suitable working area will be provided by the Engineer to the Contractor. The Contractor may have to carry out some cutting / filling work for making his working area. The cost of all such Works shall be deemed to have been included in the rates and prices quoted for the Works and no extra payment shall be made on this account.

39.2.2 Contractor's Temporary Structures

The Contractor may, at his own expense and subject to the approval of the Engineer and statutory authorities, construct offices, stores, Workshop in the area allocated to him and remove the same as per the orders of the Engineer on completion of Works. The Contractor shall furnish such details of his Temporary Works as may be called for by the Engineer and the Contractor shall satisfy the Engineer as to their safety and efficiency. Engineer may
direct those Temporary work which he considers unsafe or inefficient be removed and replaced in a satisfactory manner. The Contractor shall immediately follow Engineer's directions/instructions.

The Contractor shall make his own arrangement at his own expense for labour camp / accommodation of his labour and staff and their conveyance to Site as no workers/ staff shall unless with the specific approval of the Engineer be allowed to stay within the Site. Gate passes shall be issued by the Engineer to authorise the Contractor's staff and workers to enter the Site.

39.2.3 Procurement of Various Materials

The Employer will not supply any construction materials required for the Works under this Contract. The Contractor must, therefore, make his own arrangements for timely procurement of various materials including steel and cement. Prior approval of each and every material including steel cement, aggregate, bricks etc or any other fittings & fixtures to be taken from engineer before its procurement to site. However in case of excessive delay in procurement of various materials, the engineer may also take decision of procurement of material directly and the cost will be recovered from the contractor.

39.2.4 Water Supply & Power Supply

The Contractor shall make his own arrangement for water supply at Site for drinking as well as construction purposes at his own cost. The Contractor shall also make his own arrangements for power supply at Site for construction, testing & commissioning of all services and general use at his own cost.

Non-availability of power supply and/or water from whatever source shall not entail any additional claims or extension of Contract period in this account. The contractor will provide water &electricity to the Engineer's office free of cost for the required quantity by the engineer’s site office.

39.2.5 Site office - Deleted

39.2.6 Temporary Fencing
The Contractor shall at his own expense, erect and maintain in good condition temporary barricades/fences all around the working premises as per specifications & size approved by Engineer/Employer and statutory authorities requirements. After the successful completion of work all the temporary fencing will be dismantled/removed by contractor and all the dismantled/removed material from here shall be the property of the contractor.

39.2.7 Mix Design of Concrete

The contractor shall carry out the mix design for the relevant item of concrete from reputed institution/laboratories as approved by Engineer at his own expenses within 15 days from notification of award. Prior approval of engineer is to be taken before the samples (Cement, Coarse & fine aggregates) sent to the Institution for Mix design. The decision of engineer shall be final and binding for above. The design mix required may with or without admixtures.

39.2.8 Testing of Materials

All materials used in the works shall be subject to inspection and test. The Contractor shall carry out sampling of such materials and making of concrete test cubes as per the appropriate Indian Standards and as directed by the Engineer. The contractor shall deliver the samples of materials and concrete test cubes to the site office of the Engineer at site office/Site Testing Lab in a manner as directed by engineer who will inspect the same and then order for testing of materials and concrete cubes.

The Contractor shall arrange for testing of materials normally in site testing lab but samples may be sent outside testing laboratories if necessary. The delivery of the samples shall be undertaken by the Contractor. The cost and charges for sampling of materials and concrete cubes and delivering the same to the office of the Engineer and/or other places including all incidentals in connection with the same as directed by the Engineer and the testing charges there of shall be borne by the Contractor and shall be deemed to be included in the rates and prices quoted in the Bill of Quantities. The results of the tests carried out shall be binding on the Contractor who shall comply with any rectification measures that the Engineer may deem fit and order to be executed by the Contractor as a result of testing.
39.2.9 Approval of Samples prior to use

The Contractor shall submit the samples of all materials (Whether in list of approved make or not in list of approved make) he proposes to use in the Works for prior approval of the Engineer. A sample room shall be maintained at Site in which all approved samples shall be kept for comparison with materials being used at Site.

39.2.10 Bar Bending Schedule

Contractor shall prepare bar bending schedules in the prescribed proforma as approved by the Engineer for prior approval of the Engineer. However, the approval does not relieve the Contractor from his liability for bending, placing and binding reinforcements as per the approved drawings.

39.3 (a) Working drawings/ shop drawings/Design:

The drawings supplied by the engineer have been listed in the tender documents.

These drawings are indicating for the purpose of detailing the intent and requirement of the contracts. The contractor shall take into consideration by space allocated for equipments before ordering them to ensure that the equipment would fit in the space provided with necessary clearances required as per the relevant standard/manufactures recommendations.

Structural and architectural drawings will be provided by HSCC however to ensure the uninterrupted progress of work and timely completion, the contractor will do further detailing as per site requirement at his own.

Detailing and shop drawings of all services will have to be done by the contractor based on the schematics and other details provided by HSCC or local authorities. The work will be executed by the contractor based on the approved drawings from the concerned authority and accordingly contractor will be responsible for obtaining final NOC/clearance from concerned authority.

The contractor shall submit to the Engineer for approval details of all proposed equipments, accessories, equipment characteristics
and capacity details of all equipment, accessories and devices etc. as per the specifications and required by the Engineer.

In case there is delay in any drawings and design viz shop drawings, as made drawings etc. in preparation, design, quality, submission, etc. HSCC may ask the contractor to change the design consultant immediately or get the same done on risk and cost of the contractor.

These drawings and details shall also contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipments and also details of all related items of work by other discipline.

All drawings to be signed by authorised contractor's representative with name, seal and date before submission to Engineer.

39.4 "AS MADE" Drawings

The Contractor shall supply two complete sets of "As Made" Drawings on polyester tracing film 75 micron thick and also on computer pen drive and three prints showing details of all the Works as executed. The drawings and prints shall be delivered to the Engineer within one month of completion of the various Sections of the work or at such other times as directed by the Engineer. The drawings shall be fully dimensioned with the Engineer's standard title block or as approved by the Engineer. The cost of making the "As Made" drawings shall be deemed to be included in the rates quoted in the Bill of Quantities.

39.5 Monthly Progress Photograph

The Contractor shall supply to the Engineer a pen drive, negative and three prints of colour progress photographs in good quality album with two copy at site and one copy at HSCC Head Office of such portions of the work in progress or completed works every month end or as directed by the Engineer. The pen drive, negative and the photographs shall become the property of the Employer. The photographs shall be of approximate size 169 mm x 115 mm each. The photographs shall be mounted in albums approved by Engineer and shall be suitably inscribed and captioned. The albums in a chronological order shall be handed over to the Engineer. No pen drive prints or the negatives may be supplied to any persons without the authority of the Engineer. All photographs to be taken
from digital camera and software to be provided for transformation it to the computer. The photographs may be up to 100 nos per month as required by engineer. An amount of Rs. 10,000/- will be deducted from running bill for non-submission of photographs as required.

39.6 Programme of Work and Progress Reports

The Contractor shall submit to the Engineer within two weeks of the Award of the Contract, six copies of detailed Schedule showing in an approved form the estimated dates of commencement and completion of different parts of the Works including the expected dates for completion of the various Sections of the Works. The detailed Schedule shall be such as it can be updated quarterly or as directed by the Engineer. Six copies of the revised Schedule shall be supplied to the Engineer as and when it is revised. The schedule will be in two parts. The first part will consist of schedule for detailing & preparation & submission of shop drawings and second part of schedule for execution. The schedule will be only detailing of original schedule submitted alongwith tender.

The Contractor shall submit to the Engineer before the second day of every week, a progress report for the preceding week showing the unto date progress and progress during the preceding week on all items of each section of the Works in relation to and in consideration of the detailed Schedule.

39.7 Metric Units

Metric units have been used in the specifications and on all the drawings.

If any materials described in the Contract or ordered by the Engineer are described by dimensions in the metric units and the Contractor can not in accordance with the Contract, procure such materials in the measure specified in sufficient time to avoid delay in the performance of his other obligations under the Contract, but can obtain such materials in other measure to dimensions approximating to those described in the Contract or ordered by the Engineer, then the Contractor shall henceforth give notice to the Engineer of these facts stating the dimensions to which such materials are procurable in the other measure. As soon as practicable after the receipts of any such notice the Engineer shall give an order to the Contractor which shall either
(a) Direct the Contractor to supply such materials to the dimensions stated in his said notice to be procurable instead of the dimensions described in the Contract or originally ordered by the Engineer, or

(b) Direct the Contractor to make some other variation whereby the need to supply such materials to the dimensions described in the Contract or originally ordered by the Engineer will be avoided.

39.8 Field Materials Testing Laboratory

39.8.1.1 The Contractor shall provide, furnish, man and maintain a laboratory at his own cost for the Testing of bricks, concrete cubes, construction materials, soil and any other materials in accordance with (Indian Standards and CPWD norms etc.) & as per the directions of Engineer.

Whenever directed by the engineer the contractor shall permit other contractor working for the employer on the project to use field-testing laboratory on payments as fixed by the Engineer. Such payments will be made directly by the other contractor using the laboratory.

39.8.1.2 The laboratory shall be equipped and manned by the Contractor at his own cost with all necessary apparatus to carry out the above mentioned tests in accordance with relevant Indian Standards or equivalent approved Standards.

i) Cement testing:

Tests for fineness, Strength, setting time and soundness in accordance with IS:4031.

ii) Concrete Testing:

Test for workability, proportions, density and strength in accordance with IS:516 and 1199. In particular the cube testing machine shall be capable of exerting a slowly applied force up to 200 tonnes and the platens shall be suitable for crushing both 150mm and 200 mm cubes. A Vibrating table of suitable design shall be provided for compaction of cubes.

iii) Aggregate Testing:
In accordance with IS: 2386 (part I to VIII) for the following tests on both fine and coarse aggregates:

a. Sieve analysis
b. Determination of bulk density and voids on fine aggregates only:
c. Determination of moisture content, specific gravity and absorption on coarse aggregates only:
d. Determination of specific gravity and absorption

39.8.1.3 The contractor shall carryout inspection, testing, checks and also shall maintain records of inspection, testing & checks of material, works and activities related to construction works in the ISO 9001 quality system formats, checklists etc. to be given by consultant during execution period. After getting approval from the Engineer, The contractor shall print at his own cost all forms, tables, formats etc.

39.8.1.4 The laboratory shall be connected to the main water and electricity Services. It shall also be supplied with portable gas equipment.

39.8.1.5 On completion of the Maintenance period, the laboratory is to be dismantled and removed from Site. The dismantled materials and equipment shall be the property of the Contractor.

40.0 Rates/Prices

The quoted rates/prices for the items shall be complete in all respect including all labour, material, plant and machinery, tools and tackles, water & electricity charges, all taxes, duties, levies, octroi, statutory levies applicable from time to time and others as specified in SCC etc. The contractors attention is invited towards different floor finish and their respective finish levels as indicated in architectural drawings, and nothing extra will be payable for additional mortar bed required to achieve uniform finished levels. The Contractor should quote his rates/prices accordingly for the complete items in all respects.

41.0 Compliance of Statutory Obligations for obtaining completion Certificates:
The Contractor shall comply all the statutory obligations and obtain all required clearances to implement the project without any financial repercussions to HSCC/Employer and ensure all follow up actions with the local authorities in this respect for smooth completion of the project. All statutory charges to get any NOC, clearances from local authorities to be obtained by the contractor and the charges towards the NOC shall be reimbursed after
submitting the bills/documentary evidences along with RA bills/final bill. The contractor is required to obtain all NOC, completion & Occupancy certificates from respective local bodies, as applicable as under:

i) Pollution control Board, ii) Environment clearances, iii) NOC form fire department, iv) Lift licence, v) Chief Electrical Inspector CEA, vi) Municipal authority/NDMC vii) Airport Authority, viii) Tree cutting, ix) Explosive department, x) Jal Board/Municipal authority for water and sewer connection, xi) And any other statutory requirement to occupy the building and run the services in all respect. Contractor shall organise all inspections of concerned authorities & obtain the NOC’s within the time for completion.

The contractor is required to submit the relevant drawings like completion Drawings and any other statutory documentary requirements of local bodies in copies as per requirement to obtain the above etc. at their own cost.

42.0 deleted

43.0 Unpriced Bids
The unpriced copies of the purchase orders of major items/equipments and of subcontracts placed by the Contractor shall be furnished to the Engineer.

44.0 Milestone
The contractor shall submit mile stones for procurement of all the bought out items and completion of all the major activities including details of manpower proposed to be engaged for each activity.

45. Approval of Make / agencies

a. Engineer may add any equivalent approved make with price adjustment

b. In case of non availability /monopolistic attitude of any approved make engineers decision to introduce any other make shall be final with suitable price adjustment.

c. Approved make of same item under different sub-heads are interchangeable.
d. The same criteria for approval of electrical, HAVC, plumbing, fire fighting works and other specialised agency will be followed, as per undertaking submitted by the contractor during pre qualification.

46. Not applicable

47. **Extra/Substituted items:** The items shall be analysed based on following norms:

   a) Any extra item/non schedule item will first be analysed based on the similar items existing in the BOQ under any sub heads. Components of any similar item nearest to the non schedule item will be decomposed to get the various sub components of material and manpower. The item will again be composed on the basis of requirements taking other components from DAR and rates.

   b) Components of material, manpower, wastage, profit, sundries, etc will be taken from CPWD latest DAR.

   c) In absence of similar item and in case the components are not available in DAR, the same will be taken from actual observations made and recorded at site. A register to be made for such actual observations to be jointly signed each day of observations and put up to the engineer along with analysis for approval.

   d) Actual market rates of the material and bought out items at the time of execution of activity will be verified by the site incharge of HSCC based on the rates submitted by the contractor along with his claim for extra items after due consideration for all the project discount on the market rates of any item.

   e) Contractor’s profit on extra items will be as per CPWD norms or 10% only in case the item in any forms in not available in DAR.

   f) The analysis of items enclosing actual observation sheets, photocopy of pages of DAR, original paid bills and vouchers to be submitted at site.

   g) Labour rates will be taken from local body/collector rates of that area for minimum wages.

The claim and analysis will not be accepted unless proper analysis with supporting documents are submitted.
No extra item will be paid unless prior administrative approval of engineer is taken in writing for its execution with tentative rates and total cost involved.

48. **Financial capability:** The contractor must have the financial capability to continue the work uninterrupted at site.

No time extension will be considered for delay in payment.

49. **Details required along with submission of running/final bills to the Engineer**

Clause 33.0 under Certificates & Payment contractor is required to submit following details/documents along with every running/final bill without which bills will not be processed.

1. Bills of every section of work as provided in BOQ to be prepared separately and submitted all together. In case there is no billable amount of any section of work, the same should be clearly indicated zero value during the period of bill.

2. Complete measurement details along with location of each measurement should be clearly indicated.

3. Authorised representative of contractor with name & seal to sign on each page of bill submitted.

4. Carryover and brought forward for each & every quantity to be indicated in the bill.

5. The running bill should contain the measurement of items executed during the period of bill. Full measurement may be given in pre final/ final bill. The measurement of all concealed items should be made before covering them.

6. All the copy of challan of materials, bills and test certificates specially of the items on which secured advance has been claimed, steel, cement, sand, aggregates, bricks, any plumbing material, Aluminium, waterproofing material etc. should be submitted alongwith the every bill to the Engineer. Actual measurement of secured advance to be submitted for verification of Engineer. Rate of secured advance material to be verified by Engineer independently. Secured advance on approved make material will only be payable.
7. Manufacturer Catalogue for aluminium and other items for verification of standard unit weight and checking that material is as per specification should be submitted.

8. Weight slip of reinforcement steel and aluminium and any other material as required by Engineer Representative from authenticated source like Dharam Kanta should be submitted.

9. The computerised soft copy of the entire bill shall be submitted alongwith the bill.

10. Correction as made by Engineer Representative should be incorporated by the contractor and corrected copy in three copy should be submitted for payment. Date of submission of bill will be reckoned from the date of submission of corrected bill.

11. Material consumption statement should be submitted alongwith every bill.

12. Bill should be indexed properly and each page and correction if any should be signed and stamped by the authorised representative of the contractor and acceptance should be given.

13. Copy of challan of submission of PF & ESI and any other relevant as required from time to time should be submitted.

14. Contractor shall maintain a check list at site duly marked on drawing for the items/works already measured till previous bill should be submitted alongwith the bill.

15. Register for steel, cement, water proofing material, concealed item etc. should be maintained at site in the standard format of CPWD duly modified by Engineer Representative as per requirement. Monthly statement should be submitted along with the bill.

16. Power of attorney of authorized person on behalf of contractor to be submitted. Contractor must ensure that all papers /Measurement book to be signed by authorized person with measurement date, date of start & date of completion etc.

17. Copy of duly certified bank guarantee from bank, performance BG, insurance policies as required in terms of contract to be enclosed with first RA bill.

18. All overwriting, alterations have been countersigned by the authorized person with date.
19. Approval of extra item if any conveyed to be enclosed.

20. Contractor must ensure, in case of time extension, confirmation of extended validity of insurance, performance BG upto Defect liability period as per contract and a copy of approved time extension to be submitted.

21. Contractor must authorise their representatives competent for verification of measurement at site and these person should be available at site.

22. Contractor is required to submit all test certificates of items claimed in bill for payment or for secured advance payment. Any item not meeting the test criteria's will not be considered for payment.

23. All the pages and enclosures of bills to be stamped with name and designation of the person with full signature of contractor’s and HSCC’s site incharge before submission to the engineer.

In addition to above any other document and details as required for checking, verification and timely processing of bill.

50. Terms & Conditions of Pre-qualification

All the terms & conditions & prequalification criteria’s of prequalification document of invitation of prequalification are to be strictly complied during tenancy of contract.
ADDITIONAL SPECIFIC CONDITION OF CONTRACT

AND

SPECIFICATIONS

(A) GENERAL

Scope of work broadly consisting of the following modules but not limited to only these:

1. Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi including electrical, HVAC, Fire fighting, worksetc.

Any material and inventory which is in usable condition will have to be handed over to AIIMS authorities and its receipt to be submitted to the engineer. In case the usable material and inventories are not handed over or the receipt not submitted then the amount as per advise of AIIMS will be deducted from the bills.

The work on all the modules will be taken up simultaneously by deploying independent team of labor, supervisor etc. to that particular module.

A. Shut down of electrical HVAC, Water supply, sanitary or any other services will have to be taken by properly by making a request to AIIMS in writing at least 3 days in advance so that patient care is not affected.

B. Agency has to make temporary barricading of work site by putting curtains, sheets etc. for making the patient care area of hospital sound and dust proof.

C. If required, there will be no working during day and it will be allowed only at nights. The execution area to be made for temporary use of patient care during day.

D. Any statutory approvals required for demolition, carriage of material, addition or deletion of temporary or permanent structure will be taken by the agency. Payments made towards statutory charges will be reimbursed to the agency.

The following facilities are also required to be provided during execution of work:

1. Safety barriers
2. Safety tapes
3. Safety officer
4. Use of safety jacket, caps and shoes and other safety norms
5. Provision for electricity and water during construction
6. Scaffolding provision for support of existing structure during construction
7. Outer lights
8. Traffic warden/guards
9. Approval from local authorities
10. Round the clock working for contractor in shifts
11. Defect liabilities on total work
12. non vendor based specification
13. Plywood barrier outside working area
14. Total electrical load
15. Total water requirement
16. Signage’s
17. Exhaust and ventilation in toilets.
18. Provision for new electrical load and water supply need
19. Round the clock working permission from AIIMS

Further, The following conditions may also include in contract:

1. The following Additional Specific Conditions and specification shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific conditions shall take precedence.

2. The contractor shall be obtain all approvals/ permissions as required, from local/ statuary bodies during progress of works for dismantling/ demolition, additional/ alteration etc of any existing structure/ building or part of it.

3. The contractor shall check & ensure design, safety requirements & sustainability of existing structure on account of additions/ alterations/dismantling works.

4. Contractor shall make all arrangement of water, electricity, HVAC, fire fighting and any or part of services of the existing premises/hospital shall run uninterruptedly during execution of work. However if required to hold/interrupt any or part of services to execute the work, prior approval required to be obtained from concerned department/officials.
ADDITIONAL SPECIFIC CONDITION OF CONTRACT

AND

SPECIFICATIONS

(B) RELATING TO CIVIL, PLUMBING & fire fighting WORKS

1.0 General

1.1 The following Additional Specific Conditions and specification shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific Conditions shall take precedence.

1.2 These additional specific conditions and specification shall be considered as an extension and not as a limitation of obligation of the preference.

* The CPWD General Specification for Electrical works: Part V Down Comer System for fire fighting-latest issue. Termination used in the bid shall also be accordance with CPWD.

* For items not covered in CPWD Specification, the work shall be done as per the latest relevant IS Code of practice.

* For items not covered by any of the above the installation shall be done as directed by the Engineer and as per sound engineering practices.

2.0 Scope of Contract

2.1 The scope of work covers the supply, erection, testing and commissioning of the Civil, Plumbing, Fire Fighting & Electrical Systems, Air-conditioning works which also includes design & preparation of structural and all other detailed shop drawings, testing and commissioning of components and accessories.

* Civil works, plumbing & Fire Fighting works, Fire Alarm System.
* Electrical works.
2.2 The work shall be carried out in conformity with the plumbing drawings and the requirement of architectural, electrical, structural, and other specialised service drawings by the agency approved by Engineer.

2.3 The Contractor shall make provision of hangers, sleeves, structural openings and other requirements well in advance to hold up progress of the construction schedule.

2.4 The said Contract comprises of furnishing of all materials, equipment, labour & transportation etc. necessary to render the installation fully operational as per the intent of specification and drawings, including any necessary adjustment or corrections. The installation shall be all in conformity with local laws covering such installation.

3.0 **Contract Drawings**

3.1 The drawings issued with the Bid are diagrammatic only and indicate the extent and general arrangement of the installation. Drawings shall not be scaled.

3.2 The Contractor shall follow the Bid drawings for preparation of his detailed sanitary, plumbing & fire fighting & Shop drawings and for subsequent installation work. He shall check the drawings of other services to verify spaces in which his work will be installed. The Contractor shall examine all Architectural, Structural, Plumbing and other services drawings before starting the work and report to the Engineer any discrepancies and obtain clarification. Any changes found essential to coordinate installation of this work with other services, shall be made with prior approval of the Engineer.

4.0 **Shop Drawings**

4.1 With in two weeks after Award of the Contract, the Contractor shall furnish for approval of the Engineer, three sets of detailed sanitary, plumbing, fire fighting ( external & internal), Pump room & Shop drawings of all equipment and materials required to complete the work as per specifications. These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics, and capacity of all items of equipment, as also the details of all related items of work of other trades. All shop drawings to be made in accordance with latest fire safety norms & to be got approved by the authorities before it is finally approved by Engineer before start of work.
4.2 All drawings necessary for assembly, erection, maintenance, repair and operation of the equipment shall be furnished and different parts shall be suitably numbered for identification and ordering of spare parts.

4.3 When the Engineer makes any amendments in the above drawings, the Contractor shall supply fresh sets of drawings with the amendments duly incorporated, along with the drawings on which corrections were indicated.

4.4 No material or equipment may be delivered or installed at the job Site until the Contractor has in his possession, the approved Shop drawings for that particular material or equipment.

4.5 After approval of the drawings by the Engineer, the Contractor shall further furnish six sets of Shop drawings for the exclusive use of and retention by the Engineer.

4.6 Approval of drawings by the Engineer shall not relieve the Contractor of any part of his obligation to meet all the requirements of the Contract or of the correctness of his drawings. The Engineer's approval of specific item shall not mean the approval of the assembly of which it is a component. The Contractor shall be responsible for and is to bear the cost for all alternations of the works due to discrepancies or omission in the drawings or other particulars supplied by him, whether such drawings have been approved by the Engineer or not.

4.7 Where the work of the Contractor has to be installed in close proximity to, or will interfere with the work of other trades, the Contractor shall assist in working out the space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections to a suitable scale not less than 1:50, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with the work of other trades, he shall make all the necessary changes without extra cost.

4.8 All shop drawings and detail drawings will be made as per requirements of local authorities and tender drawings incorporating all latest regulations and requirements. No separate drawings will be, issued for making shop drawings.
5.0 Samples and Catalogues

5.1 Prior to ordering any equipment/ material/ system, the Contractor shall submit to the Engineer, the catalogues, along with samples from approved list of manufacturers. No material shall be procured prior to the approval by the Engineer.

5.2 Approval of Materials

All materials used on the Works shall be new and of the best quality available, conforming to the relevant specifications and as per good Engineering practice. Prior approval shall be obtained in writing from the Engineer for all materials proposed and when necessary, approved sample duly identified and labelled shall be deposited with the Engineer and shall be kept at Site. List of approved make indicates make / manufacturer generally acceptable but final choice of make / manufacturer of material & models shall be with the Engineer.

6.0 Material and Equipment

6.1 All material and equipment shall conform to the relevant Indian Standards.

6.2 Where interfacing occurs, equipment shall be mutually compatible in all respects.

6.3 Where an item of equipment, other than as specified or detailed on the drawings, is approved by Engineer, requires any re-design of the structure, partitions, foundation, piping, writing or any other part of the mechanical, electrical or architectural layout, all such re-design, and all new drawings and detailing required therefore, shall be prepared by the Contractor at his own expense and approval obtained by the Engineer.

6.4 All similar equipment, materials, removable parts of similar equipment etc. shall be inter-changeable with one another.

7.0 Conformity with Statutory Acts, Rules and Standards

7.1 The installation shall be in conformity with the Bye-laws Regulations and Standards of the local authorities applicable to the installations. But if the specifications and drawings call for a higher standard of materials and/or workmanship than those required by
any of the above regulations and those required by any of the above regulations and standards, then the specifications and drawings shall take precedence over the said Regulations and Standards.

7.2 However, if the drawings or specifications required something, which violates the Byelaws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

7.3 Indian Standards: The System / Components shall conform to relevant Indian standards wherever they exist and to the national Building Code Amended up to date.

7.4 Nothing in these Specifications shall be constructed to relieve the contractor of his responsibility for the design, Manufacture and installation of equipment with all its accessories in accordance with applicable statutory regulations and safety codes in force.

8.0 Technical Data

8.1 Deleted

9.0 Manufacturer's Instructions

9.1 Where manufacturers have furnished specific instructions relating to the materials and equipment used, covering points not specifically mentioned in these documents, manufacture's instructions shall be followed.

10.0 Training and Operating Instructions

10.1 If required by the Engineer, the Contractor shall at no extra cost train members of the maintenance staff either at his or the subcontractor's workshop or at such other place or places as may be considered suitable by the Engineer.

10.2 Upon completion of all work and all tests, the Contractor shall furnish the necessary skilled labour and helpers for operating the entire installation for a period of fifteen (15) working days. During this period, the Contractor shall instruct and train the Engineer's representative in the operation, adjustments and maintenance of all equipment installed.

10.3 The Contractor shall submit to the Engineer a draft copy of comprehensive operating instructions and maintenance schedule
for all systems and equipment including in this Contract. This shall be supplemented, not substituted, by manufacturer's operating and maintenance manuals. Upon approval of the draft, the Contractor shall submit to the Engineer four (4) complete bound sets of operating and maintenance schedules along with manufacturers printed literature.

11.0 Inspection and Testing

11.1 The Engineer reserves the right to request inspection and testing at manufacturer's Works at all reasonable times during manufacture of items for this Contract.

11.2 The Engineer or his authorised representative shall have full power to inspect the materials and workmanship at the Contractor’s Works or at any place from which the materials or equipment is obtained. Acceptance by the Engineer of any material or equipment shall in no way relieve the Contractor of his responsibility for meeting the requirements of the specifications. All incidental expenditure like travelling, boarding and lodging etc shall be born by the contractor.

11.3 Routine and typical tests for the various items of equipment shall be performed at the Contractor's Works and test certificates furnished. If required by the Engineer, the Contractor shall permit the authorised representative of the Engineer to be present during any of the tests.

11.4 After installation has been virtually completed, the Contractor shall carry out under the direction and in the presence of the representative of the Engineer such tests and inspections as have been specified, or as the representative shall consider necessary to determine whether or not the full intent of the requirements of the drawings and specifications have been fulfilled. In case the work does not meet the full intent of the drawings and specifications and further tests are considered necessary, the Contractor shall carry them out and bear the expenses thereof.

11.5 The Contractor shall provide all necessary instruments such as Theodolite, Dumpy level, steel tapes, weighing machine, plumb bobs, spirit levels, hammers, micrometers, thermometers, hydraulic testing machine, smoke test machine and labour for testing. The Contractor shall make adequate records of the test procedures and readings, shall repeat any tests requested by the Engineer and shall provide test certificates signed by an properly authorised person. Such test certificates shall cover all Works. All such
equipments shall be tested for calibration at any approved laboratory.

11.6 If test fail to demonstrate the satisfactory nature of the installation or any part thereof, then no claims for the extra cost of modifications, replacement or retesting will be considered. The decision of the Engineer shall be regarded as final as to what constitutes a satisfactory test.

11.7 The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

12.0 Test Certificates

The contractor shall submit test certificates for all the materials / systems. These shall be issued by a government recognized inspection office certifying that all Equipment, Materials, Construction and function are in agreement with the requirements of these specification and accepted standards.

13.0 Performance Guarantee/Retention Money

13.1 It is clearly understood that the specifications, drawings, schedule of quantities for fire fighting system are for bidder’s guidance only. The bidder shall carry out necessary calculation and provide alternative equipment required to achieve the specified level of fire fighting required for human safety. Complete sets of Architectural Drawings are available at site in the Engineer’s office and reference may be made to these drawings as required for calculations or for other details. The contractor shall also guarantee that performance of various equipments, individually, shall not be less than, the quoted ratings.

14.0 Quiet Operation and Vibration

14.1 All equipment shall operate under all conditions of load without any sound or vibration, which is objectionable in the opinion of the Engineer. In case of rotating machinery, sound or vibration noticeable outside the room in which it is installed or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense.

15.0 Accessibility
15.1 The Contractor shall locate all equipment, which must be serviced, operated or maintained in fully accessible positions. The exact location and size of access panels, required for each valve or other devices requiring attendance, shall be finalised and communicated well in time, to be provided in the normal course of work, failing this, the Contractor shall make all the necessary repairs and changes at his own expense.

16.0 Electrical Installation

16.1 The electrical installation shall be in total conformity with the control wiring drawings prepared by the Contractor and approved by the Engineer & shall be connected and tested in the presence of an authorised representative of the Contractor and of the Engineer.

16.2 It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the Contract requirements of the electrical installation work lies solely with the Contractor.

17.0 Completion Certificate

17.1 On completion of the installation, a certificate shall be furnished to the Engineer, by the Contractor, countersigned by the licensed supervisor under whose direct supervision the installation was carried out. This Certificate shall be in the prescribed form as required by the local authority. On the basis of this certificate, the Contractor shall arrange for inspection of installation by the concerned local authorities.

17.2 The Contractor shall be responsible at his own cost for getting the installation duly approved by the Authorities concerned.

18.0 Completion Drawings

18.1 At the completion of the work in all respects, the Contractor shall at his own cost submit to the Engineer 4 (four) sets of layout drawings drawn at the approved scale indicating the installation. These drawings shall clearly indicate the complete plant layouts, and piping layouts, location wiring, exact location of all the concealed piping, valves, controls, wiring and other services. The Contractor shall also submit 4(four) sets of consolidated control diagrams, technical literature on all automatic controls and complete technical literature on all equipment and materials. The Contractor shall frame under glass, in the plant room all consolidated control diagrams and all piping diagrams.
19.0 Rates

19.1 Quoted rate includes any materials, equipment, appliances and incidental work not specifically as being furnishing or installed, but which are necessary and customary to make a complete installation.

19.2 The Contractor shall check at all stages and supervise at the point of connection the associated civil, electrical and plumbing works like underground and overhead tanks, power supply and installation of makeup water connection, drain connection in the fire fighting tanks and vicinity of plant room etc. In case of any discrepancy, all rectifications etc, required as a failure to do so, shall be carried out by the Contractor at his own expenses.

20.0 Check List

20.1 The Contractor shall provide to the Engineer 4(four) copies of a comprehensive maintenance checklist and shall post a copy of it in the Plant Room. The checklist shall be a list of each piece of equipment in this Contract, and shall provide a space for each of the next fifty-two weeks to record the maintenance provided to and status of various equipment. Each month at the time of inspection, the Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, and that all necessary intention has been performed.

21.0 Repairs

All equipment that requires repairing shall be immediately serviced and repaired. During the maintenance period, all parts and labours shall be furnished at no extra cost to the Engineer.

22.0 Control System

During the maintenance period, once each month the Contractor shall check all controls in various areas to ensure that these are functioning as designed. This shall apply to all pressure switches and pressure gauges, contactors, relays, controller switches, high and low pressure cut-outs etc.

23.0 Reference Points
23.1 Contractor shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of Works.

23.2 All such reference points shall be in relation to the levels and locations, given in the Architectural and plumbing drawings.

24.0 License and Permits

24.1 Contractor shall hold a valid plumbing, electrical, HVAC license issued by the Municipal Authority or other competent authority under whose jurisdiction the work falls.

24.2 The contractor has to take all the approvals of local bodies for all the addition/deletion over the approved building plans. The documents/drawings to be prepared and submitted in the manner desired by them after the same is approved by HSCC. Contractor has to take approvals of entire/Part works if required before start of works. Contractor will be held responsible if any work at site is carried out without having approval of municipal or local bodies.

24.3 Contractor shall keep constant liaison with the competent Municipal or other authority and obtain approvals and connections for all drainage and water supply works carried out by him.

24.4 Contractor shall obtain from the competent Municipal Authority completion certificates with respect to his work as required for occupation of the building.

24.5 Before start of HVAC, Electrical, ATT, Water proofing, Fire Fighting, Fire alarm system, PA System, EPABX System, Horticulture Works, aluminium works, stainless steel works, signages works etc. The contractor must take approval of agencies from engineer.

24.6 Any fees deposited in connection with the work on behalf of the Client in Statutory bodies, Corporations, Government departments, etc. shall be paid by the Contractor and the same shall be reimbursed on production of original vouchers. Necessary endorsement / application if required shall be arranged from the Employer by the Engineer.

25.0 Cutting and Making Good

25.1 No structural member shall be chased or cut without the written permission of the Engineer.
26.0. **Operation and Running of entire system**

The contractor shall pay for and arrange for operation & running of entire sanitary, plumbing and fire fighting system including pumps etc. for a minimum period of one month after satisfactory completion of work as desired by Engineer. Cost of operation & running of entire system including required material e.g fuel, consumables, tools & tackles, requisite manpower etc. shall be deemed to be included in the contract price and nothing extra shall be paid.
C) RELATING TO ELECTRICAL INSTALLATIONS

1.0 General

1.1 The following Additional Specific Conditions shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific Conditions shall take precedence.

2.0 Regulations and Standards

2.1 The installations shall conform in all respects to Indian Standard Code of Practice for Electrical Wiring Installation IS : 732-1989 and as per latest CPWD General Specification for Electrical Works (Part I, II & IV). It shall also be in conformity with the current Indian Electricity Rules and regulations in so far as these are applicable to the installations. Wherever these Additional Specific Conditions calls for a higher standard of material and/or workmanship than those required by any of the above regulations, then this Additional Specific Conditions shall take precedence over the said Regulation and Standards. External works & fire detection & alarm system works to be done as per CPWD specification & relevant IS codes.

3.0 Rates

3.1 The rates bid shall be for complete items of work inclusive of all taxes, statutory charges and all other charges for items contingent to the work, such as, packing, forwarding, insurance, freight and delivery at Site for the materials to be supplied by the Contractor, watch and ward of all materials for the Internal & external, Electrical Installation testing & commissioning work including water & power for successful installation, testing & commissioning work at Site etc.

4.0 Completeness of Bid

All sundry fittings, assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections as required, and all other sundry items which are useful and necessary for proper assembly and efficient working of the various components of the work shall be deemed to have been included in the Bid rates and prices, whether such items are specifically mentioned in the Bid documents or not.
5.0 **Works to be done by the Contractor**

5.1 Unless and otherwise mentioned in the Bid documents, the following works shall be done by the Contractor, and therefore their cost shall be deemed to be included in their rates and prices:

   i. Foundations for equipments and components where required, including foundation bolts
   
   ii. Cutting and making good all damages caused during installation and restoring the same to their original finish
   
   iii. Sealing of all floor openings provided by him for pipes and cables, from fire safety point of view, after laying of the same
   
   iv. Painting at site of all exposed metal surfaces of the installation other than pre-painted items like fittings, fans, switchgear/ distribution gear items, cubicle switch board etc. and erection, shall however be rectified to the satisfaction of the Engineer
   
   v. Testing and commissioning of complete installation

6.0 **Tools for Handling and Erection**

6.1 All tools and tackles required for handling of equipments and materials at Site of work as well as for their assembly and erection and also necessary test instruments shall be the responsibility of the Contractor.

7.0 **Terminology & Scope**

7.1 Terminology & scope for this project shall be as per CPWD Specification for Electrical Works (Part I - Internal) - latest & External Works - Part II - latest.

7.2 Measurement

Measurement shall be as per CPWD specifications Part – I (Internal ) & Part - II ( External) unless otherwise specified in the technical specifications / BOQ.

8.0 **Drawings**
8.1 The drawings indicate the extent and general arrangements of the fixtures, controlling switches, wiring system etc. and are essentially diagrammatic. The drawings indicate the points of termination of conduit runs and broadly suggest the routes to be followed. The Contractor shall submit six sets of working electrical drawings based on tender drawing including reflected ceiling plan coordinating other essential building services for HSCC approval. Contractor has to make necessary changes if any as per comments given by HSCC before execution. The work shall be executed as indicated in the approved drawings, however any minor changes found essential to co-ordinate the installation of this work with the other trades shall be made without any additional cost of owner. The drawings are for guidance of the contractor and exact locations, distance and levels shall be governed by the building. The Contractor shall examine all architectural, structural, plumbing and sanitary & electrical drawings before starting the work and report to the Engineer any discrepancies, which in his opinion appear on them and get it clarified. Contractor shall not be entitled to any extras for omissions or defects in electrical drawings or when they conflict with other services work.

9.0 Conduit/ Trunking Layout

9.1 Prior to the laying of the conduits and trunking, the Contractor shall examine/ study drawings and report to Engineer in case he desires to make any changes from Consultant proposed conduit layout plan and shall get the same approved from HSCC.

10.0 Shop Drawings

10.1 The Contractor shall prepare and submit to the Engineer for his approval detail shop drawings of Main & Sub Distribution Boards, Distribution Boards, special pull boxes, light & fan switch boards, telephone distribution boards, FDA system and lightning protection system and other equipment to be procured/ fabrication by the Contractor within 15 days of signing of the above items required to complete the electrical installation in all respect.

11.0 Manufacturer's Instruction

11.1 Where manufacturers' have furnished specific instructions, relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.
12.0 **Materials & Equipment**

12.1 All materials and equipment shall be ISI marked and shall be of the approved make and design. Unless otherwise called for, only the best quality of materials and equipment shall be used. The Contractor shall be responsible for the safe custody of all materials till these are taken over by client and shall insure as against theft, damage by fire, earth quake etc. A list of items of materials and equipment, together with a sample of each shall be submitted to the Site office.

13.0 **Scale**

13.1 Drawings shall be prepared to the scale as required for proper explanation and shall indicate the size and location of all equipments and accessories herein. The Contractor shall obtain all dimensions preferably at the building (Site of work) and check those plans for interference with the building structure and other equipment.

14.0 **Brochures and Data**

14.1 The Contractor shall submit four copies of all brochures / manufacturer's description data and similar literature.

15.0 **Approval of Shop Drawings**

15.1 The Engineer's approval of shop drawings, schedule, brochures etc. shall be an approval of general details and arrangements only and shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has in writing called Engineer to such deviations at the time of submission nor shall it relieve the Contractor from responsibility for errors or omissions of any kind in the shop drawings when approved.

16.0 **Samples & Catalogues**

For HSCC approval, Contractor shall submit the samples & catalogue of the material, which are used at Site as per the approved makes.

17.0 **Approval of Materials**
17.1 All materials used on the Works shall be new and of the best quality available, conforming to the relevant specifications and as per good Engineering practice. Prior approval shall be obtained in writing from the Engineer for all materials proposed and when necessary, approved sample duly identified and labelled shall be deposited with the Engineer and shall be kept at Site. List of approved make indicates make/ manufacturer generally acceptable. Contractor shall submit the detail drawings for HSCC approval.

18.0 Inspection, Testing and Inspection Certificate

18.1 HSCC and authorised representative of HSCC shall have at all Reasonable times access to the Contractor's premises or Works and shall have the power at all reasonable time to inspect and examine the materials and workmanship during its manufacture or erection or if the part of works is being manufactured or assembled at other premises or works.

18.2 The Contractor shall arrange all the materials and labour required for inspection of equipment or for any testing to be carried out at his/ manufacturer's works or at Site. Notice for such inspection/ presence for testing shall be given to the Engineer by the Contractor at least fifteen (15) days in advance together with the routine test certificates of the equipments/ materials given by the manufacturer.

18.3 Not withstanding approval of tests or equipment by the Engineer, the Contractor shall be required to perform site tests and prove the correctness of ratings and performance of equipment/ machinery and materials supplied and installed by the Contractor as per the Contract specifications and conditions. Engineer shall have full power to order the material or work to be tested by an independent agency at the electrical Contractor's expense in order to prove soundness & adequacy.

19.0 Schedule & Manner of Operation

19.1 Time being the essence of this Contract, Contractor shall be expected to furnish all labour & material in sufficient quantities at appropriate time, expedite and schedule the work to meet the Engineer's requirement and so manage the operations that the work shall be completed in time as stated else where. In case of shut down of power supply, Contractor shall coordinate with Engineer and shall carry out essential works during the shut down period allowed by the Engineer. In case Engineer allows for such period during night or early morning hours, Contractor shall make
all provisions to avail such account. Contractor shall not be entitled for any extra claims on such account. Contractor shall programme his work in such a way that items of work requiring presence of Engineer are carried out between 9 A.M. & 5 P.M. on working days.

20.0 Performance Guarantee

20.1 All equipment shall be guaranteed for a minimum period of 12 (Twelve) months from the date of handing over of installation to the Engineer against unsatisfactory performance and/or break down. The equipment or component or any other part of installation so found defective within the guarantee period shall be replaced / repaired by the Contractor free of cost to the satisfaction of the Engineer. The normal guarantee and/or warrantee provided by the manufacturer will have to be submitted along with all the test certificates from manufacturer.

21.0 Conformity with Statutory Acts, Rules and Standards

21.1 The installation shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities applicable to the installations. But if the specifications and drawings call for a higher standard of material and/or workmanship than those required by any of the above Regulations and Standards, then the specifications and drawings shall take precedence over the said regulations and standards.

21.2 However, if the drawings or specifications required something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

21.3 Indian Electricity Act and Rules: All electrical works in connection with installations of the system shall be carried out in accordance with the provision of the Indian Electricity Act, 1910 and the Indian Electricity Rules 1956, both amended up to date.

21.4 CPWD Specification: The Electrical installation work shall conform to CPWD General specifications for Electrical Works Part I (Internal) I and Part II (External) latest issues, both amended up to date.

21.5 Indian Standard: The system / components shall conform to relevant Indian Standards wherever they exist and to the latest National Building Code-1983.
21.6 Nothing in these specifications shall be construed to relieve the Contractor of his responsibility for the design, manufacture and installation of the equipment with all its accessories in accordance with applicable Statutory Regulations and safety codes in force.

22.0 Completion Drawings (As Built Drawings)

22.1 On completion of the work and before issue of certificate of virtual completion, the Contractor shall submit to the Engineer completion plan drawn to a scale in tracing cloth with ink indicating the following, along with three blue print copies of the same:

a. Run and size of conduits, inspection boxes, junction boxes and pulls boxes

b. Number of size of conductors in each conduit

c. Location and rating of sockets and switches controlling the light and power outlets

d. Location and details of main & sub distribution boards, distribution boards indicating the circuit number controlled by them

e. Type of fitting viz. fluorescent, pendants, brackets, bulkhead etc., including their rating & type of lamp, fans and exhaust fans

f. A complete wiring diagram as installed and schematic drawings showing all connections for the complete electrical system

g. Location of telephone outlets, junction boxes and sizes of various conduits and number & sizes of wire drawn

h. Layout of telephone cables

i. Location of all earthing stations, route and size of all earthing conductors, manholes etc.

j. Layout and particulars of cables & sub mains

k. Schematic drawing for telephone system

l. Layout of conduits for computer outlet points
m. Layout and details of fire detection & alarm system consisting of manual call points, fire alarm hooters, smoke & heat detector, FDA control panel including details of conduits and number of wires drawn

n. Layout and details of lightning protection system

o. Insulation tests and earth test results

p. PA System drawings

q. Fire System drawings

r. Disc Antenna drawings

s. Equipment drawings

t. Cable route layout of HT, LT & other cables, as applicable

u. External lighting drawing with road layout

23.0 **Confirmation of Quantities**

23.1 All quantities indicated in BOQ are tentative which may vary as per site conditions. Contractor has to verify quantities before procuring the material. No payment shall be payable for quantity brought to site but not used.

24.0 **Terms of Payment** (Only for items of major electrical equipments)

For purposes of estimating the contract value of work executed for certificate of payment under clause 32(d) of section II the following norms shall be followed.

a. 80% of BOQ rate on receipt of equipment against receipt of complete material at site & test certificates in accordance with clause 33(l) of SCC.

b. 10% of BOQ rate on erection and installation of equipment.

c. 10% after successful completion of all works including all testing, commissioning & taking over.

25.0 **Training of Personnel (as applicable)**
The Contractor shall arrange to train the Employer's personnel prior to provisional take over of the project for the following:

a) Lift
b) Telephone Exchange
c) All other Equipments like DG sets, pumps, panels etc.
d) Adjustment of setting for controls and protective devices
e) Preventive maintenance
f) Operation of all electrical panels including their interconnectivity and interlocking scheme
g) Fire detection system

26.0 Completion Certificate

26.1 On completion of the installation, a certificate shall be furnished to the Engineer, by the Contractor, countersigned by the licensed supervisor under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority. On the basis of this certificate, the Contractor shall arrange for inspection of installation by the concerned local authorities.

26.2 The Contractor shall be responsible at his own cost for getting the installation duly approved by the authorities concerned.

27.0 Check List

27.1 The Contractor shall provide to the Engineer 4(four) copies of a comprehensive maintenance checklist and shall paste a copy of it in the Substations & Plant Room. The checklist shall be a list of each piece of equipment in this Contract, and shall provide a space for each of the next fifty-two weeks to record the maintenance provided to and status of various equipment. Each month, at the time of inspection, the Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, and that all necessary tests have been performed.

28.0 Repairs
All equipment that requires repairing shall be immediately serviced and repaired during the maintenance period. All parts and labours shall be furnished at no extra cost to the Engineer.

29.0 Safe Custody and Storage

Safe custody of all machinery and equipment dismantled, shifted & supplied by the Contractor shall be his own responsibility till the final taking over by the Employer. The Contractor should, therefore, employ sufficient staff for watch and ward at his own expenses. The Employer may, however, allow the Contractor to use the building space for temporary storage of his equipment, if such space is ready and available.

30. Testing and Commissioning

The Contractor shall pay for and arrange without any extra cost, all necessary balancing and testing equipment, instruments, materials, accessories, power, water, fuel and the requisite labour for testing. Any defects in materials and/or in workmanship detected in the course of testing shall be rectified by the Contractor entirely at his own cost, to the satisfaction of the Engineer. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Engineer. All tests shall be carried out in the presence of the Engineer or the Engineer’s representative.

31. Operation and Running of entire system

The contractor shall pay for and arrange for operation & running of entire electrical system including for a minimum period of one month after satisfactory completion of work as desired by Engineer. Cost of operation & running of entire system including required material e.g fuel, consumables, tools & tackles, requisite manpower etc. shall be deemed to be included in the contract price and nothing extra shall be paid.

32. Layout of all services, operating and maintenance instructions. DO’s and Don’t’s etc

for all the plant rooms, AHU’s machine rooms, sub stations, pump room, toilets, control panels etc must be equipped with coloured layout of services for each floor. Operation and maintenance manual of the respective services, Do's and Don’t’s for all the plants, machinery & services to be installed with every individual units.
SPECIFIC CONDITIONS OF CONTRACT RELATING TO HVAC SYSTEM

1.0 General

1.1 The following Additional Specific Conditions shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific Conditions shall take precedence.

2.0 Scope of Contract

2.1 The scope and general character of works to be carried out under this section comprises of Supply, Installation, Testing and Commissioning of Heating, Ventilation and Air-conditioning installations as illustrated in drawings, specifications, technical data and Bill of Quantities.

3.0 Stores and Materials

3.1 The contractor shall provide every thing necessary for the proper execution of the work according to the intent and meaning of the drawings, Bill of quantities and specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can be reasonably inferred there from. In case of any discrepancy in the drawings or between the drawings, Bill of quantities and specification, the more stringent shall be followed. The decision of the Engineer in this regard will be final and complied with.

4.0 Supply of Equipment

Equipment shall be strictly as per the list of approved makes/manufacturers given in the Bid documents. However, final choice of make shall lie with the Engineer.

4.1 The Contractor shall submit manufacturer’s test certificates of equipment supplied.

4.2 The Contractor shall submit the original ”Excise Paid Certificates”, and exit Gate passes form manufacturer's factory/works clearly bearing the batch numbers and date of despatch.
5.0 **Working Drawings etc.**

5.1 The Contractor shall within 60 days of signing of the Contract, prepare and submit to the Engineer for approval, 2 sets of detailed shop drawings of equipment, equipment characteristics and capacity details of all equipment, accessories and devices etc. as per specifications and as required by the Engineer.

5.2 These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics, and capacity of all items of equipment, as also details of all related items of work by other disciplines.

5.3 If the Engineer makes any amendment in the above drawings, the Contractor shall supply two fresh sets of drawings with the amendments duly incorporated, along with the drawings on which corrections were made. After final approval has been obtained from the Engineer, the Contractor shall submit a further six sets of shop drawings for the exclusive use of and retention by the Engineer.

5.4 The shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material, to allow Engineer ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to failure to produce shop drawings in time.

5.5 Approval rendered on shop drawings shall not be consider as a guarantee of measurement or of building condition. Where drawings are approved, said approval does not mean that drawings have been checked in detail nor does it in any way relieve the contractor from his responsibility of furnishing materials or performing work as required by the contract.

6.0 **Completion Drawings**

6.1 Following "AS BUILT" drawings duly laminated and montable at various locations shall be submitted by the Contractor on completion of the work:

a. Plant installation drawings giving complete details of the entire equipment including foundations
b. Ducting drawings showing all sizes, damper locations and sizes of all air outlets and intakes, for all floors

c. Electrical drawings showing cable sizes, equipment capacities, control components and control wiring

d. Schematic control drawings giving detailed sequence of operation and notes to explain the operation of the control circuit

e. Piping drawings showing all pipe sizes, valves and fittings

f. Any other drawings to be supplied as per instructions of the Engineer.

The drawings shall be cross checked and approved by the Engineer before acceptance.

7.0 Operation and Service Manuals

7.1 The Contractor shall submit 3 (three) sets of operation and service manuals in respect of the air-conditioning plant including salient details of plant.

Following minimum details shall be furnished:

i) Detailed equipment data as approved by the Engineer

ii) Manufacturer's maintenance and operating instruction

iii) Approved test readings

The Contractor shall also submit 4 (four) sets of technical literature on all automatic controls and complete technical literature on all equipment and materials. The Contractor shall frame under glass, in the Air conditioning plant room all consolidated control diagrams and all piping diagrams.

coloured Layouts of all electrical lines in A 1 size properly laminated to be fixed at various locations at the time of handing over of building.

8.0 Inspection at Contractor's Premises
8.1 The Engineer and his representatives shall at all reasonable time have free access to the Contractor's premises/works. The Contractor shall give every facility to the Engineer and his representative and necessary help for inspection and examinations and test of the materials and workmanship.

8.2 The Engineer's representative shall have full powers to inspect drawings of any portion of the work or examine the materials and workmanship of the plant at the Contractor's works or at any other place from where the material or equipment is obtained. Acceptance of any material or equipment shall in no way, relieve the Contractor of his responsibility for meeting the requirement of the specifications.

8.3 For Imported screw type water chilling machine manufacturer's factory test certificate would be acceptable in lieu of inspection at manufacturer works.

9.0 Subcontracting

The Contractor may subcontract part of the works with the written approval of the Engineer to any of the approved subcontractors given in the list of approved subcontractors, makes and manufacturers. A single subcontractor shall be appointed for carrying out the entire work of supplying, installation, testing and commissioning of all the equipment covered under the package. However, the overall responsibility of the Contractor for compliance with the Contract terms does not alter by subcontracting.

10.0 Material Submittals

The Contractor shall submit material submittals for all equipment and machinery for the written approval of the Engineer before placing orders. The material submittals shall comprise of at least the following:

a. Manufacturer's technical catalogues and brochures giving technical data about performance and other parameters

b. Manufacturers drawings/ sketches showing construction, dimensional and installation details

c. Rating charts and performance curves clarifying rating of equipment selected and proposed
11.0 **Samples and Prototypes**

The Contractor shall submit samples of items such as grilles/diffusers, valves, controls and/or any other parts or equipment as required by the Engineer for prior approval in writing before placing the order. The Contractor shall also construct prototype or samples of work as laid down in the Contract or as instructed by the Engineer. Such samples and prototypes after approval shall be retained by the Engineer and shall serve as the standards to be achieved in final construction.

12.0 **Testing and Commissioning**

12.1 Tests on equipment as called for in the specifications shall be carried out by the Contractor in accordance with the specifications, the relevant Indian Standard Specifications and the relevant Indian and International Standards.

12.2 The initial tests shall include but not be limited to the following:

a. To operate and check the proper functioning of all electrically operated components viz., compressor motor, pumps, blowers, air handling units, rotating machine, fans, boilers, etc.

b. To operate and check the proper functioning of all electrical panels, switch gears, safety and other controls

c. To adjust and balance air, water, steam and gas quantities to provide the designed flow rates by adjusting valves, dampers, diverters etc.

d. To check the systems against leaks in different circuits, alignment of motor, "V" Belt adjustments etc.

e. To check the vibration and noise levels of the equipment

f. Setting of all control and all such other tests which are essential for smooth functioning of the plant

12.3 The Contractor shall pay for and arrange without any extra cost, all necessary balancing and testing equipment, instruments, materials, accessories, power, water, fuel and the requisite labour for testing. Any defects in materials and/or in workmanship detected in the course of testing shall be rectified by the Contractor entirely at his
own cost, to the satisfaction of the Engineer. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Engineer. All tests shall be carried out in the presence of the Engineer or the Engineer's representative.

13.0 Provisional Taking Over

13.1 After completion of the installation system, the same shall be put to a continuous running test for a period of 2 (two) days. All adjustments should be made prior to this test so that proper conditions/working are achieved during this testing. The test readings shall include items as noted in the Testing Schedules.

The plant will be provisionally taken over after successful completion of the above test and the defects liability period shall commence after provisional taking over of the system.

13.2 Final Performance and Capacity Test

In addition to the above testing, final performance and capacity tests shall be carried out on the equipment as per the "Testing Schedules" during the defects liability period as follows:

a. Peak summer/monsoon test during the period from 15th May to 31st July. The installations should be able to maintain the specified inside conditions within the tolerance limits permitted in the Contract.

b. Peak winter test during the period from 1st December to 15th February. The installations should be able to maintain the specified inside conditions within the tolerance limits permitted in the Contract.

14.0 Operation of Plant – if applicable

14.1 After provisional taking over of the plant user/owner shall provide staff for operation. Staff will work under the supervision of the Contractor for proper operation of the plant. This responsibility of the Contractor shall continue till completion of test liabilities with respect to the plant or the maintenance period, which ever ends later.

14.2 The user shall have the right to operate all equipments, if in operating condition, whether or not such equipments, have been accepted as complete and satisfactory. Repairs and alterations shall be made at such time as directed by the Engineer. In special circumstances user may have to use the plant to Air condition some
areas even before the completion of whole work. The Contractor shall co-operate fully under such circumstances.

15.0 Guarantee and Defects Liability Period

15.1 The guarantee shall be valid for a period of 12 (Twelve) months from the certified date of completion of the project. In case the contractor is not able to carry out the seasonal tests (summer/monsoon & winter) within the certified date of completion, the same can be carried out during defects liability period. If required, the Defects Liability period shall be extended till satisfactory completion of seasonal rates.

16.0 Measurement of Works

16.1 All works shall be measured in accordance with the mode of measurement given in the specific sections of the specifications. In case the method of measurement for any item is not clarified in the specifications, the same shall be measured in accordance with the relevant IS standards.

17.0 Variation in Quantities

17.1 The quantities given in the BOQ are for the guidance of the Bidder. The Contractor shall, however, be paid on the basis of actual quantities of works carried out.

18.0 Maintenance

18.1 The Contractor shall provide free maintenance for a period of twelve months after testing and commissioning of the installation. The Contractor shall carry out all routine and special maintenance of the plant and attend to any defects that may arise in operation of the plant. Consumable items required during the maintenance, loss of which is not attributable to bad material and/or workmanship will be arranged by the Employer without cost to Contractor.

19.0 Performance Guarantee

19.1 The Contractor shall submit a performance guarantee certificate from the approved subcontractor that the system shall maintain the desired parameters within +/- 5% of the specified parameters who shall also guarantee that the capacity of various components as well as the whole system covered under the scope of work, technical schedules and Bill of Quantities etc. shall not be less than the specified capacities. The guarantee of the specific equipment
supplier alone with regard to the performance of the system shall not be acceptable. However, this does not alter the overall responsibility of the Contractor for compliance with the Contract terms and conditions.

20.0 Painting

20.1 All equipment and ancillary items such as pipes, supports etc., will be painted in approved manner, using standard colour scheme as approved by the Engineer.

21.0 Safe Custody and Storage

21.1 Safe custody of all machinery and equipment supplied by the Contractor shall be his own responsibility till the final taking over by the Employer. He should, therefore, employ sufficient staff for watch and ward at his own expenses. The Employer may, however, allow the Contractor to use any part of the building for temporary storage of his equipment, if such spaces are ready and available.

22.0 Terms of Payment

The following norms shall be followed for terms of payment of HVAC equipments & installation:

A) 80% of BOQ rate shall be paid on receipt of equipment at Site and after inspection and passing on prorata basis in accordance with clause 33 of SCC

B) 10% of BOQ rate shall be paid on satisfactory erection and installation of equipment on prorata basis

C) 10% after successful completion of running tests and provisional taking over.

23.0 Training of Personnel

The Contractor shall arrange to train the Employer’s personnel on the following aspects prior to provisional take over of the plant:

a) Operation of plant

b) Gas charging and pumping down of the system

h) Adjustments of settings for controls and protective devices

i) Preventive maintenance

j) Disassembling and assembling of compressor including identification and replacement

24. Handing over & Taking over process
For handing over & taking over process in addition to clauses specified the following services/works to be complied by the main contractor:

a) Submission of Guarantees in stamp paper (format approved by Engineer) for all water proofing treatment executed in the works for a period of ten years. If any defects noticed within 10 years from completion of defect liability period the main contractor shall be sole responsible for the defects and same shall be rectified by the main contractor as per information from client within a period of 10 days from the notice.

b) Rectification of all defects shall be carried out by the main contractor before Handing over/Taking over process.

c) As built drawings 4 sets for Architectural, Structural, Plumbing, Electrical, HVAC system, Specialised services and others, approved by engineer shall be submitted by the main contractor before handing over & taking over process.

d) All services/equipments to be run and check before handing over & taking over process as per requirements of employer/principal employer.

e) Contractor has to arrange water & electricity at their own cost for the purpose of testing of services and equipments. No extra amount shall be payable on account of the same.

f) Main contractor shall submit catalogues, brochures, operation manual, manufacturer test certificate, Guaranty/Warranty papers, licence etc for all equipments/materials before handing over & taking over process.

25. Operation and Running of entire system

The contractor shall pay for and arrange for operation & running of entire HVAC system for a minimum period of one month after satisfactory completion of work as desired by Engineer. Cost of operation & running of entire system including required material e.g fuel, consumables, tools & tackles, requisite manpower etc. shall be deemed to be included in the contract price and nothing extra shall be paid.
FORM OF AGREEMENT

This Agreement made the ___________ day of ____________ 2012_______
between All India Institute of Medical Science (AIIMS), New Delhi for the
Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi
(hereinafter called "The Employer") represented by M/s HSCC (India) Limited; E-
6(A), Sector-1, NOIDA (U.P)- 201301 who enters into this Agreement of the one
part and M/s ........................................ (hereinafter called "The Contractor") of
the other part.

Whereas the Employer is desirous that certain works should be executed by the
Contractor, viz ________________ ("the Works") and has accepted a
Bid by the Contractor for the execution and completion of the works and the
remedy of any defects therein.

Now this Agreement witnessed as follows :

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

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

(a) The Letter of Award;  
(b) The said Bid;  
(c) The General Conditions of Contract;  
(d) Prequalification document  
(e) Instructions to Tenderers and Specific Conditions of Contract;  
(f) The Specification;  
(g) The Drawings;  
(h) The Priced Bill of Quantities;  
(i) Any other relevant documents referred to in this Agreement or in
the aforementioned documents

3. 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 respects with the provisions of the
Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of
the execution and completion of the Works and the remedy of defects
therein the Contract Price or only such other sums as may become
payable under the provisions of the Contract at the times and in the
manner prescribed by the Contract.
In Witness whereof the parties hereto have caused this Agreement to be executed the day and year first before written.

Signed, Sealed, and Delivered by the Said

Binding Signature of [HSCC] for and on behalf of All India Institute of Medical Science (AIIMS), New Delhi

Binding Signature of Contractor

In the presence of

Witness (1):

Witness (2):
ANNEXURE - B

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

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

Dear Sir,

In consideration of the All India Institute of Medical Science (AIIMS), New Delhi for Renovation of CCU at CN Centre at AllMS, Ansari Nagar, New Delhi which expression shall include his successor and assignees represented by his Consultant, M/s. HSCC(India) Ltd., Plot – 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201 301 (hereinafter called HSCC) having awarded to M/S_____________________________ (hereinafter referred to as the said Contractor or `Contractor' which expression shall wherever the subject or context so permits include its successors and assignees) a Contract No ________________ in terms inter alia, of the HSCC Letter No._ _____________ dated__________ and the General Conditions of Contract and upon the condition of the Contractor's furnishing Security for the performance of the Contractor's obligations and discharge of the Contractor's liability under and in connection with the said Contract upto a sum of Rs. ______________________ (Rupees ____________________ _____________only) amounting to ________ percent of the total Contract value.

1. We,_____________________________(hereinafter called `The Bank' which expression shall include its successors and assignees) hereby jointly and severally undertake to guarantee the payment to the Employer in rupees forthwith on demand in writing and without protest or demur or any and all moneys payable by the Contractor to the Employer in respect of or in connection with the said Contract inclusive of all the Employer's losses and damages and costs, (inclusive between attorney and client) charges and expenses and other moneys payable in respect of the above as specified in any notice of demand made by the Employer to the Bank with reference to this guarantee upto an aggregate limit of Rs.________________________ (Rupees ____________________ only).

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

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

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

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

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

7. This guarantee shall be a continuing guarantee and shall remain valid and irrevocable for all claims of the Employer and liabilities of the Contractor arising upto and until midnight of ____________________.

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

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

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

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

12. Notwithstanding anything contained herein above, our liability under this guarantee shall be restricted to Rs.________________ (Rupees________ _________________) and this guarantee shall remain in force till___________________ and unless a claim is made on us within 3 months from that date, that is before ______________ all the claims under this guarantee shall be forfeited and we shall be relieved of and discharged from our liabilities there under.

Dated____________________day of________________20

For and on behalf of Bank.

Issued under seal :
ANNEXURE - C

PROFORMA FOR BID SECURITY BANK GUARANTEE

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

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

To

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

Dear Sir,

In consideration of your agreeing to accept Bank Guarantee for Rs. ...................................
(Rupees ......................................................................................................... ) in
lieu of payment from M/s ......................................................................................
having its /their registered office at

..........................................................

(hereinafter called the Bidder) towards Bid Security in respect of your Tender no.
.....
.......................................................... calling for Tender for
..........................................................
at ............................................................ and for due fulfilment of the terms and
conditions of the said Tender, we hereby undertake and agree to indemnify and
keep you indemnified to the extent of Rs ..........................................
(Rupees ....................................................).

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

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

We also agree that your decision as to whether the Bidder has committed any
breach or non observance of the terms and conditions of the said Tender shall be
final and binding on us.
We undertake to pay the Consultant any money so demanded by the Consultant notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceedings pending before any Court or Tribunal relating thereto, our liability under this present being absolute and equivocal.

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

This guarantee shall continue to be in full force and effect for a period of 180 days from the date of submission of Bid.

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

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

Yours faithfully,

For

Signature & seal of the Bank    (Authorised Signatory)
## ANNEXURE – D

### APPENDIX TO TENDER

<table>
<thead>
<tr>
<th>Important Clause</th>
<th>Clause No.</th>
<th>Volume</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Performance Security</td>
<td>10.1</td>
<td>I</td>
<td>5% of the Contract Price</td>
</tr>
<tr>
<td>Minimum amount of third party Insurance</td>
<td>23.2</td>
<td>I</td>
<td>Rs. 1,00,000=00 for Any incident, no. of incidents Unlimited.</td>
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<tr>
<td>Amount of Liquidated damages</td>
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<td>I</td>
<td>0.5% of Contract price per week of delay</td>
</tr>
<tr>
<td>Limit of Liquidated Damages</td>
<td>47.1</td>
<td>I</td>
<td>5% of Contract Price</td>
</tr>
<tr>
<td>Defect Liability Period</td>
<td>49.1</td>
<td>I</td>
<td>12 Months</td>
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<tr>
<td>Percentage of Retention</td>
<td>33 (g)</td>
<td>II</td>
<td>5% of Contract Price</td>
</tr>
<tr>
<td>Programme of work and updated progress reports</td>
<td>39.6</td>
<td>III</td>
<td>Programme updated monthly, progress reported weekly</td>
</tr>
<tr>
<td>Time of Completion</td>
<td>43.1 / 1.4</td>
<td>II / III</td>
<td>within Four calendar month</td>
</tr>
</tbody>
</table>
ANNEXURE - E

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

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

Dear Sir,

In consideration of All India Institute of Medical Science (AIIMS), NEW DELHI the Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi which expression shall include his successor and assigns represented by his Consultant M/s. HSCC (INDIA) Ltd., Plot - 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201 301 (hereinafter called HSCC) having awarded to ___________________________ (hereinafter referred to as the said Contractor or `Contractor' which expression shall wherever the subject or context so permits include its successors and assigns) and the General Conditions of Contract and upon the condition of the contractor's furnishing guarantee for the retention of the contractor's obligations and discharge of the contractor's liability under and in connection with the said contract upto a sum of Rs. ______________________________ (Rupees __________________________ only) amounting to 2.5% of the total contract value.

1. We, _____________________________(hereinafter called 'The Bank' which expression shall include its successors and assigns) having its branch office at ___________________________ (a Company under the provisions of the Companies Act 1913 hereby jointly and severally undertake to guarantee the payment to the Employer in rupees forthwith on demand in writing and without protest or demur or any and all moneys anywise payable by the contractor to the Employer under in respect of or in connection with the said contract inclusive of all the Employer's losses and damages and costs, (inclusive between attorney and client) charges and expenses and other moneys anywise payable in respect of the above as specified in any notice of demand made by the Employer to the Bank with reference to this guarantee upto an aggregate limit of Rs. __________________________(Rupees __________________________ only).

2. We _____________________________Bank Ltd. further agree that The Employer shall be sole judge of and as to whether the said contractor has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by The Employer/HSCC on account thereof and the decision of The Employer that the said Contractor has committed such breach or breaches and as to the amount or amounts of loss, damage, costs, charges and expenses caused to or suffered by The Employer from time to time shall be final and binding on us.
3. The Employer shall be at liberty without reference to the Bank and without affecting the full liability of the Bank hereunder to take any other security in respect of the Contractor's obligations and liabilities hereunder or to vary the contract or the work to be done thereunder vis-a-vis the Contractor or to grant time or indulgence to the Contractor or to reduce or to increase or otherwise vary the prices of the total contract value or to release or to forbear from enforcement of all or any of the security and/or any other security(ies) now or hereafter held by The Employer and no such dealing(s) reduction(s) increase(s) or other indulgence(s) or arrangements with the Contractor or release or forbearance whatsoever shall absolve the bank of the full liability to The Employer hereunder or prejudice the rights of The Employer against the bank.

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

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

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

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

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

9. It shall not be necessary for The Employer to proceed against the said Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding that any security which The Employer may have obtained or obtain from the contractor shall at the time when proceedings are taken against the said bank hereunder be outstanding or unrealised.
10. We, the said Bank undertake not to revoke this guarantee during its currency except with the consent of The Employer in writing and agree that any change in the constitution of the said contractor or the said bank shall not discharge our liability hereunder.

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

1. Notwithstanding anything contained herein above, our liability under this guarantee shall be restricted to Rs.________________ (Rupees________ _________________) and this guarantee shall remain in force till_______________ and unless a claim is made on us within 3 months from that date, that is before ______________ all the claims under this guarantee shall be forfeited and we shall be relieved of and discharged from our liabilities thereunder.

   Notwithstanding anything contained herein,

   a) Our liability under this bank guarantee shall not exceed Rs.______________ (Rupees________ _________________).

   b) This bank guarantee shall be valid up to ________________

   c) We are liable to pay the guarantee amount or any part thereof under the Bank Guarantee only & only if you serve upon us as a written claim or demand on or before ________________

Dated____________________day of________________20

For and on behalf of Bank.
END OF VOLUME - III
Tender

For

Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Volume-IV

Technical Specifications

December’ 2012
TECHNICAL SPECIFICATIONS

CIVIL
TECHNICAL SPECIFICATIONS

CIVIL WORKS

1.0  GENERAL:-

1.01  The specifications and mode of measurements for Civil and Plumbing works shall be in accordance with C.P.W.D.specifications 2009 Volumes I and II with up to date correction slips unless otherwise specified in the nomenclature of individual item or in the specifications. The entire work shall be carried out as per the C.P.W.D. specifications in force with up to date correction slips upto the date of opening of tender.

1.02  For the item not covered under CPWD Specifications mentioned above, the work shall be executed as per latest relevant standards/codes published by B.I.S. (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of opening of tenders.

1.03  In case of B.I.S. (formerly I.S.I) codes/specifications are not available, the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.

1.04  However, in the event of any discrepancy in the description of any item as given in the schedule of quantities or specifications appended with the tender and the specifications relating to the relevant item as per CPWD specifications mentioned above, or in drawings the former shall prevail.

1.05  In general the building floor to floor height is 4.00 mtr unless specified otherwise in the drawing. However, the rates for different items of work shall be for up to 4.5 m floor to floor height at all levels, lifts, leads and depths of the building except where otherwise specified explicitly in the item of work or in special conditions appended with the tender. All works above the top most terraces (main) shall be paid under the level existing below (i.e. machine room, mumty etc)

1.06  The work shall be carried out in accordance with the architectural, structural, plumbing and electrical drawings etc. The drawings shall have to be properly co-related before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.

1.07  All materials to be used on works shall bear I.S. certification mark unless specifically permitted otherwise in writing. In case I.S. marked materials are not available (not produced),
the materials used shall conform to I.S. Code or CPWD specifications, as applicable in this contract.

In such cases the Engineer shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as "First Quality" by the manufacturers shall be used unless otherwise specified. All materials shall be tested as per provisions of the Mandatory Tests in CPWD specifications and the relevant IS specifications. The Engineer may relax the condition regarding testing if the quantity of materials required for the work is small. Proper proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the satisfaction of Engineer. Grade of cement used shall be OPC 43 Grade unless otherwise specified explicitly. Reinforcement Steel used shall be of TMT Fe-500 unless otherwise specified.

1.08 In respect of the work of the sub-agencies deployed for doing work of electrification, air-conditioning, external services, other building work, horticulture work, etc. for this project and any other agencies simultaneously executing other works, the contractor shall afford necessary coordination and facilities for the same. The contractor shall leave such necessary holes, openings, etc. for laying/burying in the work pipes, cables, conduits, clamps, boxes and hooks for fan clamps, etc. as may be required for the electric, sanitary air-conditioning, fire fighting, PA system, telephone system, C.C.T.V. system, etc. and nothing extra over the agreement rates shall be paid for the same.

1.09 Unless otherwise specified in the bill of quantities, the rates for all items of work shall be considered as inclusive of pumping out or bailing out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, or due to any other cause whatsoever.

1.10 Any cement slurry added over base surface (or) for continuation of concreting for bond is added its cost is deemed to have in built in the item unless otherwise/explicitly stated and nothing extra shall be payable or extra cement considered with consumption on this account.

1.11 The rate for all items in which the use of cement is involved is inclusive of charges for curing.

1.12 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer before the work is considered as complete.

1.13 Rates for plastering work (excluding washed grit finish on external wall surfaces) shall include for making grooves, bands etc. wherever required and nothing extra shall be paid for the same.

1.14 The rates quoted for all brick/concrete work shall be deemed to include making openings and making good these with the same specifications as shown in drawings and/or as directed. No extra payment shall be made to the contractor on this account.

1.15 Rates for all concrete/plaster work shall include for making drip course moulding, grooves etc. wherever required and nothing extra shall be paid for the same.

1.16 Rates for flooring work shall include for laying the flooring in strips/as per sample or as shown in drawings wherever required and nothing extra shall be paid for the same.
1.17 The drawing(s) attached with the tender documents are for the purpose of tender only, giving the tenderer a general idea of the nature and the extent of works to be executed. The rates quoted by the tenderer shall be deemed to be for the execution of works taking into account the "Design Aspect" of the items and in accordance with the "Construction Drawings" to be supplied to the Contractor during execution of the works.

1.18 The quoted rate shall be for finished items and shall be complete in all respects including the cost of all materials, labour, tools & plants, machinery etc., all taxes, duties, levies, octroi, royalty charges, statutory levies etc. applicable from time to time and any other item required but not mentioned here involved in the operations described above. The client/OWNER/Employer shall not be supplying any material, labour, plant etc. unless explicitly mentioned so.

1.19 On account of security consideration, there could be some restrictions on the working hours, movement of vehicles for transportation of materials and location of labour camp. The contractor shall be bound to follow all such restrictions and adjust the programme for execution of work accordingly.

1.20 The contractor has to ensure co-ordination with Institute authorities to maintain the smooth functioning / operation of existing Institute without disruption during the execution of work. This may require working rescheduling the normal working hours, working in restricted period etc. Nothing extra shall be payable on this account.

He shall also ensure that all work sites within the Institute complex are properly cordoned off by means of barricades and screens upto a height of 3.0 m above ground level. The contractor shall use painted CGI sheets which are in good condition mounted on steel props.

1.21 Stacking of materials and excavated earth including its disposal shall be done as per the directions of the Engineer-in-Charge. Double handling of materials or excavated earth if required shall have to be done by the contractor at his own cost.

15.0 Sandwich Glass Blind

The scope of work includes designing, providing and fixing motorized sandwich glass venetian blind in door, window and partitions etc. The work shall be carried out by a specialized agency, as approved by the engineer in charge. The Blind System should be designed as sun screening system for installation in double-glazing. The upper horizontal spacer bar must house the hoisting and tilting device of the Venetian blind. The blinds shall have automatic operation depending on required lux level/ direction of sun, relative to the building for everyday of the year for windows and motorized control for partitions, as per user’s requirement. The window blind should create a blind-adjustment schedule to effectively manage day light entering each façade to prevent heat and glare from entering a workspace and maximize effective day light, comfort, and productivity. It should set maximum light level from window automatically based on building requirement in each space; users can select pre-programmed blind position. The agency shall prepare shop drawings, data sheet of materials to be used in the operation as well as sample for approval before execution of work at site.
The automatic/ motorized sandwich glass venetian blind system shall consist of a hermetic sealed double glass unit of required size, Venetian blind and a system for automatic control of the blind.

15.1 HERMETICALLY SEALED UNIT

Insulating glass shall be a double glazed unit comprising two sheets of 6 mm thick toughened glass panes (as per BOQ items) separated by a spacer, hermetically sealed using primary and secondary sealants. The design of insulating glass system shall consist of:

Hollow Spacer Bar

The vertical spacer bars in the double glazing shall be so designed as to prevent the slats to stick to the primary seal.

Desiccant

The desiccant shall be Neftomol 3 A Chemetall or equivalent.

Primary Sealant
The primary sealant shall be single component approved by the Engineer in Charge, thermoplastic solvent free sealing compound based on polysosutylene. The sealant surface shall be free from cavities, depression and other defects.

Secondary Sealant

The secondary sealant in double glazed unit shall be silicone sealant approved by the Engineer in Charge. Before application of silicone/ polysulphide, the surface must be cleaned and free from oil, grease, dust and other loose matter. The surfaces shall be cleaned with alcohol or other suitable solvents. Detergent or soap shall not be used to clean the surfaces. The polysulphide shall be mixed and applied mechanically using automatic mixing machine in the manner approved by Engineer-in-Charge.

15.2 VENETIAN BLIND

The Venetian blind must have 16 mm wide aluminium slats enamelled with a non-fogging enamel paint in approved colour, of approved brand and manufacture. All components must be of UV-resistant material and must not give off any vapours in connection with heating which can deposit on the inside of the glass. The Venetian blind bottom strip must be painted in the slat colour. Upper U profile material 6060 35 alu.alloy. Thickness 1.4 and 0.7mm, surface finish should be anodized.

15.3 CONTROL SYSTEM

Electric Control
Electrically controlled Venetian blinds shall have a 24 V DC motor mounted inside the top spacer bar of the double-glazing. The control system must be with a sun automatic control/time/temperature control. Electrically operated Venetian blinds may be individually or group controlled with either a toggle switch or IR remote control. The group control shall be made electronically at the control box of each Venetian blind without mechanical operations of any kind. In the electrically controlled blind, the motor is integrated into the upper horizontal spacer bar of the double glazing. This technical solution must ensure the best possible working conditions for the motor, in the dry and dustless environment inside the double glazing. The blinds can be controlled by anything from a toggle switch to a more advanced system, in which e.g. time, daylight, sun or external/internal temperatures control whether the Venetian blinds are up or down.

Remote control, with an infrared transmitter, may be incorporated in the control system. In automatic systems, the slats move simultaneously in all windows and are positioned at the same angle (within 5º), thereby creating a calm and harmonious façade. The elevation speed is uniform within + 5% on all blinds. As there are no loose control cords to disturb the visual impression, electrically driven blinds do not disturb the design of the façade. An advanced built-in, electronic limit switch ensures correct stop of the motor driven blinds, in upper and lower positions.

**Motor**

The motor is a direct current motor 24 Volt DC, mounted in the upper horizontal spacer bar of the double glazing. The motor has a quiet and vibration free running, caused by two synthetic motor bearings. The electric coupling to the motor is done through a special plug in the upper left corner of the internal double glazing. The plug does not require extra space in the rabbet of the frame. Double glazing with double motor has plugs in the two upper corners. The motors should carry minimum of 5 years onsite warranty.

**Control unit**

The control system must ensure that the motor at any time has the required torque, which ensures a lenient handling of motor/gearbox and the blind itself, securing a long lifetime on the complete system. The motor control unit may be with and without regulated motor speed.

**Motor cable**

The motor cables should be available in adjusted lengths, with a fit on electrical plug, matching the current motor type.

**Power supply**
The motor control system must be supplied with 24 Volt DC.

**Toggle switch control**

The blinds may be operated with a simple up/down toggle switch control of approved quality.

**Remote control**

The blinds may also be controlled with a remote control of approved quality which may operate up to six groups.

**Automatic control**

The above system may be supplemented by automatic control systems, operating the blinds according to different parameters like, Outdoor temperature, Indoor temperature, time control, light control, and sun control.

**Electric mounting**

The blind controls should be designed for DIN-band mounting, while operation switch, remote control receiver etc. are designed for wall mounting.

It is recommended that the control units, designed for DIN-band mounting, should be installed in controller boards or suitable UG boards, and that they are assembled in groups as large as possible for each room, floor etc.

The system needs 24 Volt DC, therefore one or more power supplies are needed.

**15.4 MEASUREMENT**

The height and width of double glazed unit as fixed in place shall be measured correct to one centimeter and area calculated in sqm. correct to second place of decimal shall be taken for payment.

**15.5 RATE**

The rate shall include the cost of all the materials, labours involved in all the operations as described in nomenclature of item and particular specification.

**15.6 GUARANTEE**

At the close of the work and before issue of final certificate of virtual completion by the Engineer, the Contractor shall furnish a written guarantee indemnifying the Owner against defective materials and workmanship for a period of five years after completion and handing over. The Contractor shall hold himself fully responsible for repair/ replacement free of cost to the Owner of:

a. Any defective material or equipment supplied by the Contractor, or defect arising out as a result of operation during guarantee period.

b. Any material or equipment supplied by the Owner which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.
16.00 Anti-bacterial Powder Coating

Powder Coating of Aluminum Profile to be done having a minimum thickness of 50 microns using Ultra durable Interpon D 2000 powder of Akzo Nobel or equivalent coatings confirming to (American Architectural Manufacturer Association) AAMA 2604 – 2002 with 5 year Florida Specification with 15 years Guarantee against Peel Off, Film Integrity and Gloss Retention. The powder to have Antibacterial Properties, evaluated versus JIS Z 2801:2000 and ASTM E 2801-01 standards. Coating to be done through ISO/ISI Certified Approved applicator of Akzo Nobel or approved equivalent, who has been carefully selected, audited for their quality management system, samples evaluated for the different specification. Certificate of warranty and AB properties to be issued with the coatings.

19.00 PLUMBING & SANITARY INSTALLATIONS

19.01 Special condition for PHE work: The plumbing work shall be carried out by specialized plumbing agency who has licensed plumber and experience of similar works. For supervising the plumbing work at least one engineer who has rich experience in executing plumbing work shall be engaged full time. Approval of specialized agency shall be obtained from HSCC.

19.02 The provision of adequate sanitary and safety facilities as per the norms of NBC and good engineering practice shall be compliance during construction for construction workers and staff.

19.03 The water use for construction shall be suitable for the same and should be used efficiently and checks and control valves shall be provided to avoid the wastage and leakage.

19.04 To reduce the water consumption of the building, the flushing system of water closet shall be of dual flushing cistern type and plumbing fixture shall be provided which require GRIHA compliance for low flow rate.

19.05 Lab service related to plumbing & fire fighting will be executed by specialized agency who has experience of carrying out similar work earlier. All the lab item shall be detailed out & redesign as per requirement of client, WHO, CDC norms, items given in BOQ are indicative but covered the cost as per the latest requirement of client, WHO, CDC and required approval of client before execution.

19.06 Wall Caps

Wall caps shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pass through them. These wall caps shall be chromium plated brass snugly fittings and shall be large enough to cover the puncture properly and shall conform to IS: 4291.

19.07 Pipes, Hangers, Brackets, etc.

Sturdy hangers, brackets and caddles of approved design shall be installed to support all pipe lengths, which are not embedded over their entire runs. The hangers and brackets shall be of adjustable heights and painted with red oxide primer, and two coats of enamel paint of approved make and shade. Clamps, coils and saddles shall be provided to hold pipes with suitable gaskets of approved quality. The brackets and hangers shall be designed to carry the
weights of pipes safely. Wherever required pipes may run along ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.I. Pipes</td>
<td>300 cms</td>
<td>240 cms</td>
</tr>
<tr>
<td>H.C.I. Pipes</td>
<td>180 cms</td>
<td>120 cms</td>
</tr>
</tbody>
</table>

19.08 Pipe sleeve

Adequate number of sleeves (pipe inserts) of Cast Iron or Mild Steel shall be provided where pipes cross through concrete, masonry and similar work. The pipe inserts shall be provided with removable timber plugs to keep foreign matter out till installation of the services pipe cross the sleeve. The diameter of sleeve should be one size higher than the proposed dia or as instructed by the Engineer.

19.09 Floor trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, contractor shall have a special type G.I. / M.S. inlet hopper without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and hopper inlet socket shall be lead caulked/welded/threaded. Hopper shall connected to a C.I. P or S trap with at least 50mm water seal. Floor trap inlet hoppers and traps shall be set in cement concrete 1:2:4 blocks without any extra cost.

19.10 C.P. gratings

Floor trap and urinal trap shall be provided with 110mm square or round C.P. /stainless steel grating, with rim of approved design and shape. Minimum thickness shall be 3 mm.

19.11 Hot Water Supply

The chase will be closed in cement mortar 1:2 ( 1 cement : 2 coarse sand). Pipes shall be clamped to the wall inside the chase.

19.12 Making Connections

Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manholes for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

19.13 Water Heater

Water heater shall be automatic pressure type water heater (with pressure release valve) with heavy gauge copper container duly tinned, thermostats, indicator lamp and glass wool insulator. the water heaters shall be fitted with pressure release valve, non-return valve and inlet and outlet stop valves as required. Water heaters to conform to IS:2082.
19.14 FULLWAY BALL VALVE
The valves shall be of full-bore type and of quality approved by the Engineer. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

19.15 COMPOSITE PIPES: Composite pipes shall be used in the internal water supply if specified in the Bill of Quantities. These may required to be connected to the existing/ new GI pipes.

19.16 SAMPLE AND SHOP DRAWINGS;
All plumbing items shall be provided as per approved sample/data sheet approved by the HSCC. Before placing the order, the contractor shall submit the shop drawings prepared based on tender drawings and BOQ alongwith samples for approval of HSCC. The shop drawings shall have all the details. The contractor has to obtain the approval of external plumbing drawings from DJB/MCD before start of work.

24.00 FIRE FIGHTING SYSTEM

24.01 GENERAL
1.1 Work under this contract shall be executed as shown on the drawings and given in the specifications and required at site whether explicitly shown or not.

1.2 Not-with standing the sub-division of the documents into separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and in to the contract so far as it may be practicable to do so.

1.3 Where it is mentioned in the specifications that the contractor shall perform certain work or provide certain facilities, it is understood that the contractor shall do so without any extra cost to the Employer/HSCC.

1.4 The material, design and workmanship shall satisfy the local fire regulations. The job specifications contained herein and codes referred to where the job specifications stipulate in addition to these contained in the standard codes and specifications, these additional requirements shall also be satisfied.

1.5 Portable fire extinguisher shall be provided in the building as per BOQ which should not contain halogen to minimize the use of ozone depleting substance as per GRIHA.

2.0 SCOPE OF WORK
2.1 Work under this contract consist of furnishing labour, materials, equipment and appliances necessary and required to completely do all works relating to the fire protection system as described here-in-after and shown and the drawings, consisting of:

i) Supply, installation, testing and commissioning of:
   Fire hydrant system including fire pumps and ancillary equipment’s described later in the Volume.
   Fire sprinkler system, as described later in the volume.
   Portable Fire Extinguishers

ii) Preparation of plans and getting pre-installation approval by the Local Fire Authority.

Getting tested by and approval of the installation by the Local Fire Authority during the fabrication/construction stage as well as after completion. It will be the responsibility of the Contractor to get all approval and completion certificate from the Local Fire Department without which the work will not be taken over by the owner. Fee payable to the local bodies for such activities shall be borne by the Owner on production of receipts for money paid and the all other expenses barring the fee will be borne by the Contractor.
iv) Supply of necessary spare parts during the commissioning stage.

v) Supply of any other item or services not specifically mentioned anywhere but required by the Local Fire Authority or essential for the completion & operation.

3.0 INTERPRETATION

3.1 In interpretation of specifications, the following order of decreasing importance shall be followed:

a. Statutory Rules & Regulation
b. Schedule of quantities
c. Additional specifications
d. List of approved make of materials
e. General rules and conditions

3.2 Matters not covered by the specifications given in this contract, as a whole shall be covered by relevant and latest CPWD specifications / Indian Standard Codes. If such codes on a particular subject have not been framed, the decision of the engineer shall be final and binding.

4.0 SPECIFICATIONS

4.1 Work shall be carried out strictly in accordance with the specifications attached to the tender.

4.2 Works not covered in the specifications shall be carried out as per relevant latest CPWD specifications/Indian standard Code of practice specifications of materials.

5.0 EXECUTION OF WORK

5.1 The work shall be carried out in conformity with the contract drawings and within the requirements of architectural, HVAC, plumbing, electrical, structural and other specialized services drawings.

6.0 TENDER DRAWINGS

6.1 For guidance of the bidder, drawings as listed are enclosed with these tender documents. These drawings are broadly indicative of the work to be carried out. The Contractor on award of work will furnish shop drawings based on the working drawings issued to him, as required in advance for approval of Engineer and get the same approved by Local Fire Authority/other statutory bodies. No claim whatsoever shall be admissible on account of changes that may be introduced by the Engineer /Local Fire Authority.

6.2 The Contractor shall examine all specifications, tender conditions and drawings before tendering for the work.

6.3 Information, levels and dimensions given in the tender drawings are supposed to be correct but the contractor shall make independent inquiries and verify the same. No claims for extras shall be admissible in case of any deviations for incorrectness of the information, levels or dimensions.

6.4 The contractor shall obtain all information relating to the local regulations, bylaws, and application of any and all laws relating to him work or profession. No additional claims shall be admissible on this account.

7.0 SHOP DRAWINGS
7.1 The Contractor shall prepare and furnish all shop drawings in quadruplicate at no extra cost for approval by the Engineer before commencing fabrication/manufacture of the equipment. Such shop drawings shall be based on the Architectural & Fire fighting drawings and requirements laid down in the specifications and as per site conditions. The manufacture of equipment shall be commenced only after the shop drawings are approved in writing by the Engineer. Such drawings shall be co-ordinated with all disciplines of work.

7.2 Contractor shall verify all dimensions at site and bring the notice of the HSCC any or all discrepancy or deviations notices. The decision of the HSCC in the regard shall be final.

7.3 Large size details and manufacturer’s dimensions for materials to be incorporated shall take precedence over small-scale drawings.

7.4 All drawings issued by the consultants for the work are the property of the Consultants and shall not be lent, reproduced or used on any other works than intended, without the written permission of the Consultants.

7.5 Working drawings shall be approved by the consultant. Four sets of shop drawings shall be submitted for approval showing:

a) Any change in layout from the contract drawings.

b) Equipment layout, piping, wiring diagram and instrumentation.

c) Manufacturer’s or contractor’s fabrication drawings for any material or equipment.

8.0 COMPLETION DRAWINGS

On completion of the work and before issuance of certificate of virtual completion, the Contractor shall submit to the Engineer. General layout drawings, drawn at approved scale indicating layout of pump house piping and its accessories “As installed”. These drawings shall in particular give the following:

a. General layout of pump house.

b. Panels and other equipment location and sizes etc.

c. Complete Schematic as installed.

d. Location of Hydrants, Earth pipes, route of earthling conductors etc.

e. Route of all cables and pipes run along with detail sizes and mode of installation.

9.0 DOCUMENTS

The Contractor shall submit to the Engineer, the following documents on completion of the work and before issuance of virtual completion.

i. Warranty for equipment installed.

ii. Test certificates.

iii. History sheets of the equipments.

iv. Catalogues.

v. Operation and Maintenance manuals.

vi. List of recommended spares and consumables.
vii. Reconciliation statement.

viii. All approvals and sanctions.

10.0 MATERIALS

10.1 All materials used on this work shall be new, conforming to the specifications.

10.2 Materials shall conform to the technical specification and/or the latest CPWD Specifications /Indian Standards Specifications as amended up to date and carry certification mark, wherever so required.

10.3 Only approved make of material shall be used. The contractor shall get the samples of all the items approved from the Engineer before commencing the supply.

11.0 TESTING OF MATERIALS

11.1 Contractor shall be required to produce manufacturer’s test certificates for the particular batch of materials supplied to him. The test carried out shall be as per the relevant CPWD specifications/Indian Standards.

11.2 Any weights of sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost. The decision of the HSCC shall be final and binding on the contractor.

11.3 The Engineer shall have full power to get any material of work to be tested by an independent agency at Contractor's expense in order to prove the soundness and adequacy.

12.0 INSPECTION AND TESTING

12.1 All equipment shall be inspected and tested as per an agreed quality Assurance Plan before the same is packed and dispatched from the Contractor's Works. The Contractor shall carry out tests as specified/directed by Engineer.

12.2 Contractor shall perform all such tests as may be necessary to meet requirements of Local Authorities, Municipal or other statutory laws/ bye-laws in force. No extra shall be paid for these.

12.3 The Engineer may, at his sole discretion, carry out inspection at different stages during manufacturing and final testing after manufacturing.

12.4 Approvals or passing of any inspection by the engineer or his authorized representative shall not, however, prejudice the right of the Engineer to reject the plan if it does not comply with the specification when erected or give complete satisfaction in service.

12.5 All materials and equipment found defective shall be replaced and the whole work again tested to meet the requirements of the specifications, at the cost of the contractor. Contractor has to obtain a performance certificate/approval for the complete layout of piping/equipment erected.

13.0 WELDING

13.1 The welding procedure, types of electrodes etc. shall be in accordance with the following IS specifications.

Welding Procedures IS: 823

Welding Electrodes IS: 814, but of approved makes only

Testing of Welders IS: 817
13.2 Only Welders fulfilling the requirements of IS: 817 and approved by the HSCC shall be employed by the Contractor.

14.0 JOINING MATERIAL (GASKET)

Gasket, for use in between flanged joints, to be of CAF as per IS-2712, thickness as specified in S.O.Q.

15.0 PAINTING

15.1 All above ground pipes, pipe fittings, hose cabinets structural steel work pipe supports etc. shall be painted as per specifications given below.

15.2 Painting shall be done only after the completion of fabrication work and testing.

15.3 The instructions of paint manufacturer shall be followed as far as possible otherwise the work is to be done as directed by the HSCC.

15.4 All cleaning materials, brushes, tools and tackles, painting, material etc. shall be arranged by the Contractor at site in sufficient quantity.

15.5 All rust, dust shall scales, welding slag or any other foreign materials shall be removed fully so that a clean and dry surface is obtained prior to painting. Any other oily containment shall be removed by use of a solvent prior to surface cleaning.

15.6 First coat of primer paint must be applied by brush on dry clean surface immediately or in any case within 3 hours of such cleaning.

15.7 Primer paints - one coat (minimum thickness 100 microns) self-priming epoxy mastic.

15.8 Finishing coats:

a) For Pump Rooms - 2 coats (thickness minimum 50 microns each) of epoxy paint, fire red shade as per IS: 4.

b) For other than Pump Rooms - 2 coats of synthetic enamel paint, fire red shade as per IS: 4.

16.0 COATING WRAPPING FOR UNDERGROUND PIPES

16.1 All underground piping shall be protected by coating and wrapping as per the following procedure.

16.2 The materials and workmanship shall in general conform to IS: 10221, 1982 or as directed by the HSCC.

16.3 Cleaning - The pipes shall be thoroughly cleaned by dust, rust will scales, oil, grease etc. by stiff wire brush and scrappers. The surface shall be coated with the primer immediately after cleaning.

16.4 Priming – Suitable primer shall be applied as an undercoat. The manufacturers recommended procedure would be followed for applying the primer.

16.5 Paste Application - Paste shall be applied to fill up uneven surfaces in order to ensure smoothness for subsequent wrapping with multi-layer tape.

16.6 Tape Wrapping - The tape is to wrap while the second coat of primer is still tacky. Winding is to be done with 50% overlap so that the total thickness of 2.0mm tape would become 4.0mm. It should be ensured while wrapping that air bubbles are not trapped. The ends of tape shall be secured with nylon binding to ensure that the tape doesn’t get loosened while handling.
16.7 The total thickness including 2 coats of primer, 50% overlap of tape etc. should not be less than 4.5mm or as per manufacturer recommendations.

16.8 The ‘Holiday Test’ is to be conducted as per IS: 10221 for detecting any entrapped air or any other defect. The Contractor is to arrange for the Holiday Test and to rectify the defects if found any.

17.0 TRAINING OF DEPARTMENT PERSONNEL

17.1 The Contractor shall train the Owner’s personnel to become proficient in operating the equipment installed. Training shall be done before the expiry of the defects liability period.

17.2 The period of training shall be adequate and mutually agreed upon by the Engineer and Contractor.

17.3 The Owner’s personnel shall also be trained for routine maintenance work and lubrication, overhauling, adjustments, testing, minor repairs and replacement.

17.4 Nothing extra shall be paid to the Contractor for training Owner’s personnel.

18.0 PERFORMANCE GUARANTEE

At the close of the work and before issue of final certificate of virtual completion by the Engineer, the Contractor shall furnish a written guarantee indemnifying the Owner against defective materials and workmanship for a period of one year after completion and handing over. The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to the Owner.

a. Any defective material or equipment supplied by the Contractor.

b. Any material or equipment supplied by the Owner which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.

21.02 SPECIFICATIONS FOR PUMPS AND ANCILLARY EQUIPMENT

1.0 SCOPE OF WORK

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically/diesel engine operated pumps for fire hydrant installations as required by the drawings and specified hereinafter or given in the schedule of quantities.

1.2 Without restricting to the generality of the foregoing the pumps and the ancillary equipment and shall include the following:

Electrically/diesel operated pumps with motors/diesel engine, base plate and accessories.

Pump suction and delivery headers, valves, air vessel and connections.

c) Alarm system, Pressure gauges/Pressure switch.

d) Electrical switchboards, wiring, cabling, cable tray, control panel and properly connecting to earthing system of the Factory.

e) Foundations, vibration eliminator pads and foundation bolts.

2.0 GENERAL REQUIREMENTS

2.1 Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.

2.2 Pumps and motors shall be truly aligned with suitable instruments.
2.3 All pump connections shall be standard flanged type with appropriate number of bolts.

2.4 Manufacturer instructions regarding installation connections and commissioning shall be followed with respect to all pumps, switchgear and accessories.

3.0 QUALITY CONTROL

3.1 These shall comply with the IS Codes as specified.

4.0 SUBMISSIONS

4.1 Product Manuals

4.2 Hydraulic Details

5.0 STORAGE

6.0 These shall be stored as delivered in original packings.

6.0 FIRE AND JOCKEY PUMPS

6.1 Pump Sets

i) Centrifugal, split casing, horizontal pump should be selected as per IS. Pump should have following specification.

<table>
<thead>
<tr>
<th>PARTS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CASING</td>
<td>CAST IRON</td>
</tr>
<tr>
<td>IMPELLER</td>
<td>BRONZE IS:318, GR.LTBJ/LTB 2 SS-410</td>
</tr>
<tr>
<td>CASING WEARING</td>
<td>CAST IRON</td>
</tr>
<tr>
<td>SHAFT</td>
<td>STAINLESS STEEL</td>
</tr>
<tr>
<td>SHAFT SLEEVE</td>
<td>SS-410</td>
</tr>
<tr>
<td>SHAFT SEAL</td>
<td>MECHANICAL</td>
</tr>
<tr>
<td>THRUST BEARING</td>
<td>ANTI-FRICTION OF TITLING PAD TYPE</td>
</tr>
</tbody>
</table>

ii) Pumps shall be connected to the drive by means of spacer type love joy couplings, which shall be individually balanced dynamically and statically.

iii) The coupling joining the prime movers with the pump shall be provided with a sheet metal guard.

iv) Pumps shall be provided with approved type of mechanical seals.

v) Pumps shall be capable of delivering not less than 150% of the rated capacity of water at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.

vi) The pump shall meet the requirements of the Tariff Advisory Committee and the unit shall be design proven in fire protection services.

vii) Pumps shall be provided with pressure gauge with isolation cock on the delivery side.
viii) In case of motor driven pump the motor rating should be adequate to drive the pump at 150% of rated discharge.

Waterproof PVC coated windings.

6.2 Electric Drive

i) Electrically driven pumps shall be provided with totally enclosed fan cooled induction motors. For fire pumps the motors should be rated not to draw starting current more than 3 times normal running current.

ii) Motors for fire protection pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service.

iii) Motors shall be wound for class B insulation and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fibre insulated.

iv) Motors for fire pumps shall meet all requirements and specifications of the Tariff Advisory Committee.

v) Motors shall be suitable for 415 volts, 3 phase 50 cycles a/c supply and shall be designed for 38 deg. C ambient temperature. Motors shall conform to I.S. 324.

vi) Motors shall be designed for two start system.

vii) Motors shall be capable of handling the required starting torque of the pumps.

viii) Contractor shall provide inbuilt heating arrangements for the motors for main pumps to ensure that motor windings shall remain dry.

ix) Speed of the motors shall be compatible with the speed of the pump.

x) The fire pumps shall operate on drop of pressure in the mains as given below. The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only.

6.3 Operating Conditions for Fire & Sprinkler Pumps

<table>
<thead>
<tr>
<th>Operating Pressure</th>
<th>CUT IN</th>
<th>CUT OUT</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jockey Pump</td>
<td>(H-0.5) Kg/Sqcm.</td>
<td>(10M+Head of pump as per BOQ in M). ie 1.0+(H)Kg/Sqm</td>
<td>H Kg/Sqcm.</td>
</tr>
<tr>
<td>Main Fire Pump (One No)</td>
<td>(H-1.0) Kg/Sqcm.</td>
<td>Push button manual</td>
<td>To start by pressure switch No. 2 on air vessel</td>
</tr>
<tr>
<td>Common Diesel Engine (One NO)</td>
<td>(H-2.0) Kg/Sqcm.</td>
<td>Push button manual</td>
<td>To start by pressure switch No. 3</td>
</tr>
</tbody>
</table>
6.4 Vibration Eliminators

i) Provide on all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per manufacturer details.

6.5 Installation

i) Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.

ii) Pumps and motors shall be truly aligned by suitable instruments.

iii) All pump connections shall be standard flanged type with appropriate number of bolts. In case of non-standard flanges companion flanges shall be provided with the pumps.

iv) Manufacturer’s instructions regarding installation, connections and commissioning shall be followed with respect to all pumps and accessories.

v) Contractor shall provide necessary test certificates and performance charts with NPSH requirement of the pumps from the manufacturer. The contractor shall provide facilities to the Architect or their authorised representative for inspection of equipment during manufacturing and also to witness various tests at the manufacturer’s works without any cost to the owners.

6.6 DIESEL ENGINE

Diesel engine shall be of 6 cylinder with individual heat assemblies. The engine shall be water cooled and shall include heat exchanger and connecting piping strainer, isolating and pressure reducing valves, by pass line, exhaust pipe, silencer day tank for fuel all interconnected piping etc. complete in all respects.

The speed of the engine shall match the pump speed for direct drive.

c) The engine shall be capable of being started without the use of the wicks, Cartridge heater plugs or either at the engine room temperature 4 deg.C and shall take full load with in 15 second from the receipt of the signal to start.

d) The engine shall effectively (i.e. without any derating) operated at 46 deg.C ambient temperature at 150 meter above mean sea level.

e) Noise level of the engine shall not exceed 90 db (free sound pressure) at 3-meter distance.

f) The engine shall be self starting type upto 4 deg.C shall be provided with one 24 volts heavy duty D.C. battery, starter, cutout, battery leads complete in all respects. One additional spare battery leads complete in all respects. One additional spare battery shall be provided. The battery shall have an adequate capacity for cold cranking amperage as recommended by the Engine Manufacturer.

g) An automatic change over system shall be provided so that the spare battery comes into operation in case the engine is not started by its own battery.

h) Pump Control Panel should have visual and audio alarm and indication for battery failure.

i) The working battery as well as battery should have output amperage capacity for at least 3 consecutive cranking/starting of the Engine.
j) Provide a battery charger of sufficient amperage capacity of fully charge the batteries in 20 hours with tickle and booster charging facility and regulators.

k) Arrangement for starting shall be automatic on receiving the signal. But shut-off shall be manual.

l) The engine shall be provided with an oil bath or dry type air cleaner as per manufacturer’s design.

m) Engine shall be suitable for running on high-speed diesel oil.

n) The system shall be provided with a control panel with push button starting arrangement also wired to operate the engine by differential pressure switches.

o) The entire system shall be mounted on a common structural base plate with anti vibration mounting and flexible connections on the suction and delivery piping.

p) Contractor shall provide one fully mounted and supported day oil tank fabricated from 6mm thick MS sheet electrically welded with capacity for 8 hours working at full load but not less than 200 ltrs. Provide level indicators - low level and full level in the day oil tank on the control panel through float switches and an air breather. Day oil tank shall also be provided with filling connection (threaded) with cap, gauge glass indication & cocks, drain cock, inspection/cleaning cover with gasket and nuts/bolts. M.S. dyke to hold 150% of the day tank capacity to be built around the Day Tank.

q) Contractor to provide one exhaust pipe with suitable muffler (residential type) to discharge the engine gases to outside in open air as per site conditions (contractor to check the site).

r) Contractor to provide all accessories, fittings, and fixtures necessary and required for a complete operating engine set. The exhaust pipe shall be taken outside the building with minimum number of bends (approx. length 30 Mts.) and shall be duly heat insulated with 50mm thick glass wool covered with 24 gauge aluminum cladding.

s) Contractor shall submit to the Owner special requirements, if any, for the ventilation of the pump room.

6.7 BASE PLATE

Pumps and motors shall be mounted on a common structural base plate and installed as per manufacturer instructions.

6.8 AIR VESSEL

The contractor shall provide one air vessel fabricated from 8mm M.S. plates with 10mm dished ends and suitable supporting legs. Each air vessel shall be provided with a 80mm dia, flanged connection from pump, one 25mm dia, drain with valve, one gun metal water level gauge and 25mm sockets for pressure switches. The vessel shall be 450mm dia x 1800mm high and tested to 20 Kgs./Sq.cm. pressure.

6.9 CUBICLE TYPE SWITCH BOARDS/L.T. PANEL

6.9.1 Cubicle type switch boards and components shall conform to the requirements of the latest revision including amendments of the following codes and standards.

\[
\text{IS:8623} : \quad \text{Specification for factory built assemblies of switch- gear and control gear for voltage up to and including 1000-V AC/1200 V-DC.}
\]

\[
\text{IS:4237} : \quad \text{General requirements for switchgear and control-gear for voltage not exceeding 1000-V.}
\]
The board shall be metal enclosed single front, indoors, floor mounted free standing type or wall mounting type as mentioned in BOQ. The panel shall be designed for a degree of protection of IP-52. The panel height shall not exceed 2350 mm including horizontal main bus bar at top. Keeping in view the operating height of the top switch 1750mm from finish floor, 400-mm clear space shall be left through out the panel at bottom. The cold rolled sheet steel will be of 2mm thick.

All cutouts and covers shall be provided with synthetic rubber gaskets. (Preferably neoprene).

The panel shall be divided into distinct vertical sections each comprising of:

i) Complete enclosed bus bar compartment for running horizontal and vertical bus bars.

ii) Complete enclosed switchgear compartment one for each circuit for housing air circuit breaker, MCCB etc.

iii) Compartmentally for power and control cables of at least 300mm width covering entire height provided.

All cable alley must be provided with threaded nipples for CO2 flooding system and shall be connected to all compartment with centralized CO2 system

v) The panel shall have 20% spare space duly wired for future use.

The front of each compartment shall be provided with hinged single lead door with locking facilities. Panel shall be provided with suitable lifting facilities. Isolators & MCCB/ACBs shall be of fixed/drawout type as described later.

Each feeder shall have compartmentalized construction cable entry shall be from top/bottom (3mm thick gland plate shall be provided) as required.

The panel shall be provided with three phase buses and neutral bus bars of aluminium sections throughout the length of the panel and shall be adequately supported and braced to withstand the stresses due to the short circuit current of 50 KA rms. For 1 sec. Maximum temperature rise of bus bars and bus bar connection while carrying rated current shall not exceed 40 amp. over an ambient temperature of 50 deg.C.

The minimum clearance in air between phases and between phases and earth for the entire run of the bus bar connections shall be 25mm minimum bus bars support insulators shall be made of non-hydroscopic non-combustible track resistant and high strength type porcelain or polyester fibre glass moulded material.

All bus bars shall be colour coded as per IS: 375 and the current density shall be 1 amp/sq.mm.
G.I. earth bus of 50x6mm size shall be provided at the bottom of the panel throughout the length. Similarly, 40x6mm G.I. strip in each vertical section for earthing the individual equipment/accessories shall be provided and connected to the main horizontal bus.

Contractors shall be electro-magnetic types with interrupted duty as per IS: 2959. The main contacts shall be of Silver or silver alloy, provided with minimum 2 NO and 2 NC auxiliary contacts. The push button should be of shrouded type and each should be provided with 1 NO and 1 NC contact. Colour coding shall be as per IS: 6875 (Part II).

6.9.2 ACB

The circuit breaker shall be of air break type in order to eliminate fire and explosion risk and shall comply with the IS: 13947-1993 with a rupturing capacity of not less than 50 MVA at 415 volts or as specified elsewhere (The service short circuit breaking capacity shall be as specified and equal to the short circuit with stand value). The breaker shall be provided with microprocessor based releases for overload and short circuit protection.

The breaker shall consist of a horizontal drawout pattern triple pole, fully interlocked, independent manual spring operated mechanism. The mechanism should be such that the circuit breaker is at all times free to open immediately. The trip coil is energized. Current carrying parts should be silver plated and suitable arcing contacts shall be provided to protect the main contact arc-chutes for each pole shall be provided and shall be lifted out for the inspection of main and arcing contact.

Self-aligning cluster type isolating contacts shall be provided on breaker for interlocking protection metering and for any other purposes.

Breaker shall be provided with automatic safety shutters to screen the main live contact when the breaker is withdrawn. The frame of the circuit breaker should be positively earthen when the breaker is racked into the cubicle.

The following safety arrangements shall be provided for the safety of the personnel to prevent mal-operation.

i) Interlock to prevent the truck from being withdrawn or replaced except in the fully isolated position.

ii) Interlock to prevent earth connection from being made by the earthing device except breaker is open.

iii) Interlock to prevent the breaker from being made alive without its rack in position.

6.9.3 Moulded Case Circuit Breaker (MCCB)

MCCB shall conform to the latest IS: 13947-1993/IEC 947-1989. The Service Short Circuit Breaking Capacity (ICS at 415 VAC) should be 50 KA.

MCCB shall be Current Limiting and comprise of Quick Make - Break switching mechanism preferably Double Break Contact system are extinguishing device and the tripping unit contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable magnetic short circuit pick up.

The trip command shall over ride all other commands. MCCB shall employ maintenance free double break contact system to minimize the let thru’ energies and capable of achieving discrimination up to the full short circuit capacity of downstream MCCB. The manufacturer shall provide both the discrimination tables and let thru’ energy curves. The MCCB shall not be restricted to Line/Load connections.
The handle position shall give positive indication of ‘ON’, ‘OFF’ or ‘Tripped’ thus qualifying to
disconnection as per the IS/TEC indicating the true position of all the contacts. In case of 4 pole
MCCB the neutral shall be defined and capable of offering protection.

The general-purpose control switch shall be provided for ON/OFF Auto/Manual. The switch shall be
provided with engraving plates on the front with the complete inscription.

The switch shall be normally a fixed control box type heavy-duty unit.

Indicating lamps shall be of the panel mounting, LED type and shall have execution plates marked
with its function wherever necessary. The colour of the lamp cover shall be red for ‘ON’ and green for
‘OFF.

6.9.4 Motors and Starters for Fire Pumps

The starters shall be of DOL type. The motors should have double sq. cage or other provision to limit
the starting current to 4 times the full load current.

6.9.5 Name Plates & Lables

i) Panel and all modules shall be provided with prominent engraved identification plates. The module
identification designation. For single front switchboards, similar panel and board identification lables
shall be provided at the rear also.

ii) All nameplates shall be of non-rusting metal or 3-ply lamicold, with white engraved lettering on black
background. Inscription and lettering sizes shall be subject to Owner’s approval.

iii) Suitable stencilled paint marks shall be provided inside the panel/module identification of all
equipment in addition to the plastic sticker lables, if provided. These lables shall be partitioned so as to
be clearly visible and shall have the device number, as mentioned in the module wiring design.

6.9.6 Painting of all Steel Work

The steel used for fabrication of electrical/panels/equipment should be stove enameled as per the
detailed specifications given below:

a) Degreasing: All the steel components, to be painted, should be effectively cleaned by alkaline
degreasing.

b) Pickling: Oxide scale rust formation are to be removed in a hot bath of sulphuric acid. Pitting of the
surface is to be prevented by the use of pickling in habitors.

c) Cold Rinsing: The parts are then to be washed with cold water to remove all traces of acidic solution.

d) Phosphating: In order to attain durable paint coating the metal surface is to be given phosphating
treatment by development a phosphate layer on the surface. Preferably hot grenadine solution is to be
used in the phosphating plant.

Pessivating: This process is to be carried out by using deodilate solution.

Drying: The treated parts should then be dried in a hot chamber in dust free atmosphere to ensure that
they are absolutely clear and dry before the paint is applied.

Primer Coating: The treated and dried parts are to be sprayed with high corrosion resistance primer.

Stove Drying: The primer coating is to be backed in an electrically heated, air circulated area type
storing oven.
i) Finishing Coat: The finishing paint coat is to be applied by spraying two coats of 15 micron thickness powder coated paint of approved shade.

6.9.7 Wiring

Control and protective wiring shall be done with copper conductor PVC insulated 1100 volts grade multi-stranded flexible wire of 2.5 sq.mm 2 cross section. The colour coding shall be as per latest edition of IS: 374.

Each wire shall be identified by plastic ferrule. All wire termination shall be made with type connection. Wire shall not be taped or spliced between terminal points.

Terminal blocks shall preferably be grouped according to circuit function and each terminal block group shall have at least 20% spare capacity.

Not more than 1 (one) wire shall be connected to any terminal block.

6.9.8 Current Transformer

Current transformers shall be of ratio, burden (shall be worked out by panel supplier), class/accuracy specified in Single Line Diagram.

Current transformers shall conform to latest edition to relevant standards. Current transformers shall be epoxy resins cast with bar Primary or ring type.

The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to the maximum short circuit current of the circuit.

The current transformer shall preferably be capable of being left open circuited on the secondary side with primary carrying rated full load current, without overheating or damage. Short time current rating and rated withstands time shall be same as corresponding C.B.

CT core laminations shall be of high-grade silicon steel.

Secondary terminals of CT shall be brought out to a terminal block, which will be easily accessible for testing and external connections. Facility shall be provided for short-circuiting and earthing of CT secondary leads through a removable and accessible link with provision for attaching test link.

Rating plate details and terminal markings shall be according to the latest edition of relevant Indian Standard specification.

Generally separate current transformers (core) shall be used for metering and protection.

7.0 CABLES

a) Contractor shall provide all power and control cables from the motor control center to various motors and control devices, of ratings as per IS: 3961.

b) All power and wiring cables shall be FRLS with (inner and outer sheath) aluminium conductor PVC insulated armoured and PVC sheathed of 1.1 KV grade. Control cables and power cables of 2.5 sq.mm or less shall be of copper, FRLS, armoured. Cables and wires shall comply with requirements of IS: 5831, 694, 8130, 7098 (I) & 1554 as the case may be.

c) All cables shall have stranded conductors. The cables shall be supplied in drums as far as possible and hear the manufacturer’s identification mark.

d) All cable joints shall be made in an approved manner as per accepted practice.
7.1 CABLE TRAYS

7.1.1 Cable trays shall be 2mm thick GI/CRCA powder coated as per approved shade of client. Sheet steel, ladder type/perforated cable trays including fixing along wall/ceiling complete with M.S. rod/flat hangers directly grouted in walls/ceiling etc as required.

7.1.2 The sizes shall be as follows and as directed by the Owner.

A. PERFORATED CABLE TRAY
   a) 150 mm wide 75 mm deep
   b) 300 mm wide 75 mm deep

B. LADDER TYPE CABLE TRAY
   a) 150 mm wide
   b) 300 mm wide

7.2 EARTHING

7.2.1 Fire Fighting Contractors shall have to provide earthing strips (G.I. 25x3mm) or earthing wires (G.I. 8 SWG) as may be required for proper earthing of the equipments supplied by him. Thickness of galvanization to be 75 microns (minimum). Each electrical equipment is to be earthen at 2 points.

21.03 SPECIFICATIONS FOR FIRE HYDRANT SYSTEM

1.0 SCOPE OF WORK

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet riser fire hydrant system as required by the drawings and specified hereinafter or given in this schedule of quantities.

1.2 Without restricting to the generality of the foregoing, the fire hydrant system shall include the following:

- Mild steel mains including valves, hydrants and all other accessories.
- Mild steel pipe fire risers within the building.
- Landing valves, synthetic hose pipes, hose reels, hose cabinets, fire brigade connections, connection to pumps, appliances and pressure reducing devices.
- Excavation, anchor blocks and valve chambers.

2.0 GENERAL REQUIREMENTS

2.1 All materials shall be of the best quality conforming to the specifications and subject to the approval of the employer. The wet riser system shall remain pressurized at all times during operation, and as such the piping work shall be carried out to withstand the same.

2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc.

2.4 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.
2.5 Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

3.0 PIPES AND FITTINGS

FOR INTERNAL WORK:

a. All pipes within the building in exposed locations and shafts including connections buried under floor shall be ERW mild steel tubes conforming to IS: 1239 (Heavy class) up to 150mm AB and IS 3589 above 150 NB’s with screwed or welded joints as specified by the engineer in charge at least 10% of welded joints shall be radiographically tested.

b. Fittings of 50mm or below shall be forged steel with socket weld ends of approved makes. For 65mm and above shall be W.I./M.S. with butt weld ends.

4.0 JOINTING

Gasket, for use in between flanged joints, to be of CAF as per IS-2712, thickness as specified in S.O.Q.

5.0 EXCAVATION

5.1 Excavations for pipeline shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipelines shall be buried to a minimum depth of 1 to 1.5 meter or as shown on the drawings.

5.2 Wherever required contractor shall support all trenches or adjoining structures with adequate supports to prevent land slides.

5.3 On completion of testing and painting, trenches shall be refilled with excavated earth in 15-cm layers and compacted.

5.4 Contractor shall dispose off all surplus earth within the site.

6.0 ANCHOR BLOCKS

6.1 Contractor shall provide suitable cement concrete anchor blocks as may be necessary for overcoming pressure trusts in under ground/external pipes. Anchor blocks shall be of cement concrete 1:2:4 mix.

7.0 VALVES

7.1 Butterfly valves above 65mm shall be of cast iron body and bronze/gunmetal seat. They shall conform to type PN 1.0 of IS: 13095.

7.2 Non return valves shall be of cast iron body and bronze / gunmetal seat. They shall be swing conform to Class 1 of IS: 5312 and have flanged ends. They shall be swing check type in horizontal runs and lift check type in vertical runs of piping. They shall not be spring loaded type.

7.3 Check valves shall be cast iron double flanged conforming to IS 5312-1975 with cast iron steel body and stainless steel internal trims.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20kg/sqcm pressure. Valves shall conform to IS:778.

8.0 FIRE HYDRANTS

8.1 EXTERNAL HYDRANTS
Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron sluice valve. Hydrants shall have instantaneous type 63-mm dia outlets. The hydrants shall be of gunmetal and flange inlet and single outlet conforming to I.S.5290-1983 with G.I. duck foot bend and flanged riser of required height to bring the hydrant to correct level above ground.

8.2 Contractor shall provide for each external fire hydrant two nos. of 63 mm dia 15 meter long synthetic fibre non perculating hose pipe with gunmetal male and female instantaneous type couplings machine wound with copper wire hose to I.S. 636 type B and couplings to IS 903 with IS certification), gunmetal branch pipe with 16 mm nozzle to I.S. 903-1984.

9.0 INTERNAL HYDRANTS

9.1 Contractor shall provide on each landing and other locations as shown on the drawings one single headed gunmetal landing valve with 63 mm dia outlets and 80 mm inlet (I.S. 5290-1969) with individual shut off valves and cast iron wheels. Landing valves shall have flanged inlet and instantaneous type outlet as shown on the drawings.

9.2 Instantaneous outlets for fire hydrants shall be of standard pattern approved and suitable for fire brigade hoses. Contractor shall provide for each internal fire hydrant station four numbers of 63 mm dia 7.5 meter long gunmetal non perculating hose pipes with gunmetal male and female instantaneous type coupling machine wound with G.I wire (Hose to I.S. 636 type B and couplings to I.S. 903 with I.S. certification), fire hose reel, gunmetal branch pipe with nozzle I.S. 903 fireman’s axe.

9.3 Each hose box shall be, after thorough cleaning of surface, painted as per Section 28 of General Technical Specifications. The words FIRE HOSE to be painted on the inner face of the glass.

10.0 FIRST AID HOSE REELS

10.1 Contractor shall provide standard fire hose reels with 20 mm dia high pressure rubber hose of 36 meters length with gunmetal nozzle with 5mm bore, and control valve, shut of nozzle connected wall mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall conform to IS: 884-1969. The hose reel shall be connected directly to the M.S pipe riser through an independent connection.

11.0 PRESSURE GAUGES

11.1 All pressure gauges shall be of dial type with bourdon tube element of SS 316. The gauge shall be of reputed make. The dial size shall be 150-mm dia and scale division shall be in metric units marked clearly in black on a white dial. The range of pressure gauge shall be 0 to 12 kg/sq.cm.

11.2 All pressure gauges shall be complete with isolation cock, nipples, tail pipes etc.

12.0 PRESSURE SWITCHES

12.1 The pressure switch shall be industrial type single pole double throw electric pressure switch designed for starting or stopping of equipment when the pressure in the system drops or exceeds the pre-set limits. It shall comprise of a single pole changeover switch, below element assembly and differential spindle.

12.2 All the pressure switches shall have 1/4" B.S.P (f) inlet connection and screwed cable entry for fixing cable gland.

12.3 The electric rating of the switch shall be as under:

<table>
<thead>
<tr>
<th>Type of supply</th>
<th>Voltage</th>
<th>Non –Inductive</th>
<th>Inductive</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.C.</td>
<td>110-380</td>
<td>10 Amp</td>
<td>6 Amp</td>
</tr>
<tr>
<td>D.C.</td>
<td>24-250</td>
<td>12 Watts</td>
<td>12 Watts</td>
</tr>
</tbody>
</table>

13.0 FIRE BRIGADE CONNECTION
13.1 The contractor shall provide as shown on drawing gunmetal four ways collecting head with 63mm dia instantaneous type inlets with built in check valve and 100/150 mm dia. Outlet connection to the fire main grid and for tank filling, collecting head shall conform to IS: 904-1964.

14.0 AIR VALVES

14.1 The contractor shall provide 25 mm dia screwed inlet cast iron single acting air valve on all high points in the system or as shown on drawings.

14.0 DRAIN VALVE

50mm dia black steel pipe conforming to IS:1239 heavy class with 50mm gunmetal full way valve for draining and water in the system in low pockets.

Pressure gauge of suitable range shall be installed on the discharge side of each pump vacuum gauge shall be provided on suction side for pumps with negative suction. The dial size shall be 250mm. The gauges shall have brass cocks.

Orifice plates shall be of 6mm thick stainless steel to reduce pressure on individual hydrants to operating pressure of 3.5kg/sq.cm. Design of the same shall be given by the Contractor as per location and pressure condition of each hydrant.

15.0 VALVE CHAMBERS

15.1 Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:5:10 mix (1 cement: 5 fine sand 10 graded stone aggregate 40 mm nominal size) 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling, complete.

15.2 Valve chamber shall be of the following size:

For depths 130 cm and beyond 120x120 cms
Weight of C.I. frame and cover shall be 38 kg.

16.0 PIPE PROTECTION

See Clause 15.0 & 16.0 on ‘Painting’ and ‘Coating/wrapping’ under General Technical Specifications).

17.0 PIPE SUPPORTS

17.1 All pipes shall be adequately supported from ceiling or walls by means of anchor fasteners by drilling holes with electrical drill in an approved manner as recommended by manufacturer of the fasteners.

17.2 All supports/clamps fabricated from M.S. structural e.g. roads, channels, angles and flats shall be painted as described in specifications for “Painting” under General Technical Specifications.

17.3 Where inserts are not provided the contractor shall provide anchor fasteners. Anchor fasteners shall be fixed to walls and ceilings by drilling holes with electrical drill in an approved manner as recommended by the manufacturer of the fasteners.

<table>
<thead>
<tr>
<th>Pipe Support Spacing</th>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe upto 50 mm</td>
<td>2 Mtr</td>
<td>3 Mtr</td>
</tr>
<tr>
<td>Pipe 65 - 100 mm</td>
<td>1.75 Mtr</td>
<td>3 Mtr</td>
</tr>
<tr>
<td>Pipe above 100mm</td>
<td>1.50 Mtr</td>
<td>3 Mtr</td>
</tr>
</tbody>
</table>
18.0 AIR VESSEL AND AIR RELEASE VALVE

Air vessel on top of each wet riser piping shall be installed before execution for approval fabricated out of at least 8mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 300 mm dia and 1m high. This shall be completed with necessary flange connection to the wet riser piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and galvanized to IS: 4736-1968. This shall be tested for twice the working pressure.

19.0 TESTING

1 All piping in the system shall be tested to a hydrostatic pressure of 11.0 kg/sq.cm without drop in pressure for at least 2 hours.

Rectify all leakages, make adjustments and reset as required and directed.

20.0 HOSE CABINETS

20.1 Provide doors/hose cabinets for internal/external hydrants respectively fabricated from 16 gauge M.S. sheet with double glass front door and locking arrangement, with breakable glass key access arrangement, duly painted red as per specifications given on page 12 para 28.8 fixed to wall/floor as per site conditions. The cabinet shall have a separate chamber to store a key with breakable glass as per approved design. Hose cabinets shall be hinged double door partially glazed with locking arrangement, painted as per Section 28 of General Technical Specifications with ‘FIRE HOSE’ written on it prominently. Samples of hose cabinet for indoor and outdoor works shall be got approved from HSCC before production/delivery at site.

20.2 For external hydrants the hose cabinets shall be fabricated from 16 gauge thick M.S. sheet with double shutter glass front door and locking arrangement with breakable glass key access arrangement. The cabinet shall have ‘FIRE HOSE’ written on it prominently. Sample of hose cabinet shall be got approved from the HSCC before installation at the site.

21.0 MEASUREMENT

21.1 Mild steel pipes shall be measured per linear meter of the finished length along the center line and shall include all fittings (including flanges), welding, jointing, clamps for fixing to walls or hangers, anchor fasteners and testing.

21.2 Butterfly valves, check valves and full way valves shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications/schedule of quantities.

21.3 Landing valves hose cabinets, synthetic non-perculating fire hose pipes, First-aid fire hose reels (with gunmetal full way valves) and gunmetal branch pipes shall be measured by numbers and shall include all items necessary and required for fixing as given in the specifications/schedule of quantities.

21.4 Suction and delivery headers shall be measured per linear meter or finished length and shall include all items as given in the schedule of quantities.

21.5 Painting/wrapping/coating of headers, pipes shall be included in the rate for pipes and no separate payment shall be made.

21.6 Brick masonry chambers shall be measured by number and shall include all items as given in the schedule of quantities/specifications.

21.7 No additional payment shall be admissible for cutting holes or chases in walls or floors, making connections to pumps, equipment and appliances.

21.04 SPECIFICATIONS FOR SPRINKLER SYSTEM
1.0 SCOPe OF WORK

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install the sprinkler system as required by the drawings and specified herein after or given in the schedule of quantities.

a) Sprinkler mains, branch and external piping complete with valves, alarm, hangers and appurtenances and painting.

b) Sprinkler heads with spare sprinklers

c) Connections to risers, pumps and appliances

2.0 GENERAL REQUIREMENTS

2.1 All materials shall be of the best quality conforming to specifications and subject to the approval of the engineer.

2.2 Pipes and fittings shall be fixed truly vertical horizontal or in slopes as required in neat workman like manner.

2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc.

2.4 Pipes shall be supported from walls and ceiling by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.

2.5 Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

2.6 Sprinkler heads shall be approved by the underwriters Laboratories (U.L.) or Fire officers Committee (FOC). The finish shall be as specified in the schedule of quantities. The contractor shall give required tools for removing and fixing of different types of sprinklers free of cost as directed by the HSCC.

3.0 SPRINKLER HEADS

a) Sprinkler heads shall be of quartzoid bulb type with bulb, valve assembly yoke and the deflector. The sprinklers shall be of approved make and type.

b) Types:

i) Conventional Pattern:

The sprinklers shall be designed to produce a spherical type of discharge with a portion of water being thrown upwards to the ceiling. The sprinklers shall be suitable for erection in upright position or pendant position.

ii) Spray Pattern:

The spray type sprinkler shall produce a hemispherical discharge below the plane of the deflector.

iii) Ceiling (flush) Pattern:

These shall be designed for use with concealed pipe work. These shall be installed pendant with plate or base flush to the ceiling with below the ceiling.

c) Constructions:
i) Bulb: Bulb shall be made of corrosion free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a predetermined level.

ii) Valve Assembly: Water passage of the sprinkler shall be closed by a valve assembly of flexible construction. The valve assembly shall be held in position by the quartzoid bulb. The assembly be stable and shall withstand pressure surges or external vibration without displacement.

iii) Yoke: The yoke shall be made of high quality gun metal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti-corrosive treatment if the same is to used in corrosive conditions.

iv) Deflector: The deflector shall be suitable for either upright or pendant erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

d) Colour Code:

The following colour code shall be adopted for classification of sprinkler according to nominal temperature ratings:

e) Size of Sprinklers Orifices:

The following sizes of sprinklers shall be selected for various classes or hazards.

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Orifice Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra light hazard</td>
<td>10/15 mm nominal bore</td>
</tr>
<tr>
<td>Ordinary light hazard</td>
<td>15 mm nominal bore</td>
</tr>
<tr>
<td>Extra high hazard</td>
<td>15/20 mm nominal bore</td>
</tr>
</tbody>
</table>

f) Stock of replacement sprinkler:

The following spare sprinklers shall be supplied along with the system:

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Spare Sprinklers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra high hazard systems</td>
<td>6 sprinklers</td>
</tr>
<tr>
<td>Ordinary hazard systems</td>
<td>24 sprinklers</td>
</tr>
<tr>
<td>Extra high hazard systems</td>
<td>36 sprinklers</td>
</tr>
</tbody>
</table>

g) Temperature Rating:

For normal conditions in temperature climates rating of 68/74 deg. C shall be used. However the temperature rating shall be as closed as possible to, but not less than 30 deg. C above the highest anticipated temperature conditions.

4.0 Installation Control Valve:

Installation control valves shall comprise of the following:

a. One man stop valve of full way pattern with gunmetal pointer to indicate where open/shut.

b. One automatic alarm valve, fitted with handle and cover.

c. One hydraulic alarm motor and gong for sounding a continuous alarm upon out-break of fire.

d. One combined waste and testing valve including 5mtr of tubing and fittings.

e. Alarm stop valve

f. Strainer

g. Drain plug
5.0 Pressure Gauges:- Burden type pressure gauges conforming to IS/BS specifications shall provided at the following locations.

a. Just above alarm valve.
b. Just below alarm valve, on the installation stop valve.
c. One pressure gauge on delivery side of each pump.
d. Required number of pressure gauges on pressure tank.

6.0 INSTALLATION OF PIPING

A. Below ground piping :- Under ground piping shall be installed in masonry trenches with cover or reinforced concrete. The pipe work shall be supported at regular intervals of 2.5m with masonry or RCC supports. Wherever pipes pass through roads/pavements suitable size hue pipes shall be provided for protection of piping. Underground pipes shall be protected against corrosion with two coats of bituminous painting and wrapped with tarfelt or similar covering. If the piping is to be buried in ground with back filling of earth, a coat of epoxy painting shall be given.

B. Above ground piping:-

a. All above ground piping shall be installed on suitable to pipe hangers/supports as required. The hangers shall be made of MS angles, channels etc. and painted to the required finish (with suitable synthetic enamel Paint). The spacing of piping supports shall be as follows:

   i) 20mm to 32mm dia                        2 mtr
   ii) 40mm to 65mm dia                        2 mtr
   iii) 65mm to 100mm dia                               1.75 mtr
   iv) above 150mm dia                                1.50 mtr

b) Piping shall be so installed that the system can be thoroughly drained. All the pipes shall be arranged to drain to the installation drain valve. In case of basement and other areas where the pipe work, is below the installation drain valve/auxiliary valves of the following sizes shall be provided.

   i) 20mm dia valve for pipes upto 50mm dia
   ii) 25mm dia valve for 65mm dia pipes
   iii) 32mm dia valves for pipes larger than 65mm dia

c) Piping shall be screwed type upto 50mm dia. Welding of joints will be allowed for pipes of 50mm of larger diameters.

d) The piping shall be pressure tested by the hydrostatic method upto a pressure of 1.5 times the working pressure the piping shall be slowly charged with water so that all the air is expelled from the piping by providing a 25mm inlet with a stop cock. The piping shall be allowed to stand full of water for a period of 2 hours and then the piping shall be put under pressure by means of manually operated test pump or by a power driven test pump. The pressure gauges used for testing shall be accurate and shall preferably the calibrated before the testing is carried out. All the leakages and defects in joints revealed during the testing shall be rectified to the entire satisfaction of the Consultant. The system may be tested in sections parts as the work of erection of piping proceeds. The piping shall withstand 1.5 times the working pressure for at least 2 hours.

7.0 FLOW SWITCH
7.1 Provide one electrically operated flow switch of appropriate dia, at the head of each circuit. Flow switches should be capable of the required flow in the circuit. The electrical cabling for the flow switches and control panel shall be provided by the contractor.

8.0 PUMP SETS

Same as wet riser & Hydrant system specification.

9.0 ANNUNCIATION SPRINKLER PANEL

The equipment for control panel should be compact neatly wired and enclosed in a suitable 14 gauge M.S. sheet/16 CRCA sheet Metal Box which is suitably treated against corrosion. The control panel should be painted with over banked enamel paint. The panel shall consist of:

a) Panel should be made in a modules of 10 zones e.g. Each module will have audible and visual indications and will monitor the circuit conditions.

A.C. Power Supply
Fault and Fire indication lamp.
Alarm acknowledgment push buttons.

b) The circuits provided in the control panel for each zone shall indicate the following conditions:

i) Open Circuit in zone wiring
Short Circuit in zone wiring

iii) Normal conditions
iv) Power failure
v) Low battery

c) The Automatic annunciation panel shall suitable for operation on 24V DC and shall be provided with power supply unit suitable to operate on A.C. mains of 230V with a variation of 10%. The system shall be so designed that in case of failure of A.C. main supply it shall automatically change over to battery supply.

d) Suitable protection may be provided against charging of the battery over and above the specified values.

7.0 BATTERY UNIT

i) The system shall be powered by lead acid storage stationery complete with automatic duel rate charger boost and trick operating from 220V, 50 Hz, single phase, mains supply. The battery capacity should be adequate for operation of the system connected to it for at least 24 hours in the non-alarm state followed by 30 minutes operation of all sounders and other connected equipments after a power (mains) failure.

ii) The automatic charger should operate at the boost charge when the battery terminal voltage is less than about 2.1V 20 per cell, and operate at a trickle charge rate of 100 to 200 HA, when the battery terminal voltage exceeds about 2.25 per cell.

iii) The power unit should have the following:

a) Voltmeter 0-30 V
b) Ammeter of suitable range
c) Indicator lights for mains

d) Indicator lights for DC output

iv) The preferred nominal DC voltage shall be 24 V and shall preferably be isolated. (IF an isolated supply is provided a line earthing indicator should also be provided).

v) The DC system and the detection and sounder circuits shall be protected against their attaining a voltage to earth exceeding 50V.

vi) The connection to the 220V, 50Hz, single phase system shall be through a three pin plug socket especially provided for the connection to the annunciation panel. This connection should in addition utilized for earthing all non-current carrying metal parts of the sprinkler system, except those that are either doubly insulated or mounted at a height exceeding 2.2 meters.

vii) The battery unit shall be housed in a steel cabinet with suitable mounting at least 2.5mm thick suitably painted with two coats of Post Office Red, Enamel necessary vent holes should be provided for proper ventilation.

viii) One battery unit complete with battery charger shall be provided for each control panel.

10.0 TESTING

10.1 All pipes in the system shall be tested to a hydrostatic pressure of 11.0 kg/sq.cm without drop in pressure for at least 2 hours. Rectify all leak ages, make adjustments and retest as required.

11.0 MEASUREMENT

11.1 Black steel pipes shall be measured per linear meter of the finished length and shall include all fittings including flanges, welding, jointing clamps for fixing to walls or hangers and testing.

11.2 Butterfly valves, check valves and full way valve and flow indicating switches shall be measured by numbers and shall include all items necessary and required for fixing as given in specifications.

11.3 Cabinet and the spare sprinkler heads, with spanner etc. shall be measured as per actual item given in the schedule of quantities.

11.4 Sprinkler heads shall be measured by numbers.

11.5 No additional payment shall be admissible for cutting holes, or chases in the wall or floors, making connections to pumps, equipment and appliances.

11.6 Painting and coating/wrapping of pipes shall be included in the rates for pipes and no extra payment shall be made.

21.05 COMMISSIONING OF FIRE FIGHTING SYSTEM

1.0 SCOPE OF WORK

1.1 Work under this section shall consist of pre commissioning, commissioning testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the contractor under this contract.

2.0 GENERAL REQUIREMENTS
2.1 Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

2.2 Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

2.3 All inspection and testing for gauging the efficacy of all equipment would be as per the TAC regulations.

A survey of the site of the work shall be made by the Contractor before preparation of the detailed drawings for submission to the department for approval. The installation shall be carried out strictly in accordance with the approved drawing.

2.4 The scope of installation work shall include the following, where or not expressly mentioned in the schedule of work.

i. Cement concrete (1:2:4 mix) foundation for all pump sets.

ii. Vibration isolation arrangement for all pump sets.

iii. Filling up the hole in flooring with cement concrete, after laying the wet riser pipes.

iv. Necessary supports and clamps for wet riser pump room.

v. Necessary supports and clamps for wet riser plumbing the building.

vi. Supporting bracket/frame work for the fuel oil tank of the engine.

vii. Excavation of the earth, consolidation and refilling after laying of wet riser piping in ground.

viii. Provision of necessary brick base or intermediate support as required in approved manner in case of soils which are no strong enough to support the pipes, thereby likely to cause different settlement.

ix. Necessary anchor block of ample dimensions in 1:2:4 cement concrete at all bends, tee connections, foot of the wet riser, and other places as required to stand the pressure thrust in pipes.

x. Necessary masonry work/steel work for supporting hose cabinets near external (yard) hydrants.

xi. Valve chambers of approved design with external (yard) hydrant.

xii. Ground level hydrants of approved design, where specifies.

xiii. Cutting and making good the damages for the installation work of the riser system.

xiv. Strainers and foot valves for pumps with negative suction and strainers for pumps with positive suction.

xv. All the required control piping, exhaust piping (5m long) from engine, oil piping for fuel oil and lubricating oil for the engine, drain piping from the pumps to the drain pint in the pump room, overflow piping from priming tank to the sump. The piping work shall include all necessary fittings, valve and accessories for effective functional requirements.

xvi. Inter-connecting cable work with controls, control panel, batteries etc. including battery leads.

xvii. Orifice plates at individual hydrants, as required.

Where provision of GI/MS pipe shall below ground become inescapable, it shall be protected from soil corrosion by 2 coats of coal tar hot enamel paint and 2 wraps of reinforced fiber glass tissue or bitumenised horizon.
Each CI pipe/GI pipe shall be subjected to hydraulic pressure test before installation, in presence of the Engineer or his authorised representative.

External (yard) hydrants shall be located at least 2m away from the face of the buildings but not more than 15m and be accessible.

Where external hydrants below ground level are specifically indicated in tender specifications, there shall be enclosed in masonry or cast iron structure of size 75cm2 and 8cm above ground level. The hydrant shall be with in 8cm from the top of the enclosure.

Necessary facility for draining the rise pipe shall be provided at ground floor level with 40mm size sluice valve.

Internal hydrants at each floor shall be located at about 1m above floor level.

Valve chambers shall be of 1m2 in size, with cover.

All hoses shall be numbered and a record submitted with completion plane. The number and length shall be easily recognizable on each hose pipe.

External hose boxes shall be installed such that the hose is not exposed to sun rays.

3.0 PRECOMMISSIONING

On completion of the installation of all pumps, piping, valves, pipe connections, electrical wiring motor control panels and water level controlling devices the contractor shall proceed as follows:

3.1 TESTING OF M.C.C

Tests to be carried out for motor control centers shall be:

3.1.1 Insulation resistance test with 500 volt merger, before and after high voltage test, on all power and control wiring.

3.1.2 High voltage test at 2000 volts A.C. for one minute on all power and control wiring.

3.1.3 Low voltage continuity test (6 volts) on power wiring of each feeder, between bus bars and outgoing terminals with switches and contractors in closed position.

3.1.4 Low voltage continuity test (6 volts) on all control wiring.

3.1.5 Operation test for all feeders with only control supply made “ON” to ensure correctness of control wiring, operation of the various equipment used, such as push buttons, protective devices, indicating lamps and relays, etc. All contractors shall be checked for the presence of humming and chattering.

3.1.6 Earth continuity test with voltage not exceeding 6 volts between various non-current metallic of equipment, steel work, etc. and the earth bus provided in the M.C.C.

3.1.7 Operation of all instruments and meters provided on the M.C.C.

3.2 FIRE PROTECTION SYSTEM

3.2.1 Check all hydrant valves and close if any valve is open. Check that all suction and delivery connections are properly made.

3.2.2 Test run and check rotations of each motor and correct the same if required.

3.3 PIPE WORK
3.1 Check all clamps, supports and hangers provided for the pipes.

3.2 Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specifications if any leakage is found. Rectify the same and reset the pipes.

4.0 COMMISSIONING AND TESTING

4.1 FIRE HYDRANT SYSTEM

4.1.1 Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure shutoff the pump.

4.1.2 Open by-pass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the pre-set pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.

4.1.3 Open bye-pass valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the preset pressure and should not cut-out automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pump should cut out as soon as the main pump starts.

4.1.4 Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.

4.1.5 When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant simultaneously and allow the hose pipe to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.

4.1.6 Diesel engine driven pump should also be checked in the same manner as given in para above by running for 8 hours.

4.1.7 After laying and jointing, the entire piping shall be tested to hydrostatic test pressure. The pipes shall be slowly charged with water so that the air is expelled from the pipes. The pipes shall be allowed to stand full of water for a period of not less than 24 hours and then tested under pressure. The test pressure shall be 10kg/cm². The test pressure shall be applied by means of manually operated test pump or by a power driven test pump to be provided by the Contractor. In either case precautions shall be taken to ensure that the required test pressure is not exceeded.

4.1.8 The open end of the piping shall be temporarily closed for testing.

4.1.9 Test shall be conducted on each pump set after completion of the installation with respect of delivery head, flow and B.H.P. The test shall be carried out by the Contractor at his own cost.

4.1.10 All leaks and defects in different joints noticed during the testing and before commissioning shall satisfaction of Engineer.

4.1.11 Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting, which is found to be incompatible and does not fit into the other properly, shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

4.1.12 Testing of fittings/equipments shall be carried out either at site or at works in the presence of a representative of the Engineer. Test certificates shall also be furnished by the Contractor.

4.1.13 The automatic operation of the system for the various functional requirements and alarms as laid down in his specification shall be satisfactory carried out on as described above.
4.2 HANDING OVER

4.2.1 All commissioning and testing shall be done by the contractor to the complete satisfaction of the engineer /consultants, and the job handed over to the client.

Contractor shall also hand over to the client all maintenance and operation manuals and all items as per the terms of the contract.

21.06 HAND APPLIANCES

1.0 SCOPE OF WORK

1.1 Work under the section shall consist of furnishing all labour, material, appliances and equipments necessary and required to install fire extinguishing hand appliances.

1.2 Without restricting to the generality of the foregoing the work shall consist of the following:

Installation of fully charged and tested fire extinguishing hand appliances CO2, Foam, Dry chemical powder type as required by these specifications and drawings.

2.0 GENERAL REQUIREMENTS

2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended upto date: -

   a) Water gas type I.S. 940
   b) Dry powder type I.S. 2171-1962
   c) Mechanical Foam I.S. 10204
   d) ABC I.S. 13849

2.2 Fire extinguishers shall be installed as per Indian Standard "Code of practice for selection, installation and maintenance of portable first aid appliances “I.S. 2190-1962”.

2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners.

2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

2.5 All appliances shall be fixed in a true workman like manner truly vertical and at correct locations.

2.6 The contractor has to obtain approval of Fire Department for all fire fighting installations.

21.07 STANDARDS AND CODES

1. IS 1648 Code of practice for fire safety of building (general ) fire fighting equipment and maintenance.

2. IS 3844 Code of practice for installation of internal fire hydrant in multistorey buildings

3. IS 2217 Recommendations for providing first aid and fire fighting arrangement in public buildings.

5. Part IV, fire fighting National building code
6. IS 5290 External fire hydrants
7. IS 5290 Internal landing valves
8. IS 904 2 & 3 way suction collecting heads
9. IS 884 First aid hose reel
10. IS 5132 High pressure rubber pipe
11. IS 1537 C.I. Double flanged pipes
12. IS 1538 C.I. Double flanged fittings
13. IS 780 C.I. Sluice valves and Gunmetal valves
14. IS 934 Specifications for portable chemical fire extinguisher soda acid type.
15. IS 2873 Specifications for fire extinguisher of Carbon-di-oxide.

**26.00 LIST OF APPROVED MAKES : CIVIL WORKS**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>MATERIALS</th>
<th>MANUFACTURERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Doors &amp; Windows fixtures/ Fittings</td>
<td>Everite, Hardima, Global, Crown, Ozone, Dorset</td>
</tr>
<tr>
<td>2.</td>
<td>Door Closer / Floor spring</td>
<td>Doorking, Everite, Hardwyn, Amar Darny, Hardima, Ozone</td>
</tr>
<tr>
<td>3.</td>
<td>Aluminium Sections.</td>
<td>Hindalco, Jindal, Indal , Bhoruka,</td>
</tr>
<tr>
<td>5.</td>
<td>Laminates</td>
<td>Formica, Decolam, Century, Marino, Green Ply</td>
</tr>
<tr>
<td>6.</td>
<td>Synthetic Enamel Paints</td>
<td>Berger (Luxol gold), Asian(Apcolite), ICI Dulux (Gloss), Nerolac (Full gloss hard drying)</td>
</tr>
<tr>
<td>7.</td>
<td>Oil Bound Distemper</td>
<td>Asian (Tractor), Berger (Bison), Nerolac (Super Acrylic).</td>
</tr>
<tr>
<td>8.</td>
<td>Cement Paint</td>
<td>Snowcem Plus, Berger (Durocem Extra), Nerolac (Nerocem with titanium),.</td>
</tr>
<tr>
<td>9.</td>
<td>Plastic Emulsion Paint</td>
<td>ICI, Asian, Nerolac</td>
</tr>
<tr>
<td>10.</td>
<td>Other Paints/Primers</td>
<td>ICI Dulux, Asian, Berger, Nerolac</td>
</tr>
<tr>
<td>11.</td>
<td>Cement</td>
<td>OPC 43 grade conforming to BIS-8112 and approval of source by Engineer</td>
</tr>
</tbody>
</table>
12. Reinforcement Steel : TMT steel conforming to BIS-1786 and approval of source by Engineer
13. Glass Mosaic Tiles : Italica, Bizzaza, Pallidio
14. Back-up Rod. : Supreme Industries or equivalent
15. M.S. Pipe : Jindal Hisar, Prakash-Surya, BST, Kalinga, Tata
16. Polycarbonate Sheets : GE Plastics or approved equivalent
17. Wooden Fire Check Doors : Navair, Pacific Fire Control, Kutty Promat, Sukri
19. Gypsum Board System : Gyproc, Laffarge, Boral

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>MATERIALS</th>
<th>MANUFACTURERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Admixtures for concrete.</td>
<td>CICO, Vam Organics, Roffe, Pidilite, FOSROC</td>
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<tr>
<td>21</td>
<td>Ceramic Tiles</td>
<td>Johnson, Somany, Kajaria, Nitco</td>
</tr>
<tr>
<td>22</td>
<td>Pre-Laminated Particle Board</td>
<td>Novopan, Greenlam, Kitlam, Marino</td>
</tr>
<tr>
<td>23</td>
<td>Flush Door Shutters.</td>
<td>Century, Kitply, Novapan, Green Ply, Marino</td>
</tr>
<tr>
<td>24</td>
<td>Glazed Tiles</td>
<td>Bell, Somany, Johnson, Kajaria, Cera,</td>
</tr>
<tr>
<td>25</td>
<td>PVC Water Stops</td>
<td>Supreme, Fixapan or approved equivalent</td>
</tr>
<tr>
<td>26</td>
<td>White Cement.</td>
<td>Birla White, J.K.</td>
</tr>
<tr>
<td>27</td>
<td>Powder Coating Material Pure Polyester.</td>
<td>Jotun, Berger, Goodlass Nerolac</td>
</tr>
<tr>
<td>28</td>
<td>Masking Tapes</td>
<td>Suncontrol, Wonder Polymer.</td>
</tr>
<tr>
<td>29</td>
<td>Stainless Steel Screws For Fabrication and fixing of Windows.:</td>
<td>Kundan, Puja, Atul.</td>
</tr>
<tr>
<td>30</td>
<td>Dash Fasteners./Anchor bolts</td>
<td>Hilti, Fischer, Bosch.</td>
</tr>
<tr>
<td>32</td>
<td>Stainless Steel Pressure Plate Screws.</td>
<td>Kundan, Puja, Atul.</td>
</tr>
</tbody>
</table>
34. E.P.D.M. Gaskets. : Anand Reddiplex, Enviro Seals
35. Weather Silicon. : Dow Corning, Wacker, GE
36. Structural Silicon at butt joints : - Do -
38. Floor Springs. : Doorking, Opel or equivalent
39. Water proofing / Injection Grouting : Specialized agency as approved by engineer
40. 6mm thick Reflective Glass : Glaverbel, Glavermas, Saint Gobain.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>MATERIALS</th>
<th>MANUFACTURERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>41.</td>
<td>Door Locks.</td>
<td>ACME, Godrej, Harrison, Hardima, Mobel, Ozone</td>
</tr>
<tr>
<td>42.</td>
<td>Door Seal – Woolpile Weather Strip</td>
<td>Anand -Reddiplex</td>
</tr>
<tr>
<td>43.</td>
<td>Aluminium Grill</td>
<td>Hindalco, Decogrille or approved Equivalent</td>
</tr>
<tr>
<td>44.</td>
<td>Vitrified Tiles</td>
<td>Restile, Naveen, Bell-Ceramics, Kajaria, Somani</td>
</tr>
<tr>
<td>45</td>
<td>Carpets</td>
<td>Hollitex, Standard, Mohawk, Birla Transasia</td>
</tr>
<tr>
<td>46.</td>
<td>Aluminium Cladding sheets</td>
<td>Alstrong , Alpolic, Alucobond, Alucomat Alu Decor</td>
</tr>
<tr>
<td>47.</td>
<td>Aluminium Die-cast handles &amp; two point locking kit</td>
<td>Giesse, Securistyle, Alu-alpha</td>
</tr>
<tr>
<td>48.</td>
<td>Stainless steel D-handles</td>
<td>D-line, Giesse, Dorna, Hardima</td>
</tr>
<tr>
<td>49.</td>
<td>Fabric for Auditorium</td>
<td>ESSMA, Raymonds or equivalent</td>
</tr>
<tr>
<td>50.</td>
<td>Stainless Steel Pipes/Flats</td>
<td>304 Grade (as approved by Engineer)</td>
</tr>
<tr>
<td>51.</td>
<td>Structural Steel</td>
<td>Conforming to BIS 2062 and approval of source by Engineer</td>
</tr>
<tr>
<td>52.</td>
<td>Ready Mix Concrete</td>
<td>ACC,BIRLA, Ahlcon or approved equivalent</td>
</tr>
<tr>
<td>53.</td>
<td>Epoxy Flooring/ wall coating</td>
<td>Fosrock, Beck, Famaflor,</td>
</tr>
<tr>
<td>54.</td>
<td>SBS bitumen based Self adhesive membrane Material</td>
<td>Grace-Bituthene CP1.5, Texsa-Texself 1.5</td>
</tr>
<tr>
<td></td>
<td>Item</td>
<td>Supplier(s)</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>56.</td>
<td>Curtain wall/Structure Glazing/Hermatic seal Sliding Doors</td>
<td>Specialised Agency to be approved by Engineer</td>
</tr>
<tr>
<td>57.</td>
<td>Fire Panic bar</td>
<td>Briton, Monarch, Von-Duprin, Dorma, Mobel</td>
</tr>
<tr>
<td>58</td>
<td>Ply board</td>
<td>Greenply, Kitply, Century, Archid, Marino</td>
</tr>
<tr>
<td>59</td>
<td>UPVC Windows</td>
<td>Fenesta or equivalent approved</td>
</tr>
<tr>
<td>60.</td>
<td>Corian Partitions, signage, cladding, Guard rail</td>
<td>Du Pont or equivalent approved</td>
</tr>
<tr>
<td>61.</td>
<td>PVC Flooring</td>
<td>LG, Tarkett, Armstrong, Responsive or approved equivalent</td>
</tr>
<tr>
<td>Sl.No.</td>
<td>MATERIALS</td>
<td>MANUFACTURERS</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>62</td>
<td>SS Railing</td>
<td>Specialized Agency to be approved by Engineer</td>
</tr>
<tr>
<td>63</td>
<td>Interlocking Paver Tiles</td>
<td>Ultra, Shree or Approved Equivalent</td>
</tr>
<tr>
<td>64</td>
<td>Wall Clading Tiles</td>
<td>Ultra, Shree or Approved Equivalent</td>
</tr>
<tr>
<td>65</td>
<td>Acoustic Seals</td>
<td>Anand Reddiplax, Enviroseal or equivalent</td>
</tr>
<tr>
<td>66</td>
<td>Smoke Seals</td>
<td>Pemko or Equivalent</td>
</tr>
<tr>
<td>67</td>
<td>Fire rated door closer/Mortice Lock/Door Co-ordinator</td>
<td>Dorma, Becker F.S. Australian, Dorset or approved equivalent</td>
</tr>
<tr>
<td>68</td>
<td>Sunken Portion Treatment</td>
<td>Choksey, Roffe, Krytone, Sika, CICO</td>
</tr>
<tr>
<td>69</td>
<td>Roller blind system including automatic control</td>
<td>Lutron, Vestametic, Goelst</td>
</tr>
<tr>
<td>70</td>
<td>Roller blind fabric (antimicrobial)</td>
<td>Galaxy99, Ferrari, Goelst</td>
</tr>
<tr>
<td>71</td>
<td>Motorized sandwich Venetian Blind</td>
<td>Hagen, Galaxy, Goelst</td>
</tr>
<tr>
<td>72</td>
<td>Motor and Automatic control for Venetian Blind</td>
<td>Vestamatic, Buhler, Lutron</td>
</tr>
<tr>
<td>73</td>
<td>Metal Doors (PCGI/SS)</td>
<td>Shakti-met, Chempharm, Klenzoid</td>
</tr>
<tr>
<td>74</td>
<td>Walkable Metal Ceiling</td>
<td>Chempharm, Klenzoid or approved equivalent</td>
</tr>
</tbody>
</table>

**Note**: Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer
## LIST OF APPROVED MAKES : PLUMBING WORKS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Materials</th>
<th>Relevant IS Code</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Vitreous China Sanitary ware</td>
<td>2556</td>
<td>Hindustan Sanitary ware, Cera, Kohler, American standard</td>
</tr>
<tr>
<td>2.</td>
<td>White Glazed Fire Clay Sink</td>
<td>771</td>
<td>Sanfire, Cera, Neycer, Hindware.</td>
</tr>
<tr>
<td>3.</td>
<td>Stainless Steel Sink</td>
<td></td>
<td>Jayna, Jaguar, Commander, Nirali</td>
</tr>
<tr>
<td>4.</td>
<td>Plastic seat cover of W.C</td>
<td>2548</td>
<td>Commander, Cera, Kohler Jaquar, American standard</td>
</tr>
<tr>
<td>5.</td>
<td>Geyser</td>
<td></td>
<td>Racold, Jaguar, Rheem, Usha Lexus</td>
</tr>
<tr>
<td>6.</td>
<td>C.P. Fittings Mixer/Pillar taps</td>
<td>1795</td>
<td>Aquabaths, Othello, Jaquar,Kohler,Marc</td>
</tr>
<tr>
<td></td>
<td>Washers, C.P. brass accessories</td>
<td>4291/4827</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Centrifugally /Sand cast iron pipes &amp; fittings</td>
<td>3989/1729</td>
<td>Neco, Hepco</td>
</tr>
<tr>
<td>8.</td>
<td>G.I. Pipes</td>
<td>1239 Part I</td>
<td>Jindal-Hissar, Tata, Prakash-Surya</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B.S.T., SAIL,</td>
</tr>
<tr>
<td>10.</td>
<td>Gunmetal Valves</td>
<td>778</td>
<td>Zoloto, Leader,</td>
</tr>
<tr>
<td>11.</td>
<td>Brass stop &amp; Bib Cock</td>
<td>781</td>
<td>Zoloto, Sant, L&amp;K, Jaquar</td>
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<tr>
<td>12.</td>
<td>Ball valve with floats</td>
<td>1703</td>
<td>Zoloto, Leader, Sant, Jayco</td>
</tr>
<tr>
<td>13.</td>
<td>Stoneware pipes &amp; Gully Traps</td>
<td>651</td>
<td>IS Marked pipes</td>
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<tr>
<td>14.</td>
<td>R.C.C. pipes</td>
<td>458</td>
<td>IS Marked pipes</td>
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<tr>
<td>15.</td>
<td>D.I. Manhole Covers</td>
<td>1726</td>
<td>RIF, NECO,</td>
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<tr>
<td>16.</td>
<td>Water Tank</td>
<td></td>
<td>Sintex, Polycon, Uniplast</td>
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<tr>
<td>17.</td>
<td>Mirror</td>
<td></td>
<td>Golden, Atul, Modi guard, Gujarat Guardian</td>
</tr>
<tr>
<td>18.</td>
<td>Hand drier</td>
<td></td>
<td>Kopal, Automat, Euronics</td>
</tr>
<tr>
<td>19.</td>
<td>PVC flusing cistern</td>
<td></td>
<td>Commander, Parryware, Duralite</td>
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<tr>
<td>20.</td>
<td>Insulation of Hot water pipes</td>
<td></td>
<td>Vidoflex insulation, Superlon, Paramount Kaiflex</td>
</tr>
<tr>
<td>S.No.</td>
<td>Materials</td>
<td>Relevant ISI Code</td>
<td>Manufacturers OR EQUIVALENT</td>
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<tr>
<td>-------</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Oriplast</td>
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<tr>
<td>23.</td>
<td>Sluice valve / NRV</td>
<td></td>
<td>Kirloskar, Kilburn, Zoloto</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Castle,</td>
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<tr>
<td>24.</td>
<td>Water supply pumps</td>
<td>KIRLOSKAR, WILO, GRUNDFOS</td>
<td></td>
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<tr>
<td>25.</td>
<td>Submersible pumps</td>
<td>KIRLOSKAR, GRUNDFOS, KSB, Mather &amp; Platt</td>
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<tr>
<td>26.</td>
<td>UPVC pipes &amp; fittings</td>
<td>Finolex, Prince, Supreme, Oriplast</td>
<td></td>
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<tr>
<td>27.</td>
<td>Chlorinator</td>
<td>ALFA, USA, Ion exchange, Sigma DH Combine Inc.</td>
<td></td>
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<tr>
<td>28.</td>
<td>HDPE Solution tank</td>
<td>WATCON, ION EXCHANGE, Water Supply Specialist P (Ltd)</td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>C.P Flush Valves</td>
<td>Jaquar, DOCOL(Germany) marketed by GEM, Ideal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Othello, Jaquar, Marc, Kholer, Aquabaths</td>
</tr>
<tr>
<td>30.</td>
<td>C.P Angle Valves, bib cock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>Infrared Sensor operated Faucets</td>
<td>Jaquar, AOS-Robo, Euronics, U-tec Kholer</td>
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</tr>
<tr>
<td>32.</td>
<td>Gratings, Strainers, Cleanouts etc</td>
<td>Neer Brand (Sage Metals) or Equivalent</td>
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<tr>
<td>33.</td>
<td>Level controller</td>
<td>Femac or equivalent</td>
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</tr>
<tr>
<td>34.</td>
<td>Drainage Pumps</td>
<td>Grundfos, KSB, Kirloskar</td>
<td></td>
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<tr>
<td>35.</td>
<td>Water / Effluent Treatment Plant</td>
<td>Thermax, Geo Miler &amp; Co, Fontos Ion-Exchange, Aquaprocess, Akar-Impex, Polycon Technologies, Indwa</td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>Decorative bath room fittings</td>
<td>Jaquar (Florentine range), Marc (equivalent), Aquabaths (equivalent)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Item</td>
<td>Make</td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td>-----------------------------</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>PE-AL-PE</td>
<td>Kitec, Jindal, NEXGEN</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>HDPE pipes and fittings</td>
<td>Oriplast, So-Soon, Finolex</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Infrared Sensor operated Urinals</td>
<td>Jaquar, Euronics, U-tec</td>
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</tr>
<tr>
<td>41</td>
<td>Grab Bars</td>
<td>Marino or equivalent</td>
<td></td>
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<tr>
<td>42</td>
<td>CPVC pipe</td>
<td>Ajay, Flowguard, Astral</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Solar Panel</td>
<td>Tata BP, BHEL, EMMVEE</td>
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<tr>
<td>44</td>
<td>Copper Pipe</td>
<td>Raj Co., Maxflo</td>
<td></td>
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<tr>
<td>45</td>
<td>Copper Fittings</td>
<td>Viega, IBP</td>
<td></td>
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<tr>
<td>46</td>
<td>Lab drainage</td>
<td>Viega or Equivalent as approved.</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Lab Fittings</td>
<td>Vijay, Viega, or equivalent approved</td>
<td></td>
</tr>
</tbody>
</table>

**Note**: Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Material</th>
<th>Relevant ISI Code</th>
<th>Brand/ Manufacturers OR EQUIVALENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>G.I./M.S. Heavy class pipe</td>
<td>1239/3589</td>
<td>Jindal-Hissar, Tata, Prakash -Surya, B.S.T., SAIL</td>
</tr>
<tr>
<td>2.</td>
<td>Gate Air Valve</td>
<td></td>
<td>Leader, Zoloto, SBI,</td>
</tr>
<tr>
<td>4.</td>
<td>Portable Fire Extinguisher</td>
<td>2171</td>
<td>Minimax, Safex, Nitin, Kanex, Ceasefire, Newage, Eversafe</td>
</tr>
<tr>
<td>5.</td>
<td>First aid Fire hose reels</td>
<td>884</td>
<td>Minimax, Safex, Firex, Newage, Eversafe</td>
</tr>
<tr>
<td>6.</td>
<td>Fire hose pipes</td>
<td>636</td>
<td>Newage, Safex, Eversafe, Jyoti</td>
</tr>
<tr>
<td>7.</td>
<td>Fire Hydrant valves</td>
<td>5290</td>
<td>Minimax, Newage, Eversafe, Ceasefire, Vijay, Agnice</td>
</tr>
<tr>
<td>8.</td>
<td>Sprinkler Heads</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Pendent type</td>
<td></td>
<td>Tyco, Viking-usa, Spray safe, HD, Newage</td>
</tr>
<tr>
<td></td>
<td>b) Side wall type</td>
<td></td>
<td>Newage, Reliable, Tyco, Viking-usa</td>
</tr>
<tr>
<td></td>
<td>c) Sprinkler Side wall extended through</td>
<td></td>
<td>Spray safe, HD, Viking-usa, Tyco.</td>
</tr>
<tr>
<td>9.</td>
<td>Sluice and non return/ check valve foot valve strainer</td>
<td></td>
<td>Kirloskar, I.V.C., Kilburn, Zoloto, Leader</td>
</tr>
<tr>
<td>10.</td>
<td>Rubber hose 12/20mm dia</td>
<td></td>
<td>Dunlop, Good year, Jyoti Eversafe</td>
</tr>
<tr>
<td>11.</td>
<td>Reinforced rubber lined/canvas</td>
<td></td>
<td>Newage, Jayshree, CRC, Eversafe</td>
</tr>
<tr>
<td>12.</td>
<td>Standby battery lead acid</td>
<td></td>
<td>Exide, Standard, Amco</td>
</tr>
<tr>
<td>13.</td>
<td>PVC Insulated Copper Conductor.</td>
<td></td>
<td>Finolex, Plaza, National</td>
</tr>
<tr>
<td>14.</td>
<td>Recess/concealed type</td>
<td></td>
<td>Spraysafe., Reliable</td>
</tr>
<tr>
<td>15.</td>
<td>Horizontal centrifugal/Fire pumps</td>
<td></td>
<td>Kirloskar, Mather &amp; Platt(WILO), GRUNDFOS,</td>
</tr>
<tr>
<td>16.</td>
<td>Diesel engine</td>
<td></td>
<td>Kirloskar Cummins, Ashok Leyland</td>
</tr>
<tr>
<td>17.</td>
<td>Electric motors</td>
<td></td>
<td>Kirloskar, GEC, Siemens, NGEF, ABB Crompton</td>
</tr>
<tr>
<td>18.</td>
<td>Electrical switch gear &amp; starters</td>
<td></td>
<td>As per Electrical Works</td>
</tr>
<tr>
<td>19.</td>
<td>Cables</td>
<td></td>
<td>As per Electrical Works</td>
</tr>
<tr>
<td>20.</td>
<td>Flow meter</td>
<td></td>
<td>Scientific Equipment (P) Ltd. Hyderabad,</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
<th>System Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.</td>
<td>Suction strainer</td>
</tr>
<tr>
<td>22.</td>
<td>Vibration eliminator connectors</td>
</tr>
<tr>
<td>23.</td>
<td>Single phase preventor</td>
</tr>
<tr>
<td>24.</td>
<td>G.I. Fittings 1239 Part I</td>
</tr>
<tr>
<td>25.</td>
<td>Yard Hydrant Stand Post, 4 way suction</td>
</tr>
</tbody>
</table>

**Note**: Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer
TECHNICAL SPECIFICATIONS

1.00 GENERAL SCOPE OF WORK

The scope of work shall cover internal and external electrical works for “Cardiac Care Unit (CCU) at AIIMS, New Delhi. The scope of work covers major electrical equipments as per BOQ. Also, supply, installation, testing and commissioning of electrical works of the project including the following main items/systems:

i. MV Panel

ii MCB Distribution Boards.

iii. Internal electrification through concealed MS conduit and provide light points, fan points, socket outlets etc. including supplying, installation, testing and commissioning of light fixtures, fans etc.

iv. Conduiting and wiring for telephone points including Main Telephone Distribution Boards (Tag Blocks), telephone outlets etc. complete with telephone cabling from tag blocks to telephone outlets etc. including EPABX.

v Addressable Fire Detection & Alarm System consisting of Main Fire Control & Indicator Panel, Smoke & Heat Detectors, Manual Call Points Hooter etc. including conduiting/wiring & cabling complete.

vi Conduiting for computer networking

vii LT Cabling.

viii Earthing, safety equipments and misc items required for electrical installation complete in all respect.

ix Public Address System

x Testing and commissioning of all electrical installations

xi Any other items/ works required for the completion of electrical works.

xi Enhancement/Sanctioning Electrical Load from State Electricity Board.

xii Submission of GA drawings of electrical equipments and getting approvals from Client/ Owner before manufacturing/fabrication.

xiii Obtaining approvals from Chief Electrical Inspectors, Local Electricity Supply Authority, Telecom Department, and any other statutory authorities for the complete scope.
xiv Approval from CCE Nagpur for Diesel tank and pollution control for DG set.

Contractor shall submit equipment drawing from manufacturer along with the layout etc. and working drawings for approval from HSCC Electrical Engineer before manufacture / commencement of work at site.

xv Contractor has to submit the working drawing of internal as well as external electrification based on our tender drawings for the approval of HSCC before commencement of work.

xvi Contractor has to take the approval of DB schedule/drawing of each DB from HSCC.

xvii Incase, details of any electrical item/ system are left out, then kindly refer the CPWD specifications & approval from Engineer.
2.0 REGULATIONS AND STANDARDS

2.1 All equipments their installation, testing and commissioning shall conform latest CPWD/ IS specifications in all respects. Indian Standard Code of Practice for Electrical Wiring Installation IS:732-1989. It shall also be in conformity with Indian electricity Rules and the Regulations, National Electric Code, National Building Code, latest CPWD specifications amended up to date and requirements of the Local Electric Supply Authority. In general, all materials equipment and workmanship shall conform to the Indian Standards specifications and code. Mode of all measurement will be as per latest CPWD norms/ specifications Some of the applicable codes/standards are as under:

<table>
<thead>
<tr>
<th>Code/ Standards</th>
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<tbody>
<tr>
<td>a) CPWD General specifications for electrical works</td>
<td>Part-I (Internal)- 2005</td>
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<td>g) Guide for marking of insulated conductors</td>
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<td>h) Guide for uniform system of marking and identification of conductor and apparatus terminals.</td>
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<td>i) Low voltage switchgear and control gear assemblies</td>
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<td>k) Enclosed distribution fuse boards and cutouts for voltages not exceeding 1000V AC and 1200 V DC</td>
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<tr>
<td>l) Code of practice for selection, Installation and maintenance of switchgear and control gear.</td>
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<td>n) PVC insulated (heavy duty) electric cables</td>
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<td>o) PVC insulated cables for working voltages upto and including 1100V.</td>
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p) Conduit for electrical installations
   IS 9537

q) Accessories for rigid steel conduits for electrical wiring
   IS 3837

r) Boxes for the enclosure of electrical accessories
   IS 14772

s) General and safety requirements for luminaries
   IS 1913

t) Code of practice for earthing
   IS 3043

u) Electrical accessories – circuit breakers for overcurrent protection for household and similar installations.
   IS 8828

v) Low voltage switchgear and control gear
   IS 13947 part 1 – 5

w) Residual current operated circuit breakers
   IS 12640

x) Current Transformers
   IS 2705

y) Voltage Transformers
   IS 3156

z) Direct acting indicating analogue electrical measuring instruments and their accessories
   IS 1248 part – 1 to 9

A1) Control Switches (switching device for control and auxiliary circuits including contactor relays) for voltages upto and including 1000V ac and 1200V DC.
   IS 13947 & IS 1336

B1) Dry type power transformer
   IS 11171

In case of contradiction in specification the priority of the documents shall be as follows:

CPWD/ IS specification, BOQ, drawings, Technical specifications.
4.0 L.T. PANELS AND M.V. PANELS

4.1 GENERAL

Main/Sub Distribution Panels shall be indoor type, metal clad, floor mounted, free standing, totally enclosed, extensible type, air insulated, cubicle type for use on 415 Volts, 3 phase, 50 cycles system.

4.2 CONSTRUCTION

Main/Sub Panels shall be:

i. Of metal enclosed, indoor, floor mounted, free standing construction (unless otherwise specified) type.

ii. Made up of the requisite vertical sections, which when coupled together shall form continuous dead front switchboards.

iii. Provide dust and damp protection.

iv. Be readily extensible on both sides by the addition of vertical sections after removal of the end covers in case of Main Panels.

v. All panels shall be front access type.

Main/Sub Panels shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses, as the effects of humidity, which are likely to be encountered in normal service.

Each vertical section shall comprise of the following:

i. A front-framed structure of rolled/folded sheet steel channel section, of minimum 2 mm thickness, rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment, such as circuit breaker cassettes, moulded case circuit breaker, main horizontal busbars, vertical risers and other front mounted accessories. The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 2 mm thickness and 100 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

ii. A cable chamber housing the cable end connections, and power/control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling, and adequate safety for working in one vertical section without coming into accidental contact with live parts in an adjacent section.
iii. A cover plate at the top of the vertical section, provided with a ventilating hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1 mm diameter perforations to prevent entry of vermin.

iv. Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.

The height of the panels should not be more than 2400 mm for MV Panels. Operating handle of breaker in top most compartments shall not be higher than 1800 mm. The total depth of the panel should be adequate to cater to proper cabling space and should not be less than 350mm.

Doors and covers shall be of minimum 2mm thick sheet steel. Sheet steel shrouds and partitions shall be of minimum 1.6 mm thickness. All sheet panels shall be smoothly finished, leveled and free from flaws. The corners should be rounded. The apparatus and circuits in the power control centers (panels) shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.

Apparatus forming part of the Main/Sub Panels shall have the following minimum clearances.

i. Between phases - 32 mm
ii. Between phases and neutral - 26 mm
iii. Between phases and earth - 26 mm
iv. Between neutral and earth - 26 mm

When, for any reason, the above clearances are not available, suitable insulation shall be provided. Clearances shall be maintained during normal service conditions.

Creepage distances shall comply with those specified in relevant standards.

All insulating material used in the construction of the equipment shall be of non-hygroscopic material, duly treated to withstand the effects of the high humidity, high temperature tropical ambient service conditions.

Functional units such as circuit breakers and moulded case circuit breakers shall be arranged in multi-tier formation, except that not more than two air circuit breakers shall be housed in a single vertical section. Cable entry for various feeders shall be from the rear. Panel shall be suitable for termination of bus duct for incoming breakers.
Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

i. Main busbars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.

ii. Cable termination of one functional unit, when working on those of adjacent unit/units.

All doors/covers providing access to live power equipment/ circuits shall be provided with tool operated fasteners to prevent unauthorized access.

Provision shall also be made for permanently earthing the frames and other metal parts of the switchgear by two independent connections.

4.3 METAL TREATMENT & FINISH

All steel work used in the construction of the Main/Sub Panels should have undergone a rigorous metal treatment process as follows:-

i. Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.

ii. Pickling in dilute sulphuric acid to remove oxide scales & rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.

iii. A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.

iv. Passivating in de-oxalite solution to retain and augment the effects of phosphating.

v. Drying with compressed air in a dust free atmosphere.

vi. Panel shall be powder coated with epoxy based powder paint after the above process so as to render the material suitable for corrosive environment.

vii. Paint shade shall be Pebble (light) grey, shade no RAL 7032 unless otherwise specified.

4.4 BUSBARS

The busbars shall be air insulated and made of high conductivity, high strength aluminum alloy complying with the requirement of IS-5082.
The busbars shall be suitable braced with non-hygroscopic SMC supports to provide a through fault withstand capacity of 50 kA RMS symmetrical for one second. The neutral as well as the earth bar should be capable of withstanding the above level. Ridges shall be provided on the SMC supports to prevent tracking between adjacent busbars. Large clearances and Creepage distances shall be provided on the busbar system to minimize possibilities of fault.

The Main/Sub Panels shall be designed that the cables are not directly terminated on the terminals of breaker etc. but on cable termination links. Capacity of aluminum busbars shall be considered as 0.8 Amp per sqmm. of cross sectional area of the busbar. The main busbars shall have continuous current rating throughout the length of Panels. The cross section of neutral busbars shall be same as that of phase busbar for busbars of capacity up to 200Amp; for higher capacity the neutral busbar shall not be less than half (50%) the cross section of that the phase busbars. The busbar system shall consist of main horizontal busbar and auxiliary vertical busbars run in busbar alley/chamber on either side in which the circuit could be arranged/connected with front access.

Connections from the main busbars to functional circuit shall be arranged and supported to withstand without any damage or deformation the thermal and dynamic stresses due to short circuit currents. Busbars to be colour coded with PVC sleeves.

4.5 SWITCHGEARS

Refer subhead 5.00 – LT switchgears

4.6 CABLE TERMINATIONS

Cable entries and terminals shall be provided in the Main/Sub Distribution Panels to suit the number, type and size of aluminium conductor power cables and copper conductor control cable specified.

Provision shall be made for top or bottom entry of cables as required. A cable chamber 150 mm. high shall be provided at the bottom through out the length and depth of the MDB/SDB. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated.

Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.

Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.
4.7 LABELS

Labels shall be anodised aluminium with white engraving on black background shall be provided for each incoming and outgoing feeder of Main/Sub Distribution and all Panels.

4.8 TEST AT MANUFACTURES WORK

All routine tests specified in IS: 8623-1977 shall be carried out and test certificates submitted.

4.9 TESTING AND COMMISSIONING

Commissioning checks and tests shall be included all wiring checks and checking up of connections. Primary/secondary injection tests for the relays adjustment/setting shall be done before commissioning in addition to routine meggar test. Checks and tests shall include the following.

a) Operation checks and lubrication of all moving parts.

b) Interlocking function check.

c) Insulation test: As per CPWD Specifications.

d) Trip tests & protection gear test.
5.00 L.T. SWITCHGEARS

5.01 AIR CIRCUIT BREAKERS

5.01.1 GENERAL

Air circuit breakers shall be incorporated in Main Distribution Panels wherever specified. ACBs shall conform to IS 13947 (Part 2) & IEC 947 (2) in all respects. ACBs shall be suitable for operation on 415 volts, 3 phase, 50Hz, AC supply.

5.01.2 TYPE AND CONSTRUCTION

Air Circuit Breakers shall be of enclosed pattern, dead front type with 'trip free' operating mechanism. It shall have microprocessor based electronic release. Air Circuit Breakers shall be EDO type (Electrically drawout type unless otherwise specified) with horizontal drawout carriage. The ACBs shall be strong and robust in construction with suitable arrangements for anchoring when in fully engaged or fully drawn-out positions. The carriage or cradle on which the breakers are mounted shall be robust design made of fabricated steel, supported on rollers. Cradle shall also comprise of main and secondary separable contacts and all draw out mechanism in a completely fig welded assembly. There shall be no dependence upon the switchboard frame for any critical alignment. The withdrawal arrangement shall be such as to allow smooth and easy movement.

All the current carrying parts of the circuit breakers shall be silver plated, suitable arcing contacts shall be provided to protect the main contacts. The contacts shall be of spring loaded design. The sequence of operation of the contacts shall be such that arcing contacts 'make before' and break after the main contacts. Arcing contacts shall be provided with efficient arc chutes on each pole and these shall be such suitable for being lifted out for inspection of main as well as arcing contacts. The contact tips and arc chutes shall be suitable for ready replacement. Self aligning isolating contacts shall be provided. The design of the breaker shall be such that all the components are easily accessible to inspection, maintenance and replacement. Interphase barriers shall be provided to prevent flashover between phases.

5.01.3 OPERATING MECHANISM.

Air Circuit breaker shall be provided with a quick-make, trip free operating mechanism, the operating mechanism shall be 'strain-free' spring operated. The operating handle shall be in front of the panel type. The design shall be such that the circuit breaker compartment door need not be opened while moving the breaker from completely connected, through test, into the disconnected position. Electrical operated breakers shall have a motor wound spring charged closing mechanism. Breaker operation shall be independent of the motor, which shall be used solely for charging the closing spring. The operating mechanism shall be such
that the breaker is at all times free to open immediately and the trip coil is energised. Mechanical operation indicator shall be provided to show open and closed position of breaker. Electrically operated breakers shall be additionally provided with mechanical indication to show charged and discharged condition of charging spring. 24 volt DC supply through battery backup for closing and opening for tripping circuit.

Means shall be provided for slow closing and opening of the breaker for maintenance purposes and for manual charging and closing of electrically operating breakers during emergencies.

5.01.4 INTERLOCKING AND SAFETY ARRANGEMENT

Air Circuit Breakers shall be provided the following safety and interlocking arrangements:

i. It shall not be possible for breaker to be withdrawn when in "ON" position.

ii. It shall not be possible for the breaker to be switched on until it is either in fully inserted position or for testing purposes it is in fully isolated position.

iii. The breaker shall be capable of being racked into 'testing', 'isolated' and 'maintenance' positions and kept locked in any of these positions.

iv. A safety catch to ensure that the movement of the breaker, as it is withdrawn is checked before it is completely out of the cubicle.

v. The operating mechanism shall provide for racking the breaker into connected, test and disconnected positions without operating compartment door. When cubicle door shall be open position, the breaker can be pulled out to a fourth position, maintenance, where free access shall be possible to all parts of the breaker.

5.01.5 RATING

The rating of the circuit breaker shall be as per the drawings and schedule of quantities. Rated service breaking capacity (Ics) of the breakers shall be 50kA unless otherwise specified at 415 volts. The rated making capacity shall be as per the relevant standard.

5.01.6 ACCESSORIES

The breaker shall be equipped with electronic microprocessor based release to provide over current & earth fault protection. The breaker shall be fitted with following accessories for control, signal and interlocking.

i. Auxillary contacts 6 NO + 6 NC, of rating 16Amp at 415 volts 50Hz.
ii. Shunt release for tripping the breaker remotely and shall be suitable for 240 volt/415 volt 50Hz with range of operation from 10% to 130% of rated voltage.

iii. Micro switches shall be mounted on the cradle of draw out breaker to indicate the position of the breaker on the cradle.
   a. Kit for test/isolated indication.
   b. Kit for service position indication.
   c. Kit for shutter assembly.

iv. Accessories for following interlocking schemes shall be provided.
   a. Accessory kit for locking the breaker in isolated position. This kit is useful for interlocking scheme as well as keeping personnel and equipment safe.
   b. Door interlock kit: Panel or cubicle door cannot be opened with the ACB in Test or Service position.
   c. Lockable trip push button.

5.01.07 MOUNTING

Circuit Breakers shall be mounted as per manufacturers’ standard practice.

5.01.08 TESTING

Testing of each circuit breaker shall be carried out at the works as per IS 2516 and the original test certificate shall be furnished in triplicate. The tests shall incorporate at least the following.

i. Impulse withstand test.

ii. Power frequency withstand test.

iii. Short circuit test.

iv. Temperature - rise test under rated conditions.
5.02 MOULDED CASE CIRCUIT BREAKERS.

5.02.01 GENERAL

Moulded Case Circuit Breaker shall be incorporated in the Main/Sub Distribution Boards wherever specified. MCCBs shall conform to IS 13947 (Part 2) & IEC 947 (2) in all respects. MCCBs shall be suitable either for single-phase AC 230 volts or three phase 415 volts. All MCCBs shall have microprocessor based over current and short circuit releases with adjustable current setting from 0.4In to 1.0 In.

5.02.02 Technical Specifications

The MCCB should be current limiting type with trip time of less than 10 milli sec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ.

MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2 /IEC 60947-2 and should have test certificates for breaking capacities from independent test authorities CPRI / ERDA

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.

The breaking capacity of MCCB shall be minimum 35KA / 50 KA or as specified in BOQ. The rated service breaking capacity should be equal to rated ultimate breaking capacities (Ics=Icu).

All MCCBs upto 200A ratings should be provided with Thermal Magnetic type release with adjustable Overload and fixed short circuit protections. MCCBs of ratings 250A & above shall be provided with Microprocessor based having inbuilt adjustable protections against Over Load (L), Short Circuit (S) and Ground Faults (G)] with time delay.

All MCCBs should be provided with the Rotary Operating Mechanism. The ROM should be with door interlock (with defeat feature) & padlock facility

MCCB should have Spreader links & Phase barriers as standard feature. Superior quality of engineering grade plastics confirming to glow wire Tests as Per IEC 60695-2-1 should be used for insulation purpose.

The handle position shall give positive indication of ‘ON’, ‘OFF’ or ‘Tripped’ thus qualifying to disconnection as per the IS/IEC indicating the true position of all the contacts.
5.02.02 FRAME SIZES

The MCCBs shall have the following frame sizes subject to meeting the fault level.

a. Upto 100A rating ...... 100A frame.
b. Above 100A upto 200A ...... 200A frame.
c. Above 200A up to 250A ...... 250A frame.
d. Above 250A up to 400A ...... 400A frame.
e. Above 400A up to 630Aq ...... 630A frame.
f. Above 630A to 800A ...... 800A frame.

5.02.03 CONSTRUCTIONS

The MCCB's cover and case shall be made of high strength heat treatment and flame retardant thermo-setting insulating material. Operating handle shall be quick make/quick break, trip-free type. The operating handle shall have suitable "ON", "OFF" "and" "tripped" indicators. Three phase MCCBs shall have common operating handle for simultaneous operation and tripping of all the three phases. MCCBS shall be provided with rotary handle.

Suitable extinguishing device shall be provided for each contact. Tripping unit shall be of thermal magnetic or static release type provided in each pole & connected by a common trip bar such that tripping of any pole operates all three poles to open simultaneously. MCCB shall be current limiting type.

Contact trips shall be made of suitable air resistant, silver alloy for long electrical life. Terminals shall be of liberal design with adequate clearance.

5.02.04 BREAKING CAPACITY

Unless otherwise specified, rated service breaking capacity of the Moulded Case Circuit Breakers shall be minimum 25kA or as mentioned in the BOQ

5.02.05 TESTING

a. Original test certificate of the MCCB as per Indian Standards (IS) 315-C-8370 shall be furnished.

b. Pre-commissioning tests on the Main Distribution/Sub Distribution Board incorporating the MCCB shall be done as per standard.
5.03 SWITCH DISCONNECTOR FUSE UNITS

The Switch Disconnector Fuse Units shall be double break type suitable for load break duty (AC 23) quick make and break action. Hinged doors shall be duly interlocked with operating mechanism so as to prevent opening of the door when the switch is in 'ON' position and also prevent closing of the switch when the door is not properly secured. All contacts incoming and outgoing terminals of switch shall be adequately sized to receive proper size of cables. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall be in accordance with IS 13703-1&2-1993 and having rupturing capacity of not less than 31 MVA at 415 volts. HRC fuse links shall be provided with visible indicators to so that they have operated. The switch disconnector fuse units shall be manufactured in accordance with IS 13947-3-1993.

FUSE

Fuse shall be of the high rupturing capacity (HRC) fuses links and shall be in accordance with IS 13703-1&2-1993 and having rupturing capacity of not less than 31 MVA at 415 volts. The backup fuse rating for each motor/equipment shall be chosen as the fuse does not operate on starting of motors/equipments.

5.04 MEASURING INSTRUMENTS, METERING & PROTECTION

5.04.01 GENERAL

Direct reading electrical instruments shall be in conformity with IS 1248. The accuracy of direct reading shall be 1.0 for voltmeter and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The errors due to variations in temperature shall be limited to a minimum. The meter shall be suitable for continuous operation between-10 degree Centigrade to + 50 degree Centigrade. All meters shall be of flush mounting type of 96mm square or circular pattern. The meter shall be enclosed in a dust tight housing. The housing shall be of steel or phenolic mould. The design and manufacture of the meters shall ensure the prevention of fogging of instrument glass. Instruments meters shall be sealed in such a way that access to the measuring element and to the accessories within the case shall not be possible without removal of the seal. The meters shall be provided with white dials and black scale markings.

The pointer shall be black in colour and shall have zero position adjustment device which could be operated from outside. The direction of deflection shall be from left to right.

Suitable selector switches shall be provided for all ammeters and voltmeters intended to be used on three-phase supply.
The specifications herein after laid down shall also cover all the meters, instrument and protective devices required for the electrical work. The ratings type and quantity of meters, instruments and protective devices shall be as per the schedule of quantities.

5.04.02 AMMETERS

Ammeters shall be moving iron or moving coil type/ digital type as mentioned in the BOQ. The moving part assembly shall be with jewel bearing. The jewel bearing shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks, the ammeters shall be manufactured and calibrated as per the latest edition of IS:1248. Ammeters shall be instrument transformer operated, and shall be suitable for 5A secondary of instrument transformer. The scales shall be calibrated to indicate primary current, unless otherwise specified. The ammeters shall be capable of carrying sustained overloads during fault conditions without damage or loss of accuracy.

5.04.03 VOLTMETERS

Voltmeter shall be of moving iron or moving coil type/ digital type as mentioned in the BOQ. The range for 415 volts, 3 phase voltmeters shall be 0 to 500 volts. Suitable selector switch shall be provided for each voltmeter to read voltage between any two lines of the system. The voltmeter shall be provided with protection fuse of suitable capacity.

5.04.04 CURRENT TRANSFORMERS

Current transformers shall be in conformity with IS: 2705 (Part I, II & III) in all respects. All current transformers used for medium voltage applications shall be rated for 1kV. Current transformers shall have rated primary current, rated burden and class of accuracy as required. However, the rated acceptable minimum class of various applications shall be as given below:

Measuring : Class 0.5 to 1

Protection : Class 5P10.

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 50KA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identification of poles. Separate CT shall be provided for measuring instruments and protection relays. Each C.T. shall be provided with rating plate.

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CT's shall be copper
conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

All Current Transformer shall be Cast resin type.

5.05 MISCELLANEOUS

Control switches shall be of the heavy-duty rotary type with escutcheon plates clearly marked to show the operating position. They shall be semi-flush mounting with only the front plate and operating handle projecting.

Indicating lamps shall be of the filament type of low watt consumption, provided with series resistor where necessary, and with translucent lamp covers, bulbs & lenses shall be easily replaced from the front.

Push buttons shall be of the momentary contact, push to actuate type fitted with self-reset contacts & provided with integral escutcheon plates marked with its functions.
6.00 INTERNAL ELECTRIFICATION OF BUILDING

6.1 SCOPE

As specified in subhead 1.00

6.2 GENERAL

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice for Electrical Wiring Installation IS: 732-1989 and IS: 2274-1963. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations, so far as these become applicable to the installation. Electrical work in general shall be carried out as per following CPWD Specifications with up to date amendment.

- Specifications for Electrical Works Part-I (Internal) by CPWD – 2005 or latest revision
- Specifications for Electrical Works Part-II (External) by CPWD – 1994 or latest revision

Wherever these specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification then the specification here under shall take precedence over the said regulations and standards.

6.3 DISTRIBUTION BOARDS.

As a general practice only pre-wired MCB type double door DB shall be used. Pre-wired DB shall have following features:

i) Recess/ surface type with integral loose wire box.
ii) Phase/neutral/ earth terminal blocks for termination of incoming & outgoing wires.
iii) DIN channel for mounting MCBs.
iv) Arrangement for mounting incomer MCB/RCCB/RCBO/MCCB as required.
v) Copper bus bar.
vi) Earthing terminals.
vii) Wiring from MCBs to terminal block.
viii) Interconnection between terminal block/ incoming switch/ bus bar/ neutral/ terminal block/ earth terminal connector with specified size of FRLS pre insulated copper conductor cable duly fitted with copper lugs/ thimbles.
ix) Termination block should be suitable for termination of conductor/ cable of required size but minimum rated cross section of the terminal blocks should be 6 sq. mm.
x) Terminal block shall be made of flame retardant polymide material.
xi) Coloured terminal blocks and FRLS wires for easy identification of RYB phases, Neutral and Earth.

xii) Pre-wired DB shall be provided with a detachable cassette for safe removal of MCBs, RCCBs. Terminal connectors from the DB without loosening the internal cable connections of phase and neutral circuits.

xiii) The pre-wired DB shall have peelable poly layer on the cover for protection from cement, plaster, paints etc during the construction period.

xiv) Detachable plate with knock out holes shall be provided at the top/bottom of board. Complete board shall be factory fabricated and pre-wired in factory, ready for installation at site. The box and cover shall be fabricated from M.S. sheet steel, properly pretreated, phosphotized with powder coated finish.

xv) DB shall be of double door construction provided with hinged cover in the front.

Distribution Board shall be standard type. Distribution boards shall contain miniature circuit breakers of rating specified in BOQ/DB Schedule.

Miniature circuit breakers shall be quick make and quick break type with trip free mechanism. MCB shall have thermal and magnetic short circuit protection. All miniature circuit breakers shall be of 9 KA rated rupturing capacity unless otherwise specified.

Neutral busbars shall be provided with the same number of terminals, as there are single ways on the board, in addition to the terminals for incoming mains. An earth bar of similar size as the neutral bar shall also be provided. All live parts shall be screened from the front. Ample clearance shall be provided between all live metal and the earth case and adequate space for all incoming and outgoing cables. A circuit identification card in clear plastic cover shall be provided for each distribution board.

MCB's shall be provided on the phase of each circuit. The individual banks of MCB's shall be detachable. There shall be ample space behind the banks of MCB's to accommodate all the wiring. All the distribution boards shall be completely factory wired, ready for connections. All the terminals shall have adequate current rating and size to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Earth Leakage Circuit Breaker shall be current operated type and of 30mA sensitivity unless otherwise specified. It shall also provide over-current and short circuit protection i.e. it shall be MCB-cum-RCCB (Residual Current Circuit Breaker). In case ELCB doesn't have inbuilt short circuit protection, same rating MCB have to be provided for short circuit protection along with ELCB. Cost of this MCB is deemed to be included in the cost of ELCB. ELCB shall be housed within the Distribution Board.
Distribution Boards shall be ready for connections and shall be inspected in the factory by HSCC Electrical Engineer before dispatch.

Before procurement of Distribution Boards, MCB’s, ELCB’s (incomer and outgoings) etc., the contractor has to take approval of the DB Schedule/Drawings of each DB from the HSCC Electrical Engineer. The whole unit i.e. Distribution Board, MCB’s, ELCB’s etc. shall come from the manufactures premises/workshop. After inspection and clearance from the HSCC Electrical Engineer the same may be dispatched to site for installation. However if a single component (such as ELCB or MCB or DB) is required for any reason such as replacement, increase in no. of circuits in the DB, change in the load of existing circuit, change in the total load on a particular DB etc., the same may be ordered separately but after the approval of HSCC Electrical Engineer.

6.4 METALLIC CONDUIT WIRING SYSTEM.

6.4.1 TYPE AND SIZE OF CONDUIT.

All conduit pipes shall be of approved gauge (not less than 16 SWG for conduits of sizes up to 32 mm diameter and not less than 14 SWG for conduit of size above 32mm diameter) solid drawn or reamed by welding finished with black stove enameled surface. All conduit accessories shall be of threaded type and under no circumstances pin grip type accessories shall be used. The maximum number of PVC insulated 650/1100 volts grade copper conductor cable that can be drawn in conduit of various sizes shall be as per IS Code. No steel conduit less than 20mm in diameter shall be used.

6.4.2 CONDUIT JOINTS.

Conduit pipes shall be joined by means of threaded couplers, and threaded accessories only. In long distance straight run of conduits, inspection type couplers at reasonable intervals shall be provided or running threads with couplers and jam nuts shall be provided. In the later case the bare threaded portion shall be treated with anti-corrosive preservative. Threads on conduit pipes in all cases shall be between 13 mm to 19 mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories.

Cut ends of conduit pipe shall have neither sharp edges nor any burrs left to avoid damage to the insulation of conductor while pulling them through such pipes.

6.4.3 PROTECTION AGAINST CONDENSATION.

The layout of conduit should be such that any condensation or sweating inside the conduit is drained out. Suitable precaution should also be taken to prevent entry of insects inside the conduit.
6.4.4 PROTECTION OF CONDUIT AGAINST RUST.

The outer surface of conduit including all bends, unions, tees, junction boxes etc. forming part of conduit system shall be adequately protected against rust when such system is exposed to weather by being painted with two coats of oxide paint applied before they are fixed. In all cases, no bare threaded portion of conduit pipe shall be allowed. Unless such bare thread portion of conduit is treated with anticorrosive preservative or covered with approved plastic compound.

6.4.5 PAINTING OF CONDUIT AND ACCESSORIES.

After installation, all accessible surface (if any) of conduit pipes, fittings etc. shall be painted with two coats of approved enameled paint or aluminium paint as required to match the finish of surrounding wall, trusses etc.

6.4.6 RECESS CONDUIT.

The chase in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of building under construction, conduit shall be buried in the wall before plastering and shall be finished neatly after erection of conduit. In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work. Entire work of chasing the wall, fixing the conduit in chases, and burring the conduit in mortar before plastering shall form part of point wiring work.

The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60cm apart or by any other approved means of fixing. Fixing of standard bends and elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with the long radius, which shall permit easy drawing in of conductors. All threaded joints of conduit pipe shall be treated with some approved preservative compound to secure protection against rust. Suitable inspection boxes to the barest minimum requirements shall be provided to permit periodical inspection and of facilitate replacement of wires, if necessary. These shall be mounted flush with the wall. Suitable ventilating holes shall be provided in the inspection box covers. Wherever the length of conduit run is more than 10 meters, then circular junction box shall be provided.

6.4.7 METAL OUTLET BOXES & COVERS.

The switch box shall be made of modular metal boxes with suitable size modular cover plates. Modular metal box shall be made of mild steel on all sides except on the front.

The metal box (other than modular type) shall be made of metal on all sides except on the front. Boxes shall be hot dip galvanized mild steel. Metal boxes upto 20 x 30 cm size M.S. box shall have wall thickness of 18 SWG and MS boxes above 20 x 30 cm
size shall be of 16 SWG. The metallic boxes shall be painted with anticorrosive paint before erection. Clear depth of the box shall not be less than 60mm. All boxes shall be covered from top with Phenolic laminated sheet of approved shade. These shall be of 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conform to grade P-I of IS: 2036-1994.

6.4.8 ERECTION AND EARTHING OF CONDUITS.

The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested in presence of HSCC Electrical Engineer for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirement by means of special approved type of earthing clamp effectively fastened to conduit pipe in a workmen like manner for a perfect continuity between the earth and conduit.

6.4.9 SWITCHES.

All 5 and 15 Amp switches shall be modular type of 240 volts A.C. grade. All switches shall be fixed on modular metal boxes. All 5 Amp socket shall be 5 pin type and 15 Amp socket shall be 6 pin type (unless otherwise specified) suitable for 15/5 Amp. All modular switches, sockets, telephone outlets, TV outlet etc. shall be in off white finish unless otherwise specified. The switches controlling the lights or fans shall be connected to the phase wire of the circuit. Switch boards shall be located at 1200 mm above finished floor level unless otherwise indicated on drawings or directed by Engineer-In-Charge.

In case of computer power points, power points, telephone points etc. to be fixed on laminated partition board (furniture), same shall be fixed on laminated board (portion of laminated board meant for fixing power points) with base plate/cover plate as applicable, duly fixed with screws.

6.4.10 COVER PLATE.

All modular switches, sockets, telephone outlets etc. shall be fixed modular metal boxes with modular base plates and modular cover plates on top.

6.4.11 WALL SOCKET PLATE.

Each outlet shall have a switch located beside the socket preferably on the same cover plate/modular base. The earth terminal of the socket shall be connected to the earth wire.

6.5 WIRING.

All PVC insulated copper conductor wires shall conform to relevant IS Codes. All wires/cables shall be stranded type irrespective of its size. Cable conductor size and material shall be specified in BOQ.
All internal wiring shall be carried out with PVC insulated wires of 650/1100 volts grade. The circuit wiring for points shall be carried out in looping in system and no joint shall be allowed in the length of the conductors. Circuit wiring shall be laid in separate conduit originating from distribution board to switch board for light/fan. A light/fan switchboard may have more than one circuit but shall have to be of same phase. Looping circuit wiring shall be drawn in same conduit as for point wiring. Each circuit shall have a separate neutral wire. Neutral looping shall be carried out from point to point or in light/fan switchboards. A separate earth wire shall be provided along with circuit wiring for each circuit. For point wiring red/yellow/blue colour wire shall be used for phase and black colour wire for neutral. Circuit wiring shall be carried out with red, yellow or blue colour PVC insulated wire for RYB phase wire respectively and black colour PVC insulated wire for the neutral wires. Bare copper wire shall be used as earth continuity conductor and shall be drawn along with other wires. No wire shall be drawn into any conduit until all work of any nature, that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire.

Before the wires are drawn into the conduit, the conduits shall be thoroughly cleaned of moisture, dust and dirt. Drawing and jointing of copper conductor wires and cables shall be as per CPWD specifications.

Maximum number of PVC insulated 650/1100 V grade aluminium/copper conductor cable conforming to IS : 694 - 1990

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional area of conductor in Sq.mm.</th>
<th>25mm</th>
<th>32mm</th>
<th>38mm</th>
<th>51mm</th>
<th>64mm</th>
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<td>70</td>
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<td>4</td>
</tr>
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</table>
NOTE:

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.

2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.

3. Conduit sizes are the nominal external diameters.

6.5.1 JOINTS.

All joints shall be made at main switches, distribution board socket and switch boxes only. No joint shall be made in conduits and junction boxes. Conductors shall be continuous from outlet to outlet.

6.5.2 LOAD BALANCING

Balancing of circuits in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

6.5.3 COLOUR CODE FOR CIRCUIT WIRING.

Colour code for circuit and sub main wiring installation shall be Red, Yellow, and Blue for three phases. Black for neutral and yellow/green or green only for earth incase of insulated earth wire.

6.5.4 CLASSIFICATION OF POINTS.

6.5.4.1 General

Classification and measurement of Point wiring shall be as per CPWD specification for Electrical Works (Part-I-Internal) 1994.

6.5.4.2 Point Wiring (Modular)

Definition of point wiring

A point (other than socket outlet point) shall include all work necessary in complete wiring to the light points/fan/exhaust fan/call bell point from the controlling switch/MCB. The scope of wiring for a point shall, however, include the wiring work necessary in tapping from another point in the same distribution circuit i.e. from first switch board (wiring from distribution board to first switch box is covered in the circuit wiring and is not in the scope of point wiring) to subsequent switch board(s) in
the same distribution circuit. The point wiring includes all materials specified below including chasing the wall (in case of recessed wiring in wall), fixing the conduit and making the wall good as it originally was. It also includes supply, drawing, testing and commissioning of wires.

**Scope of point wiring**

Following shall be deemed to be included in point wiring.

(a) Supply & fixing conduit & conduit accessories for the same and wiring cables (including supplying and drawing wires) between the switch box and the point outlet. [See also (i) below]

(b) All fixing accessories such as clips, nails, screws, phil plug, rawl plug etc. as required.

(c) Modular Metal boxes for control switches, regulators, sockets etc. recessed or surface type, modular base plates and modular cover plates over the same.

(d) Outlet boxes, junction boxes, pull-through boxes etc. but excluding modular metal boxes if any, provided the switchboards for loose wires/conduit terminations.

(e) In case of recessed wiring in wall the scope includes chasing of wall, fixing the conduit and making the wall good as it originally was.

(f) Control modular switch (5/6A) as specified.

(g) Ceiling rose or connector (in case of points for ceiling/exhaust fan point, prewired light fittings and call bells).

(h) Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.

(i) Interconnecting wiring between points on the same circuit, in the same switch box or from another. Interconnecting wiring from first switchboard to subsequent switch board(s).

(j) Protective (loop earthing) conductor (as specified in the BOQ) from one metallic switch box to another in the distribution circuits, and from switchboard to each point (light/fan/exhaust fan/call bell etc).

(k) Bushed conduit where wiring cables pass through wall etc.

(l) Ceiling rose (in the case of pendants except stiff pendants).

b) Lamp holder (in the case of goose neck type wall bracket, batten holder and fittings which are not pre-wired).

c) Back Plate (in the case of stiff pendants).

d) MS Fan Boxes with MS hook (as per CPWD specifications) for the erection of Ceiling Fans

Note :- In the case of call bell points the words “from the controlling switch or MCB” shall be read as “from the ceiling rose meant for connection to bell push”.

**Measurement of Point Wiring** (other than socket outlet points)
i) There shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting,

ii) No separate measurement shall be made for interconnections between points in the same distribution circuit and for the circuit protective (loop earthing) conductors between metallic switch boxes.

6.5.5. Circuit and Submain Wiring

Circuit Wiring

Circuit wiring shall mean the wiring from the distribution board upto the tapping point for the nearest first point of that distribution circuit i.e. up to the nearest first switch box.

Submain Wiring

Submain wiring shall mean the wiring from one main/distribution switchboard to another.

Measurement of circuit wiring and submain wiring

(i) Circuit and submain wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all lengths from end to end of conduit, exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included in the measurement.

(ii) The length of circuit wiring with two wires shall be measured from the distribution board to the first nearest switch box in the circuit irrespective of whether neutral conductor is taken to switch box or not.

(iii) When wires of different circuits are grouped in a single conduit, the same shall be measured on linear basis depending on the actual number and size of wires run.

(iv) When circuit wires and wires of point wiring are run in the same conduit, circuit wiring shall be measured on linear basis depending on the actual number and sizes of wires run in the existing conduit.

(v) Protective (loop earthing) conductors, which are run along the circuit wiring and submain wiring, shall be measured on linear basis and paid separately. This is not applicable if protective conductor is clubbed with the BOQ item of circuit and submain wiring.
6.5.6 Power Plug Wiring

5A Plug Wiring

Wiring for all 5 A Socket Outlets shall be done with 2X1.5 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, from the switchboard or 15A power point as the case may be.

Measurement of 5A point wiring shall be done on number basis from switchboard/15A power point to 5A point. Conduit of point wiring/power point wiring can also be used for 5A point wiring, but both phase and neutral wires shall come directly from switchboard/power point. Looping of neutral shall not be done.

15A Power Plug Wiring

Wiring for all 15 A Socket Outlets/Gyser point shall be done with 2X4 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, directly from the MCB-Distribution Board or from one power point to another in case of computer power points. Looping shall not be done in general 15A power points (other than computer power points).

Measurement of power point wiring shall be done on number basis under following two subheads:

i) Directly from MCB-Distribution Board to the Socket Outlets
ii) From One power point/computer power point to another (looping)

Wiring for 20A Metal Clad Socket Outlets

Wiring for all 20A Metal Clad Socket Outlets shall be done with 2X6 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, directly from the MCB-Distribution Board. Measurement of wiring for 20A Metal Clad Socket outlet shall be done on number basis i.e. complete wiring directly from MCB-Distribution Board to the socket outlet.

No extra payment shall be made on account of minor changes in location of power points (15A or 20A or computer power points) due to change in the architectural layout or change due to any other reason. Height of the power socket outlets shall be 300mm from the finished floor level unless otherwise specified.
6.5.7 CONDUCTOR SIZE.

Wiring shall be carried out with following sizes of PVC insulated stranded single core copper conductor wire/cable.

i. Light point. - 1.5Sq.mm

ii. Ceiling /Cabin/Exhaust Fan Point - 1.5Sq.mm

iii. Call Bell Point - 1.5Sq.mm

iv. Plug Point (5 A Outlet) - 1.5Sq.mm

v. Circuit Wiring - 1.5Sq.mm

vi. General Power Point - 4Sq.mm

vii 20A Industrial Socket Outlet – 6 Sqmm

viii Special Power Point – 6 Sqmm

ix A/C Box with 32A MCB- 6 Sqmm
6.5.8 LIGHTING FIXTURE AND FANS

6.5.8.1 GENERAL

a. The Contractor shall supply and install lighting fixtures including but not limited to lamps, ballasts, accessories fixing hardware necessary for installations, as shown on the Drawings, as required, and as herein specified.

b. All fixtures shall be delivered to the building complete with suspension accessories, canopies, hanging devices, sockets, holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc. all wired and assembled as indicated.

c. Full size shop detail drawings of special fixture or lighting equipment, where called for in the fixtures schedule, shall be submitted to the HSCC Electrical Engineer for approval.

d. Fixtures, housing, frame or canopy, shall provide a suitable cover for fixture outlet box or fixture opening.

e. Fixtures shall comply with all applicable requirements as herein outlined unless otherwise specified or shown on the Drawings.

f. Manufacturer's name and catalogue number of light fixtures, fans, switchgears etc. shall be strictly adhered.

g. Fixtures shall bear manufacturer's name and the factory inspection label.

h. Fixtures shall be completely wired and constructed to comply with the IEE wiring regulations requirements for lighting fixtures, unless otherwise specified.

i. Revamping the fixture shall be possible without having to remove the fixture from its place.

j. Lamps of the proper type, wattage and voltage rating shall be furnished and installed in each fixture.

6.5.9 INSTALLATION

Fixtures shall be installed at mounting heights as detailed on the Drawings or as instructed on site by the Engineer-In-charge.

Pendent fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation.
Flush mounted recessed fixtures, shall be installed so as to completely eliminate leakage of light within the fixture and between the fixture and adjacent finish.

Fixtures mounted outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Hickeys or extension pieces shall be installed where required to facilitate proper installation.

Fixtures located on the exterior of the building shall be installed with non-ferrous metal screws finished to match the fixtures.

6.5.10 LAMPS-GENERAL

Lamp shall be supplied and installed in all lighting fixtures listed in the BOQ.

Lamp shall be the part of Fitting no extra Payment will be made

Lamps used for temporary lighting service shall not be used in the final fixture units.

Lamps shall be of wattage and type as shown in the BOQ.

Lamps for permanent installation shall not be placed in the fixtures, until so directed by the Engineer In-charge.

6.5.11 BALLASTS-FLUORESCENT

Ballasts shall be electronic type and having high power factor type.

Ballasts shall have manufacturer's lowest sound level and case temperature rise rating.

Ballasts shall be special cool operated type.

Ballasts for indoor fixtures shall be protected by an integral thermal automatic resetting protective unit, which shall disconnect the ballast in the event of overheating.

Ballasts shall be of the same manufacture as the lamps/fixture.

6.5.12 FIXTURE SAMPLES

Detailed catalogue for all fixtures or if so required by the HSCC Electrical Engineer sample fixtures shall be submitted for prior approval of the HSCC Electrical Engineer before orders for the fixtures are placed.
6.5.13 TESTING

After all lighting fixtures are installed and are connected their respective switches, test all fixtures to ensure operation on their correct switch in the presence of the engineer.

All non-operating fixtures or ones connected to the wrong or inconveniently located switch shall be correctly connected as directed by the Engineer In-charge.

6.5.14 CEILING FANS

All ceiling fans shall be provided with suspension arrangement in the concrete/slab/roof members. Contractor to ensure that provision are kept at appropriate stage at locations shown on the drawing. Fan box with MS hook shall be as per CPWD specification. Ceiling fan shall be double ball bearing type, copper wound motor complete with canopy, down rod, blades etc. and shall conform to relevant IS standards ceiling fan shall be white in colour. Ceiling fan shall be provided with electronic regulator. Electronic Regulator shall be suitable for 240 volts A.C supply 50 Hz and shall be of continuous duty type

6.5.15 EXHAUST FANS

Exhaust fans shall be heavy-duty type with double ball bearing and conforming to IS 2312 (latest revision). Exhaust fan shall be complete with copper wound motor, capacitor, Louver/shutter, frame and mounting bracket. Exhaust fan shall be suitable fan operation on 240 volts single phase A.C supply.
7.00 TELEPHONE SYSTEM

7.01 Telephone point wiring

(a) The point wiring shall be carried out with Double pair telephone wire/cable, unarmoured, PVC insulated, 0.61 mm dia annealed tinned copper conductor (IS: 2532-1965) in suitable size conduit (one pair always remaining spare for one point)

Minimum Dia of Conduit for Internal/External Telephone Wiring - 20mm.

If more than one telephone point has to be provided at one point, multicore, unarmoured telephone cable shall be used (pairs required are equal to 2 No.of points) in suitable size of conduit.

(b) The point shall commence from the main telephone tag box/sub tag box and would terminate at outlet box of point. Connection at both ends included in point wiring.

(c) Fixing of conduit, conduit accessories draw out boxes and outlet box etc. in concealed/surface conduit works as that of wiring for light fixtures shall be applicable for telephone wiring conduit system also.

(d) Joint in telephone wiring (between main tag box/sub tag box and outlet box of point) shall not be allowed and the contractor should bear the wastages of wire if resulted due to this special requirement of telephone system.

(e) External/Internal telephone and intercom wiring can be drawn in the same conduit, provided after drawing wires, 50% of conduit cross sectional area is free. However, independent PVC insulated telephone wire of suitable pairs shall be used for external, internal and intercom.

(f) To identify each pair of multipair telephone wire/cable, PVC indication numbers shall be put on both ends of pair just before termination.

7.02 Telephone Tag Boxes

These shall be of MS sheet 2 mm thick with connector suitable for telephone connection (as approved by ITI). It shall have hinged MS sheet cover.
9.00 ADDRESSABLE FIRE DETECTION AND ALARM SYSTEM

9.01 GENERAL

The Contractor shall supply and install the Addressable Fire Detection & Alarm System as per schedule of quantities are as herein specified. The system shall include Addressable Main Fire Alarm Control Panel, battery charger, batteries, addressable heat detectors, addressable smoke detectors, manual fire alarm station, fire alarm bells/hooters, response indicators, conduiting, wiring and all necessary accessories required to complete fire alarm system installation as per IS: 2189-1988. Equipment like control panel, smoke detector, heat detectors etc shall be EN-54/ UL approved.

9.02 FEATURES

The system shall be general alarm electrically supervised type activation of manual fire alarm station or any of the automatic alarm initiating devices shall sound the general alarm bells on all floors and shall give indication on the control panel. The signal shall be continuous until the station from which it is originated is restored to normal and a reset button on the control unit is operated.

The system shall be electrically supervised against open and ground on both the stations and signal device wiring. Open and ground in the system shall cause a trouble bell to ring at the fire alarm control panel and a trouble lamp to light. It shall be possible to silence the bell but the lamp shall remain lit until the fault is rectified. Incase of power failure the system shall automatically changeover to the battery standby.

9.03 CONDUITING & WIRING

Conduiting & Wiring for FDA system shall be carried out in M.S Conduit with copper conductor PVC insulated wires.

9.04 CONTROL PANEL

The fire control panel has to be addressable type.

The Main Fire Control Panel shall be constructed to sheet steel of red colour, and provided with windows for the alarm and trouble lights. All components shall be of the plug in type, for simple replacement and extension in the future. Control panel shall be wall mounting type conforming to IS 513-1986.

The number of loops is mentioned in B.O.Q. Each loop shall be able to support at least 128 any device addressable analog/digital (as the case may be) sensors and control module etc. The control panel shall have alphanumeric display. The Main Fire control panel shall be provided with all necessary relays, resistors, fuses, transformers, rectifiers and all other components to assure full and proper functioning of the system. All relays shall conform to the relevant IS Standards. Control panel shall include power include power on lamps, system trouble lamps, audible trouble signal, trouble silence switch with ring back, alarm silence push button with repeat alarm capability, low battery indicator with reset, ground detection indicator, alarm
reset, milli ammeter, supervised alarm lamps, zone "Open" test pushbutton, zone alarm test push button, end of line resistors etc.

Each zone shall be equipped with an auxiliary contact for control of a remote annunciation.

Main control panel shall include a power supply model to provide a filtered and regulated source of power to provide additional power wherever supplementary power is required within the system. It shall include an output fuse, key reset switch, provision for automatic transfer to standby power upon primary power failure.

Main control panel shall in addition have audible signal and lamp to indicate as failure of the charge of battery.

Two stages general Alarm shall be provided in which a continuous evacuation alarm is immediately given in zone of fire and its adjoining zones. In other zone intermittent alarm signal shall be provided as per IS 2189-1988.

Repeater Panel shall be of same specification as main control panel and shall have fire/fault indication with audio device.

9.05 CHARGER AND BATTERY

Unit shall comprise a ventilated cabinet supplied complete with charger, meters, high rate charge switch and lock and key in a sheet metal enclosure.

9.06 ELECTRONIC HOOTERS

Hooter shall be electronic solid-state speaker type having tone for fire, which shall be wailing. Hooter should be loop powered having an output of approximately 6 watt. The audible range shall be around 100m under normal condition. Cable for this in our system shall be 2 cores. The switching shall be provided on the control panel. The outer enclosure of the speaker shall be of MS sheet and shall be suitably oven baked and painted. The speaker shall be 4" heavy magnet type. All hooters shall be on one or more circuits.

9.07 MANUAL ALARM CALL POINT FOR SURROUNDINGS (ADDRESSABLE)

The manual call point shall be electrically compatible with the standard range of automatic detectors so that it can be connected directly into a supervised two-wire zone of the manufacturer's standard range of control units. The manual call point shall be of pleasant, streamlined and flat appearance permitting its use as flush and surface mounted unit. The manual call point shall consist of base plate, insert and cover. The push button shall have minimum one normally closed plus one normally open contacts. The push button shall not be shrouded and the same shall be projected out from the surface of the MS Box. The whole assembly of push button shall be enclosed in the 16 SWG MS Box except from the front side. The front side shall be sealed with breakable glass covering neoprene or equivalent gasket. The glass cover shall be fixed in such a way that the actuating push button is kept
depressed (with NC contact open) so long as the glass cover is in contact. In case of fire, when the glass cover is broken to give the fire warning the push button shall be released due the spring action hence giving remote fire alarm through the NC contact. The breaking of the glass must release an alarm. All inscriptions, texts and marks must be on the manual call point front plate, not on the glass, so that the glass can easily be replaced anywhere. The alarm contacts shall be of self-cleaning design to prevent failure after a prolonged period of inactivity in unclean environments.

It shall be possible to test the call point without destroying the seal or removing the cover. The manual call point shall be equipped with a self-holding device to maintain the alarm condition until reset by an authorized person. The complete unit and the push button shall be painted signal Red. The internal surface of the MS enclosure of the box shall painted white colour. The external painting shall be of synthetic enameled paint. Aluminium hammer shall be suspended on a hook fixed to the external MS enclosure by means of a non-corrodible easy breaking of the glass cover.

Manual alarm call point located on the outer walls of the building and/or exposed to weather conditions shall be weather proof type and satisfying the requirement of APB.

The manual call point shall be capable of being remotely tested from control panel.

**9.08 OPTICAL (PHOTOELECTRIC) TYPE SMOKE DETECTORS (ADDRESSABLE TYPE)**

The optical type smoke detectors shall be based on light attenuation by smoke/ or light scattering by smoke particles. Smoke detectors shall have an inherently stable sensor with built-in automatic compensation for changes in ambient conditions. All electronic circuits must be solid-state devices and virtually hermetically sealed to prevent their operation from being impaired by dust, dirt or humidity. All circuitry must be protected against usual electrical transients and electromagnetic interference. Reversed polarity or faulty zone wiring shall not damage the detector. The detector shall have no moving parts or components subject to wear. The response sensitivity of each detector shall be factory set. A built-in barrier shall prevent entry of insects into the sensor. The detector shall be designed for fast and simple laboratory cleaning.

The detector shall be inserted into or removed from the base by a simple push-twist mechanism to facilitate exchange for cleaning and maintenance. The manufacturer shall produce and provide test equipment allowing to test and exchange smoke detectors upto 7m (23ft) above floor level. The detector shall connect to the control unit via a fully supervised two-wire circuit.

The detector shall be capable of being remotely tested from control panel.

**9.09 HEAT DETECTOR (ADDRESSABLE TYPE)**

Heat detector shall be combined rate of rise and fixed temperature type. Heat detectors shall consist of two independent thermistors, designed to automatically
compensate virtually hermetically sealed to prevent their operation from being impaired by dust, dirt or humidity. All circuitry must be protected against usual electrical transients and protected against usual electrical transients and electromagnetic interference. Reversed polarity or faulty electromagnetic interference. Reversed polarity or faulty zone wiring shall not damage the detector. The detector shall have no moving parts or components subject to wear. It shall be possible to test the detector in the field. The response (activation) of a detector shall be clearly visible from the outside by a flashing light of sufficient brightness. The detector shall be installed into the base by a simple push-twist mechanism to facilitate exchange for cleaning and maintenance. The detector shall connect to the control unit via a fully supervised two-wire circuit.

The manufacturer shall produce and provide test equipment allowing to test and exchange rate-of rise/ fixed temperature heat detectors up to 7m (23ft) above floor level.

The detector shall be capable of being remotely tested from control panel.

9.10 PLUG-IN BASES

The smoke & heat detectors shall fit into a common type of standard base. Once a base has been installed, it shall be possible to insert, remove and exchange different types of detectors by a simple push-twist movement. The standard base shall be equipped with crewels wiring terminals capable of securing wire sizes upto formation and weakening of contact pressure. The standard base shall be supplied with a sealing plate, preventing dirt, dust, condensation or water from the conduit reaching the wire terminals or the detector contact points. All standard bases shall be supplied with a removable dust cover to protect the contact area during installation and construction phase of the building. It must allow the check out and certification of the zone wiring before insertion of any detectors. The standard base shall feature a built-in mechanism, which allows mechanical locking of as installed detector head, thus preventing unauthorized removal or tempering while maintaining.

The detector contact points shall be designed to retain the detector safely and to ensure uninterrupted contact also when exposed to continuous severe vibration. All electronic components of base and modules must be solid state and virtually hermetically sealed to prevent their operation from being impaired by but, dirt or humidity. All circuitry must be protected against usual electrical transients and electromagnetic interference. Reversed polarity or faulty zone wiring shall not damage the detector. The standard base shall allow snap-on insertion of an (optional) electronic module, it shall be possible to turn a standard base part into an individually addressable detector base with its own unique identification address at the control unit. The standard base shall have a built in alarm indicator which is repeatable by connecting a simple 2 core wire to the base. No changes in the zone wiring shall be required to operate the additional alarm indicator. Removal and insertion of dust covers or detectors shall be feasible by a simple push twist movement, even if the locking device has been activates. Special base assemblies
shall be available for use in air ducts and aspiration air-sampling system wherever required.

Contractor is required to submit samples and get approved from HSCC Electrical Engineer of all above mentioned items including Response Indicators, Hooters, manual call points.

10.00 LT CABLES

10.1 GENERAL

L.T. Cables shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant Indian Standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drums. The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

10.2 MATERIAL

The L.T. power cable shall be PVC insulated PVC sheathed type aluminium conductor armoured cable and L.T. control cable shall be PVC insulated PVC sheathed type copper conductor unarmoured cable conforming to IS: 1554: 1988 (Part-I) with up to date amendments.

10.3 INSTALLATION OF CABLES

Cables shall be laid directly in ground, pipes, masonry ducts, on cable tray, surface of wall/ceiling etc. as indicated on drawings and/or as per the direction of HSCC Electrical Engineer. Cable laying shall be carried out as per CPWD specifications.

10.4 INSPECTION

All cables shall be inspected at site and checked for any damage during transit.

10.5 JOINTS IN CABLES

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilisation and avoiding of cable joints. This apportioning shall be got approved from Engineer-in-Charge before the cables are cut to lengths.

10.6 LAYING CABLES IN GROUND

Cables shall be laid by skilled experienced workmen, using adequate rollers to minimize stretching of the cables. The cable drums shall be placed on jacks before unwinding the cable. With great care it shall be unrolled on over wooden rollers
placed in trenches at intervals not exceeding 2 metre. Cables shall be laid at depth of
0.75 metres below ground level for LT Cables and 1 metre below ground level for
HT cable. A cushion of sand total of 250mm shall be provided both above and below
the cable, joint boxes and other accessories. Cable shall not be laid in the same
trench or along side a water main.

The cable shall be laid in excavated trench over 80mm layer of sand cushion. The
relative position of the cables, laid in the same trench shall preserved. At all changes
in direction in horizontal and vertical planes, the cables shall be bent smooth with a
radius of bent not less than 12 times the diameter of cables. Minimum 3 metre long
loop shall be provided at both end of cable.

Distinguishing marks may be made on the cable ends for identifications of phases.
Insulation, tapes of appropriate voltage and in red, yellow and blue colours shall be
wrapped just below the sockets for phase identifications.

Cable route marker shall be provided as per CPWD specifications. Cost of cable
route markers is deemed to be included in the cost of cables/cable laying.

**PROTECTION OF CABLES**

The cables shall be protected by bricks laid on the top layer of the sand for the full
length of underground cable. Where more than one cable is laid in the same trench,
the bricks shall cover all the cables and shall project a minimum of approximately
80mm on either side of the cables. Cable under road crossings and any other places
subject to heavy traffic shall be protected by running them through Hume Pipes of
suitable size. Pipes for cable crossing the road shall be laid at a depth of 1000 mm.

**EXCAVATION & BACK FILL**

All excavation and back fill required for the installation of the cables shall be carried
out by the Contractor in accordance with the drawings and requirements laid down
elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall
be filled in layer not exceeding 150mm. Each layer shall be properly rammed and
consolidated before laying the next layer.

The Contractor shall restore all surfaces, road ways, side walks, curbs, wall or the
works cut by excavation to their original condition to the satisfaction of the
Engineer-in-Charge.

**LAYING OF CABLES ON CABLE TRAY/SURFACE OF WALL/ CEILING**

Cable shall be laid on perforated M.S. Cable tray/ladders. Cables shall be properly
dressed before cable ties/clamps are fixed. Wherever cable tray is not proposed,
cables shall be fixed on surface of wall or ceiling slab by suitable MS
clamps/saddles. Care shall be taken to avoid crossing of cable.

**CABLES ON HANGERS OR RACKS**
The Contractor shall provide and install all iron hangers racks or racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good.

The hangers or racks shall be designed to leave at least 25mm clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at no more than 150mm centres. These shall be designed to keep provision of some spare capacity for future development.

**CABLES TAGS**

Cable tags shall be made out of 2mm thick aluminium sheets, each tag 1-1/2 inch in dia with one hole of 2.5mm dia, 6mm below the periphery. Cable designations are to be punched with letter/number punches and the tags are to be tied inside the panels beyond the glanding as well as below the glands at cable entries. Tray tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 metres.

10.7 **TESTING OF CABLES**

Prior to installation burying of cables, following tests shall be carried out. Insulation test between phases, phase & neutral, phase & earth for each length of cable.

a. Before laying.
b. After laying.
c. After jointing.

Along with the test as prescribed in IS Code, cross sectional area shall also be checked.

On completion of cable laying work, the following tests shall be conducted in the presence of the Engineer in Charge.

a. Insulation Resistance Test (Sectional and overall).
b. Continuity Resistance Test.
c. Earth Test.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipments and labour for conducting the above tests & shall bear all expenses of conducting such tests.
11.00 CABLE TRAY

11.01 Ladder Type Cable Tray

Ladder type cable tray shall be fabricated out of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a centre to centre spacing of 250 mm. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanised or painted to the desired lengths.

11.2 Perforated Type Cable Tray

The cable tray shall be fabricated out of slotted/perforated M.S. Sheet as channel section single or double bended. The channel section shall be supplied in convenient length and assembled at site to the desired lengths. These shall be galvanised or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mm x 50mm x 6mm as two longitudinal members, with cross-bracings between them by 50mm x 5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

11.3 Typically, the dimensions, fabrication details etc. are shown in CPWD General Specification for Electrical Works - Part II -External, 1994.

11.4 The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler plates and cable tray shall be scraped and removed before the installation.

11.5 The maximum permissible uniformly distributed load for various sizes of cables trays and for different supported span are as per CPWD General Specification of Electrical Work Part II -1994. The sizes shall be specified considering the same.

11.6 The width of the cable tray shall be chosen so as to accommodate all the cable in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.

11.7 Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. (Details are typically shown in figure 3 of CPWD General Specification of Electrical Work Part II -1994). The radius of bend,
junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.

11.8 The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mm x 5mm flats at specified spacing as per CPWD General Specification of Electrical Work Part II -1994. Flat type suspenders may be used for channels upto 450mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mm x 50mm x 5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the PMC/Consultant to take the weight of the cable tray with the cables.

11.9 The entire tray (except in the case of galvanised type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.

11.10 The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.

11.11 The cable trays shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross-joints, etc, and paid for accordingly.
12.00 **EARTHING**

12.01 **GENERAL**

All the non-current metal parts of electrical installation shall be earthed properly. All metal conduits trunking, switchgear, distribution boards, switch boxes, outlet boxes, and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. Earthing work shall conform to CPWD General Specifications for Earthing work shall conform to Internal) -1994 and Indian Electricity Rules 1956 amended up to date and in the regulations of the local Electricity Supply Authority.

12.02 **EARTHING CONDUCTOR**

Earth continuity conductor along with submain wiring from Main/Sub Distribution boards to various distribution boards shall be of copper. Earth continuity conductor from distribution board onward up to outlet point shall also be of bare copper. Earth continuity conductor connecting Main & Sub Distribution boards to earth electrode shall be with galvanised MS strip.

12.03 **SIZING OF EARTHING CONDUCTOR**

Single phase distribution board shall have one earth continuity conductor while three phase distribution board shall be provided with two earth continuity conductors. Earthing of main switch board and sub switch boards shall be earthed with two independent earth electrodes or as indicated elsewhere. Earth conductor laid in ground shall be protected for mechanical injury & corrosion by providing GI pipe.

12.04 GI pipe shall be of medium class 40mm dia and 4.5 metre in length. Galvanising of the pipe shall conform to relevant Indian Standards. GI pipe electrode shall be cut tapered at the bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other upto 2 metre of length from bottom. The electrode shall be buried in the ground vertical with its top not less than 20cm below ground level as per detail enclosed. Earth electrode shall not be situated less than 2metres from the building. The location of the earth electrode will be such that the soil has reasonable chance of remaining moist as far as possible. Masonry chamber of size 300 x 300 x 300mm shall be provided with water funnel arrangement a cast iron or MS frame & cover having locking arrangement at the top.

12.05 **PLATE EARTH ELECTRODE**

Earthing shall be provided with either GI plate electrode or copper plate electrode of following minimum dimensions.

i. GI Plate Electrode : 600mm x 600mm x 6mm thick
ii. **Copper Plate Electrode**: 600mm x 600mm x 3mm thick

The electrode shall be buried in ground with its faces vertical and not less than 3 metres below ground level. 20mm dia medium class GI pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on the top of this pipe for watering and earth electrode. Earth electrode the watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300mm deep. A cash iron or MS frame with cover having locking arrangement shall be provided at top of metres from the building. Care shall be taken that the excavation for earth electrode may not affect the column footing or foundation of the building. In such cases electrode may be further away from the building.

**12.06 ARTIFICIAL TREATMENT OF SOIL**

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by addition of sodium chloride calcium chloride, sodium carbonates copper sulphate, salt and soft coke or charcoal in suitable proportions.

**12.07 RESISTANCE TO EARTH**

The resistance of earthing system shall not exceed 1 ohm.
13.00 SAFETY EQUIPMENTS

13.01 DANGER NOTICES

Danger notices shall be affixed permanently in a conspicuous position in Hindi or English and the local language of the district with sign of skull and bones at every overhead lines, transformer, electrical equipments motors, etc.

13.02 FIRST AID BOX

Standard first aid box with all standard contents shall be supplied.

13.03 FIRE BUCKETS

The fire bucket unit shall consist of our galvanised iron baskets, which shall be with round bottom, and of 13 liters capacity. They shall be filled with dry sand. Arrangement shall be made to hang them on GI pipe stand comprising of at least 2 vertical and one horizontal members of 50 mm GI pipe. The stands shall have hooks and locking chain arrangement. The buckets and stand shall be painted with epoxy red paint.

13.04 FIRE EXTINGUISHER

Foam type Fire extinguishers of 9 Kg. capacity and Dry Chemical type Fire Extinguishers of 10 Kg capacity shall be of approved make. It shall be filled with carbon tetrachloride. It shall have horns. Extinguishers shall be fixed on walls/columns with necessary clamps made out of 50 mm x 6mm MS flat and coated bolts and nuts grouted in wall/column.

13.05 RUBBER MAT

Corrugated rubber insulating matting shall be provided in front of all power & motor control centers, push button station and distribution board in the electrical rooms. The width of matting shall be one meter. It shall be as ISI mark.

13.06 INSTRUCTION CHART

Printed instruction chart both in English and Hindi and duly framed with front glass, prescribing treatment to be given to persons having Electric shock, shall be supplied.
14.00 PROCUREMENT, INSPECTION OF EQUIPMENT & APPROVALS

Approved list of makes and vendors are given in the end of technical specifications. The makes of equipment/materials supplied shall be strictly as mentioned therein. For items not specially mentioned, prior approval shall be taken before procurement of the same. All equipments/material supplied shall be brand new and shall be procured directly from the manufacturers, dealers or authorised agents.

HSCC Electrical Engineer shall have access to the manufacturer’s premises for stage inspection/final inspection of any item during its design, manufacturing, and assembly and testing. After carrying out the necessary factory tests and routine tests as per IS Standards, a copy of the routine test certificate shall be forwarded along with the call for carrying out the inspection at the manufacturer’s works.

Based on the inspection certificate, HSCC Electrical Engineer reserves the right to carry out the inspection at a mutually agreed date and/or give inspection waiver. A minimum of two weeks will be needed after receipt of complete shop inspection report and other details to depute our inspector for inspection.

It is the responsibility of the contractor to ensure that all electrical works are carried out as per the IE Rules & regulations, National Building Code and IS Codes & Standards. All necessary drawings and details as required by Electricity Board, Electrical Inspector, Fire Department and other Local Statutory agencies, shall be prepared by the contractor. The contractor is responsible to submit the drawings and other details as required to the Local Authorities (refer above) and obtain necessary approvals including sanction of load/enhancement of electrical load from SEB before energizing and commissioning. All official fee required for getting the approval will be reimbursed on account of Client on submission of original documents.
15.00 NURSES CALL BELL SYSTEM

15.01 SYSTEM OPERATION:

The Nurse Call System shall consist of (1) power supply, (2) Nurses station console for suitable for proposed number of Beds. (3) Nurse station indicator panel, (4) call push button station, call cancel and reset station.

The system shall operate as under:

When a patient needs nursing assistance, he/she presses the call push button on the bed sides or uses the cord. A lamp flashing signal with a soft musical audible signal (of short duration) shall be on to indicate the number of room/bed at the nurse’s station. Simultaneously the dome light and the light on the call push button station shall also start flashing. When the nurse acknowledge the call at the nurses station by pressing push button, light stops flashing and the patient is assured that his/her call has been acknowledged and shall be attended shortly. The nurse shall restore the system to its normal working for the particular bed by pushing the cancellation button on call push button station after attending the patient and all the lights shall be OFF.

15.02 POWER SUPPLY

The power supply unit is suitable to work on 220 volts 50Hz AC mains or 24 volt D.C. as the case maybe. This shall be housed in a sheet steel enclosure duly painted. The power supply unit shall comprise of a step down transformer of suitable VA rating with adequate battery back up. All necessary power wiring shall form part of the package.

15.03 NURSES STATION CONSOLE

This shall be an appropriately housed enclosure showing display. Different colour lights for normal and emergency calls shall be registered. When more than one call is registered, the information shall be scrolled. Emergency call shall be given priority and be indicated in red display. This indicator panel be available on visual display terminal at the nurses station with audio alarm and call acknowledgment terminal.

15.04 NURSES STATION INDICATOR PANEL

This shall be in the form of an electronic messaging centre and shall feature three display colours.

RED
AMBER
GREEN

The different colours shall be accompanied by three distinct electronic tones. The displays shall be mounted ceiling or wall and shall be in double sided configurations to suit the site requirement and as per directions of Engineer-in-Charge. Calls in the system to be sorted by priority and calls of the same priority shall be scrolled on the display.
15.05 CALL PUSH BUTTON STATION

It shall consist of an indicating lamp with cancel action push button fitted on the acrylic sheet with M.S.Box (if required) and fitted slightly above the bed at suitable place. It also consists of one number bell push with provision of pull cord of required length.

15.06 CONDUITING & WIRING

Conduiting & wiring for nurses call system shall be carried out in M.S conduit with desired pair annealed tinned copper conductor PVC insulated PVC sheathed telephone cable. Desired pair cable shall be provided from call push button station via dome light up to Nurses console.

15.08 TESTING AND COMMISSIONING

After the Nurses Call System as refined above is finally installed the contractor shall give detailed testing and commissioning demonstration and maintained the system for complete duration of defects liability period.
### 16.00 LIST OF APPROVED MANUFACTURERS:

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>L.T. Cables</td>
<td>Universal/ICC/NICCO/INCAB/Rallison Cables</td>
</tr>
<tr>
<td></td>
<td></td>
<td>National/ Skytone/ Cab Com India/ Ploycab</td>
</tr>
<tr>
<td>2.</td>
<td>PVC insulated Wires/ Telephone wires &amp; cables</td>
<td>Finolex/Havells/Ploycab/Rallison/National/ Cab Com/ Skytone/ L&amp;T/ Batra</td>
</tr>
<tr>
<td></td>
<td>Co-axial cables</td>
<td>Henlay/</td>
</tr>
<tr>
<td>3.</td>
<td>Additional Make for telephone cable</td>
<td>Delton Cables</td>
</tr>
<tr>
<td>4.</td>
<td>Telephone Tag Blocks</td>
<td>Krone Type</td>
</tr>
<tr>
<td>5.</td>
<td>Modular Range of Switches, sockets etc</td>
<td>Anchor- Roma/ North West/ Toyama-Wallart/MK-wraparound/MDS-Mosaic/Havell’s/ Crab tree</td>
</tr>
<tr>
<td>6.</td>
<td>Industrial Sockets &amp; Plugs.</td>
<td>Siemens/Schneider/Crompton/MDS/BCH/Havell’s</td>
</tr>
<tr>
<td>7.</td>
<td>M.S. Conduit</td>
<td>BEC/AKG/Steel craft</td>
</tr>
<tr>
<td>8.</td>
<td>Light fixtures. (Flourescent, CFL, HPMV etc)</td>
<td>Philips/GE/Crompton</td>
</tr>
<tr>
<td></td>
<td>Light Fixture (Down, Fancy &amp; other fixtures)</td>
<td>Philips/Decon/Ankur/May Fair</td>
</tr>
<tr>
<td>10.</td>
<td>MV Panels</td>
<td>Adlee Systems Pvt Ltd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advance Panels &amp; Switchgears (P) Ltd</td>
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<tr>
<td></td>
<td></td>
<td>Tricolite</td>
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<tr>
<td></td>
<td></td>
<td>Jakson Engineers Ltd.</td>
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<td></td>
<td>Zeta Industrial Corporation Pvt Ltd</td>
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<td></td>
<td></td>
<td>Venus Controls &amp; Switchgear Pvt Ltd</td>
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<td></td>
<td></td>
<td>Neptune systems Pvt Ltd</td>
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<tr>
<td></td>
<td></td>
<td>Risha Control Engineers Pvt Ltd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPC Electrotech Pvt Ltd</td>
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<tr>
<td></td>
<td></td>
<td>Nitya Electro Controls</td>
</tr>
<tr>
<td>11.</td>
<td>Air Circuit Breakers</td>
<td>L&amp;T/Siemens/ABB/Schneider</td>
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</tr>
<tr>
<td>12.</td>
<td>MCCB</td>
<td>- L&amp;T/ Siemens/ ABB/ Schneider</td>
</tr>
<tr>
<td>13.</td>
<td>MCB-DB’s, MCB, ELCB RCCB/ MCB-Isolator etc.</td>
<td>- L&amp;T/ Siemens/ MDS- Legrand/ Schneider/ ABB</td>
</tr>
<tr>
<td>14.</td>
<td>SDFU</td>
<td>- L&amp;T/ Siemens/ Schneider/ ABB</td>
</tr>
<tr>
<td>15.</td>
<td>Power Contactors</td>
<td>- L&amp;T/ Siemens/ Schneider/ ABB</td>
</tr>
<tr>
<td>16.</td>
<td>FDA System</td>
<td>- Honeywell/ Edwards/ L&amp;T / Siemens</td>
</tr>
<tr>
<td>17.</td>
<td>Cable Joint kit</td>
<td>- Raychem/ 3M/ Cabseal</td>
</tr>
</tbody>
</table>
TECHNICAL SPECIFICATIONS

HVAC
DETAILED SPECIFICATIONS
SYSTEM DESIGN DATA

1.0 GENERAL

The system design, basis of design, estimated requirements and other relevant data are outlined in this section.

2.0 LOCATION

The proposed ‘CCU Renovation at AIIMS, New Delhi’.

3.0 SCOPE OF WORK

3.1 The work proposed under this tender includes supply, installation, testing & commissioning of air-conditioning systems for the CCU as detailed in the technical specifications and bill of quantities.

4.0 BASIS OF DESIGN

4.1 Assumptions

Following assumptions have been made for calculation of air-conditioning cooling load:

a) Fresh air : As per attached Table
b) Window glazing : Single pane glass
c) Lighting load : 2W/ Sq. ft
d) Occupancy : As per attached table
e) Equipment load : As per attached Table
f) Roof Insulation The exposed roof of air-conditioned areas shall be insulated with 50 mm thick expanded polystyrene or equivalent insulation by other agencies.
g) Electrical power supply: 415v/3ph/50Hz, AC power supply
h) Humidity control : 1) Considered in OT’s, ICU’s, recovery and other important areas.
4.2 **OUTSIDE AMBIENT CONDITIONS**

<table>
<thead>
<tr>
<th>Season</th>
<th>Dry Bulb temp</th>
<th>Wet Bulb temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMMER:</td>
<td>110 deg F DB</td>
<td>75 deg F WB</td>
</tr>
<tr>
<td>MONSOON:</td>
<td>95 deg F DB</td>
<td>83 deg F WB</td>
</tr>
<tr>
<td>WINTER:</td>
<td>45 deg F DB</td>
<td>41 deg F WB</td>
</tr>
</tbody>
</table>

4.3 **INSIDE CONDITIONS**

- **SUMMER**
  1) 72 deg F DB
  And & 55 +/- 5% RH
- **MONSOON**
  (ICU’s & critical areas)
  2) 75 deg F DB
  & RH not exceeding 60%
  (For other areas)
- **WINTER**
  68 deg F DB

5.0 **ESTIMATED LOAD**

On the basis of data given above, the estimated load for the air conditioning system is summarised in Table-I:-

<table>
<thead>
<tr>
<th>Space</th>
<th>Area (ft²)</th>
<th>Occupancy (Nos.)</th>
<th>Equipment Load (KW)</th>
<th>Fresh Air (CFM)</th>
<th>Summer (TR)</th>
<th>Monsoon (TR)</th>
<th>Winter (KW)</th>
<th>CFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCU</td>
<td>6072</td>
<td>75</td>
<td>17</td>
<td>1490</td>
<td>45.53</td>
<td>49.34</td>
<td>-25.12</td>
<td>19814</td>
</tr>
</tbody>
</table>

(Tenderers shall work out the heat loads on their own and satisfy themselves that the plant specified in this tender shall be able to maintain the inside conditions as per specification)

To cater to the above load, the air conditioning system proposed is as follows:

6.0 **System Design**

The total peak load comes out to 50 TR. After applying a diversity of 0.9 (since external and internal loads do not peak at the same time), the load works out to be 45 TR. For this requirement chilled/hot water shall be provided by the client.
System Design Description

6.4 It is proposed to provide a central air conditioning system to maintain the specified inside design conditions during summer, monsoon and winter for the proposed building.

6.4 The plant shall be located in the plant room and shall be water cooled.

6.4 Chilled water produced shall be pumped to various air handling units. Chilled water shall be pumped through insulated chilled water pipes installed in ceiling spaces and in vertical risers installed in pipe shafts. At each air handling units balancing valves are provided for balancing.

6.4 Electric type hot water generators shall be used for winter heating. Hot water generators shall be used for monsoon reheating for CCU’s and all important areas in conjunction with hot water pumps. This is after taking partial credit for the high equipment load inside and the diversity applicable.

6.5 The main electrical panel, distribution board & chilled water/ condenser water pumps will be located in the plant room.

6.6 All the AHU’s on respective floors shall be connected with chilled water pipes coming from the water chilling machines.

6.7 For fire safety motorised fire dampers with electrical actuators interlocked with the air blowers shall be provided in supply and return air paths. All materials used for insulation shall be fire proof type. The air handling units motors shall also be interlocked with the central fire alarm system such that in case of detection of smoke or fire by the fire alarm system, the air handling units shall automatically shut off.

6.8 A central control console shall be provided with indication lamps and push buttons for remote start/stop of the equipment.

6.9 The main areas of the hospital complex are as under:

A. CCUs

The system adopted for the air-conditioning of CCU shall be as under:

- CCU shall have independent air handling unit to prevent cross contamination.

- CCU shall be designed for re circulatory system with 2 air changes fresh air.

- The laminar flow air distribution system shall be followed. Air shall be supplied from ceiling level to flow unidirectional up to the beds. The return air shall be collected from corners of the room to prevent the contamination from recirculation in space.

- All ducting for CCU shall be of GI.
- Both supply and return air shall be ducted.
- Two level filtration shall be adopted with pre-filters and fine filters of following filtration efficiency:

  Fine Filters   99% down to 5 µ
  Pre Filters   90% down to 10 µ

All these filters shall be with aluminium frame to prevent formation of bacterial colonies. Epoxy resin shall be used to seal filter media with the framework.

ICU shall be maintained at positive pressure by supplying about 10% more air than return air to prevent any contamination from entering ICU space.

**PRE/POST OPERATIVE AREAS/ STERILE CORRIDOR**

- AHUs for pre post operative areas shall be provided with pre and fine filters.

7. **GENERAL DESIGN GUIDELINES**

Design parameters for selection of air handling units and its components shall be:

- Maximum face velocity across prefilters 150 M/MIN
- Maximum face velocity across Microvee 100 M/MIN
- Maximum face velocity across cooling coil 150 M/MIN
- Maximum face velocity across Heating coil 200 M/MIN
- Maximum fan outlet velocity 550 M/MIN
- Maximum fan motor speed 1450 RPM

CHW piping shall be sized for following design parameters

- Maximum flow velocity 2.5 M/SEC
- Design parameters for duct design shall be
  - Maximum flow velocity 450 M/MIN
  - Maximum friction 1 CM WG/100M
  - Maximum velocity at supply air outlet 150 M/MIN
8.0 Items to be provided by other Agencies to AC contractor:

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

8.2 Construction of AC plant rooms, AHU rooms etc.

8.3 Main 3 ph, 415 v, 50 hz, A.C. supply power supply up to main Electrical Distribution Panel in A/C plant room.

8.4 Soft filtered water supply up to each cooling tower and expansion tank etc.

8.5 Make up water tanks for soft water.

8.6 Drain trap in plant room and AHU rooms.

8.7 Any kind of false ceiling, boxing etc and insulation of boxing in NON Ac areas.

8.8 Making frames for fixing grilles & diffusers in false ceiling, boxing or in walls.

9.0 Drawings:

The drawings forming part of these specifications provide a feasible scheme for locating the equipment. The contractor may re-arrange the equipment for improving the layout and meeting the site conditions. All such changes shall however be subject to the architect’s approval. These drawings are not meant to be working drawings which shall be prepared by the contractor as required.

10.0 Test Data:

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

11.0 Technical Data:

The contractor shall furnish complete technical data, on the equipment offered as required under the heading 'Technical data'. In this specification every effort has been taken to put forth only general specifications of various equipments/ material. If inadvertently, any of the specification drawn happens to match with the specifications of any one particular firm’s product only, in respect of critical parameters, than it will not automatically mean that this particular firm’s offer is only technically suitable. In general, the specifications offered by other firms will be assessed in their own entirety to ascertain whether or not the broad functions in general expected of the requirements are available with reasonable tolerance on the desired requirements of the client and accordingly the offers would be considered based on prudent assessment and sole discretion of the Engineer.

12.0 Performance Guarantee:

12.1 The contractor shall guarantee that the air-conditioning plant and system shall maintain the desired inside temperature within +/- 2 % tolerance.
12.2 The contractor shall guarantee that the capacity of various components as well as the whole system shall not be less than specified.

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

13.0 Foreign Exchange

The contractor shall make his own arrangements to procure the necessary, specified equipments, controls for which no foreign exchange shall be made available.
AIR HANDLING UNITS

1. General:

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

2. Air Handling Units: (Double skin type)

The air handling units shall be double skin fully enclosed construction draw-thru type and shall include fan section, coil section. Filter section with filters, coil section etc.

2.1 Fan Section

Fan shall be centrifugal with backward inclined blades. Fan casing shall be made of galvanised steel sheet. Fan wheels shall be made of galvanised steel. Fan shaft shall be ground C40 carbon steel and supported in pre-greased ball bearings operating less than 75% of first critical speed. Fan wheels and pulleys shall be individually tested and precision balanced dynamically. The fan shall be selected for a fan speed not exceeding 1000 rpm for fan dia of more than 350 mm and fan outlet velocity shall not exceed 1800 fpm. The fan outlet shall be connected with casing with the help of fire retardant canvas.

2.2 Coil Section

The cooling coil shall be of seamless copper tubes, not less than 0.44 mm thick and 12 mm dia with aluminium fins firmly bonded to copper tubes assembled in zinc coated steel frame. Face and surface areas shall be such as to ensure rated capacity from each unit and such that the air velocity across the coil shall not exceed 150 MPM. The coil shall be pitched in the unit casing for proper drainage. 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 hydraulic mechanical expansion of the tubes. Fin spacing shall not exceed 5 fins per cm. The coiling coil assembly shall be on aluminium rails and nylon rollers for easy withdrawal from either side.

The coils shall be tested against leaks at 21 kg/sq.cm air pressure under water. This pressure shall be maintained for a period of at least 2 hours. No drop should be observed indicating any leaks.

The water headers shall be of heavy class 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).
2.3 **Filter**

Each unit shall be provided with a factory assembled filter sections containing washable synthetic type air filters. Filter framework shall be duly sealed and constructed from aluminium alloy. The media shall be supported with hdp mesh on one side and aluminium frame mesh on other side. Filters face velocity shall not exceed 500 fpm. Filters shall fit so as to prevent by pass. Holding frames shall be provided for installing a number of filters cells in bank. These cells shall be held within the frames by sliding the cells between guiding channels.

2.4 **Housing/ Casing**

The housing /casing of the air handling unit shall be of double skin panels, sandwiched type with polyurethane foam insulation of 25 mm thickness (over all). The housing shall be so made that it can be delivered at site in the total/semi knock down conditions depending upon the location. The frame work shall be of extruded aluminium hollow section duly powder coat painted/anodized. All the frame shall be assembled using mechanical joints to make a sturdy & strong frame work for various sections.

The outer sheet of panel shall be of made of galvanised pre-plasticised sheet/powder coated CRC sheet of 0.80 mm thickness, and inner sheet of 0.63 mm thick GSS. These panels shall be bolted from inside on the frame with soft rubber gasket in between to make the joints air tight.

Frame work for each section shall be bolted together with soft rubber gasket in between to make the joints air tight, suitable doors with chrome plated hinges and latches shall be provided for access to various panels for maintenance. The entire housing shall be mounted on steel channel frame work.

Units shall have hinged, quick operating access door in the fan section etc. The access doors shall also be double skin type similar to the casing.

Drain pan shall be constructed of 18 gauge aluminium sheet with necessary slope to facilitate fast removal of condensate. It shall be isolated from the bottom floor panels through 12 mm thick kinny foam insulation or equivalent.

2.5 **Fan Motor and Starter**

The totally enclosed fan cooled squirrel cage fan motor shall have a minimum rating as given under "Schedule of Equipments and the starter rating shall match the motor rating and both control panel shall conform to the specifications under "Motors and Switchgears". Drive to fan shall be provided through belt-drive
arrangement. Belts shall be of oil resistant type.

2.6 Controls

Each air handling unit shall be provided with a modulating valve motor and modulating thermostat, conforming to specifications under "Controls".

2.7 Fresh Air Controls

An adjustable manual damper of aluminium sheet along with bird screen air inlet louvers shall be provided for fresh air entry.

2.8 Accessories

Each air handling unit shall be complete with: -

Stem type thermometer at coil inlet and outlet. (Included in AHU’s)

Pressure gauges with cocks at inlet and outlet of the coil. (Included in AHU’s)

Balancing valve at coil outlet and butterfly valves at coil inlet & outlet. (priced separately)

Drain line from unit to drain trap. (priced separately)

Flexible connection between fan outlet and duct.

Vibration isolators of high efficiency.

2.9 Testing

Air handling units shall be tested to measure air quantity and coil performance by measuring temperature difference and then calculating capacity by using the above measurements.

2.10 Limitations

The air velocity across the cooling coil shall not exceed 500 fpm.

The fan outlet velocity shall not exceed 1800 fpm

The air velocity across the filters shall not exceed 500 fpm.
3. **Air Handling Units: (Ductable/Unitary Type)**

The unitary type air handling unit shall be compact, Double Skin, self contained and shall consist of blower assembly, cooling coil, air filter, drive and motor all enclosed in an attractive sheet steel housing.

The blower assembly shall consist of forward curved, double inlet, double width impeller, blower housing of mild steel with smooth air inlet volutes, self aligning bearing block and supports for mounting the bearing on the blower housing.

The cooling or heating coil shall be of seamless copper tubes not less than 12 mm o.d. and 0.44 mm thickness. The coil shall have continuous aluminium plate fins. The fins shall be spaced by collars forming a integral part of the fins. The tube shall be staggered in the direction of air flow. The coil circuit should be sized for adequate water velocity but not exceeding 1.8 m/s (6 F.P.S.). The fins shall be uniformly bonded to the tubes by hydraulic expansion of the tubes. The water headers shall be of copper pipers to connect all the tubes. The header shall be complete with water in/out connection vent plug on top and drain at the bottom.

The air filter shall be of metallic viscous type with a minimum depth of 50 mm. The air filter shall consist of 24 gauge wire mesh in at least five layers with outer casing of 20 ga m.s. sheet formed into channels. Both side of filter shall have expanded metal screens.

The fan motor shall be squirrel cage totally enclosed fan cooled type with suitable starter conforming to specification under "Motor and Switchgears".

The fan drive shall consist of grooved motor pulley, blower pulley and v belt, along with adjustable mounting for the motor.

All the above components shall be housed in a G.I. sheet steel housing made of 1.2 mm (20 ga) sheets, suitably reinforced to provide rigidity. Access panel to coil and fan areas shall be hinged for ease of maintenance.

3.1 **Controls**

Each unitary unit shall be provided with a heating/cooling snap acting thermostat and a 3 way water solenoid valve, conforming to specifications (wherever given in schedule of prices).

3.2 **Fresh Air Control**

An adjustable manual damper of aluminium sheet along with a bird screen on the outside wall shall be fixed in the opening provided for this purpose in the air...
handling unit room.

3.3 **Accessories**

Each air handling unit shall be complete with

One stem type thermometer for coil inlet and outlets, with tubing and gauge cocks. (Included in AHU’s)

One pressure gauge with cock for inlets and outlets of the coil, with tubing and gauge cocks. (Included in AHU’s)

Balancing valve at coil outlet and butterfly valves at coil inlet & outlet (priced separately)

Drain line from unit to drain trap (priced separately)

Flexible connection between fan outlet and duct.

Vibration isolators of atleast high efficiency.

3.4 **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 by using the above measurements.

3.5 **Limitations:**

The air velocity across the cooling coil shall not exceed 500 FPM.
The fan outlet velocity shall not exceed 1800 FPM.
The air velocity across the filters shall not exceed 500 fpm.
FILTERS

1.0 General

This section covers the general requirements for special type of filters to be installed in air moving equipment or air ducts.

2.0 Prefilters (fabric type)

Synthetic fibre Pre-filters shall be in light weight aluminium framed with non woven synthetic fibre replaceable media. The filter shall have an efficiency of 90 percent down to 10 microns particles size when tested as per B.S.2831 standards. The filter frame shall be of aluminium and shall be suitable for mounting in Air handling units or ducts as required at site. The velocity across the face of the filter shall not exceed 500 FPM and the pressure drop across the filter shall not exceed 4mm. The filters shall be suitable for operation under 100 percent relative humidity and 120 deg.C temperature conditions.

3.0 Microvee filters (fine filters)

Microvee filters shall be of dry type. Filters media shall be made from washable nonwoven synthetic fibre replaceable media reinforced with HDPE cloth & Aluminum mesh, specially treated with antifungal and bactericidal agents to prevent growth of micro organisms. The filter media shall be treated to permit washing with water several times before discharged. The media shall be properly supported and spaced so that air flow through the filter is uniform. The filter shall be housed in aluminium frame work. Filters shall be designed to remove particle down to 5 micron size and with efficiently of 99 percent tested as per BS 2831 using Test Dust II. The filters shall be installed in the air handling units after the chilled water coils. They shall be capable of being replaced or removed for servicing without the use of special tools.

4.0 High Efficiency Particulate Absolute (HEPA) Filters

HEPA filters shall be made in extended surface configuration of deep space folds of sub micron glass fibers. The filter media shall be housed in an aluminium sheet frame provided with double turned flanges and closed cell neoprene gasket. The filter media shall not absorb moisture, stretch, swell or undergo chemical change with moisture. The filter shall be resistant to fungus and bacterial growth. Filters shall be free from pin holes and other leaks.

The housing shall be designed to install the HEPA filters in the terminal locations in the false ceiling or in the duct plenum so that it is removed easily without risking the infiltration of dust whatsoever. The arrangement for filters shall be strictly in accordance with the manufacturers recommendations and shall be approved by the engineer prior to fabrication and installation. The filters shall be protected with
aluminium slotted protective grille from the bottom in case of installation of filters in false ceiling air terminals. All MS parts shall be derusted and shall be epoxy painted. The aluminium grilles shall be made from 1.6 mm aluminium sheets with minimum clear area of 60 percent. The grilles shall be anodised stove enamel painted as approved by the Engineer.
HEATING SYSTEM

1. **General:**

   The electric heating system and hot water heating system shall comply with the specifications as laid down.

**Hot Water Generator**

1.1 Hot water generator shall be the electric water heater consisting of a vertical tubular shell, closed to both the ends with bolted end covers. The shell shall be fabricated from M.S. sheet and joints shall be welded. It shall be mounted on a rigid chain iron tripod stand. A drain shall be provided at the lower and outlet and inlet connections with flanges shall be on upper end lower side. Connections for safety wall and controls shall be provided on the top. A required no. of sockets for heater elements shall be provided. The construction shall conform to the Indian standards/international standards. It shall be designed for a working pressure of 21 Kg/cm² and tested accordingly.

1.2 Sheathed tabular electric resistance type heater elements shall be used and connected for equal loading.

1.3 The heater shall be connected in a manner to provide capacity control as under:

   - Upto 100 KW - 2 Steps
   - 101 KW to 300 KW - 3 Steps
   - 301 KW to 600 KW - 4 Steps

   Upto 2 sets, a remote bulb 2 step thermostats shall be used in conjunction with contactors of same size and fire 3 or more steps. A modulating type thermostat, modulation motor and step controller shall be used.

1.4 The electric water heater shall be equipped with a safety thermostat to cut off the power in case the temperature of water exceeds the normal limits. A safety valve shall be provided on the top of the heater and the outlet of the same be piped out of the plant room. The drain shall be connected to the nearest drain point. Stem type thermometer & pressure gauge at inlet & outlet of the boiler shall be provided.

1.5 The electric heater shall be insulated with 50 mm thick resin bonded fibre glass or equivalent material. The thermal conductivity of the insulating material shall not exceed 0.03 Kcal. per m/hr. at 10 deg. C mean temperature and density shall not be less than 24 Kg/Cum for fibre glass and 48 Kg/Cum for mineral wool. The insulation shall be cladded with 1 mm thick aluminium sheet.

1.6 The electric hot water heater shall be installed as per the manufacturers instruction and as shown on drawings.
PAN TYPE HUMIDIFIER

Type:
The pan type humidifier shall be closed type and connected to the supply air duct for introduction of steam when required.

Construction

The body of the humidifier shall be fabricated out of stainless steel sheet at least 2mm thick with all joints welded with stainless steel welding rods and all edges rounded off. The pan shall be made completely air tight and leakproof. On top of the pan an openable cover shall be provided for maintenance of internal components.

The humidifier shall be externally insulated with Resin bonded fibreglass of density not less than 32 Kg/cub.m and then cladded with 0.8 mm thick aluminium sheet.

The humidifier shall have two chambers with two banks of heaters. One bank of heaters shall always remain ON when the AHU is in operation to maintain the temperature of water between 60 - 70 deg. C and the other bank should come on when there is signal from the humdistat for humidification.

The electric heaters shall be submersible type made out of incloy sheeth and brass/bronze flanges. The heaters shall be of suitable rating to produce instant steam when required.

Electrical panel (For Hot Water Generator/Boiler and Pan type Humidifier)

The electrical panel box shall be made of 16 GCRC sheet and painted with heat and water resistant paint. All switchgears and internal components of the panel shall be of L&T/seimens/EE make only.

Controls and accessories:
The humidifier shall be complete with following controls and accessories:

a. Water proof light in the tank
b. Water level indicator
c. Low water level cutoff switch
d. Float valve with bronze ball
e. Make up , quick fill and drain connections
f. Safety thermostats.
g. Fault indication lamp.
CONTROLS

1. **SCOPE**

This chapter covers the requirements of equipment safety controls, refrigerant flow controls and system controls.

2.0 **EQUIPMENT SAFETY CONTROLS**

Compressor:

Compressor shall be provided with the following safety controls: -

i) High discharge pressure (HP) safety (cut-out) to stop the compressor automatically, in case discharge pressure exceeds a pre-set safe value. This safety shall operate when discharge head pressure exceeds the set point. Only manual resetting shall be provided for this safety.

ii) Low suction pressure (LP) safety (cut-out) to stop the compressor automatically, in case suction pressure falls below a pre-set value. This safety shall operate when the suction pressure falls below the set point. Automatic resetting shall be provided for this safety, with adjustable cut-in and cut-out pressures. This safety shall be used for pumping down the system for shutting off the refrigeration plant.

iii) Oil pressure (O.P) safety (cut-outs) to stop the compressor, in case lubricating oil pressure falls below a safe set value. A time delay mechanism shall also be provided, so as to permit running of the compressor up to a maximum period of 90 seconds, with the oil pressure differential below the set value and allow it to continue normal operation if the pressure differential builds up to the set value within that time, or otherwise shut-down the compressor. Only manual resetting shall be provided for this safety.

iv) High bearing temperature cut-out (for centrifugal compressor only). This shall be provided with a manual reset only.

v) High lubricating oil temperature cut-out (for centrifugal compressor only). This shall be provided with a manual reset only.

vi) Time delay mechanism on the starting gear to limit short cycling regardless of mal-functioning of controls.

The cut-outs (i) to (v) mentioned above shall operate when the respective controlled variable crosses the set point to trip the compressor. Audio visual alarm shall be provided to indicate such operations. A manual reset shall be
provided for them. Safeties mentioned above shall operate when the respective controlled variable crosses the set point to trip the compressor. Audio visual alarm shall also be provided to indicate such operations.

Condenser

The safety control for a condenser shall comprise a safety pressure relief valve on the shell. This shall operate to relieve the pressure at the set point without prior leakage. For small condensers, a fusible plug may be provided to melt at a predetermined temperature.

Chiller

I) An antifreeze shall be provided with water chiller, set at a few degrees above the freezing point. This shall operate, when the temperature of water in the chiller falls below the set point to trip the compressor motor. The reset provided for the safety shall be manual.

II) Flooded type of chiller in addition, shall be provided with safety pressure relief valve.

Refrigeration Plant

i) In addition to the safety controls as above for the individual components of a refrigeration plant, the following safety controls shall also be provided for the plant.

a) Compressor motor over current cut-out.
b) Condenser water flow switch.
c) Chilled water flow switch.
d) Condenser air flow switch in the condenser fan discharge (in case of air-cooled condensers).
e) Air flow switch in the evaporator fan discharge in case of direct expansion coils

ii) The above controls, on operation, shall trip the compressor motor, and these shall be provided with manual reset arrangement.

iii) The compressor motor shall also be interlocked electrically with,

a) condenser water pump in case of water cooled condenser, and condenser fan with air cooled condensers,

b) Chilled water pumps in case of chilled water system and evaporator fan in case of direct expansion system, and
c) antifreeze thermostat in case of chillers.

iv) Indicating lamps shall also be provided on the control panel for indicating operation of the safeties and interlocks.

3.0 REFRIGERANT FLOW CONTROLS

A refrigeration plant shall be provided with controls, necessary for starting, stopping and modulating the flow of refrigerant in the plant so as to satisfy the load requirements. These comprise solenoid valve, thermostatic expansion valve, float valve, compressor capacity controls etc. and other special controls if specified in a particular work.

Solenoid Valve

a) For reciprocating, scroll and screw type compressors liquid line solenoid valve shall be provided in the liquid line of the system, ahead of the expansion valve, to allow or to stop the flow of liquid refrigerant to an evaporator, or a section of sectionalized evaporator. This shall be operated by snap-acting thermostat and it shall also be provided with a test switch to enable manual energizing.

b) Discharge gas valves shall be provided in the following applications as required: -

i) Hot gas defrosting: normally this solenoid valve shall remain closed, but it shall open up to feed the evaporator with hot gas for defrosting when required, especially in cold storage applications.

ii) Compressor capacity control for reciprocating compressor and for cylinder unloading during starting.

c) Solenoid valves shall be direct acting in smaller sizes and pilot operated for larger sizes, as required. The size of the valves shall be determined by the desired flow rate of refrigerant through them and the pressure drop across the same (and not by the size of the refrigerant line).

Thermostatic Expansion Valve

Thermostatic expansion valve shall be provided in DX type refrigeration plant to modulate the flow rate of liquid refrigerant entering the evaporator in response to the extent of superheat of refrigerant gas leaving the evaporator, so that only a metered flow is ensured matching the load.

The number of expansion valve shall be such that the specified accuracy of
temperature control of the system can be achieved and that no valve is expected to operate below 35% of its rated capacity. The sizes shall be selected suitably so as to avoid hunting. Adjustable super heat control and external equaliser port shall be provided for each valve. Each expansion valve shall be easily removable for cleaning and adjusting.

**Float Valve**

Float valve shall be provided in refrigeration plant with flooded type chiller for maintaining the liquid level in chiller under all conditions of load at a rate commensurate with the rate of vaporisation. This can be provided either on low pressure side or on high pressure side. When provided as low side float valve, this shall be located as a part of the chiller or accumulator.

### 4.0 SYSTEM CONTROLS

i) The requirements for maintaining the inside design conditions as specified in the tender specifications for the work shall be met by appropriate system controls and control elements. The system shall satisfy the requirements of both full load and partial load conditions. Details of complete control elements shall be indicated by the tenderer in the tender.

ii) For cooling applications in plants other than package type AC (PTAC) units, control shall be effected by 3 way diverting valve in chilled water coil. For heating using hot water coils, flow control through them shall also be achieved by using 3 way valves.

In the case of PTAC type AC units, the control of the units is affected through snap acting room thermostat.

iii) The size of 3 way diverting valves shall be selected so as to match the coil wherein the flow is to be regulated. The make and size shall be indicated in the Technical particulars with the tender.

iv) Operation of the modulating motor of 3 way diverting valve shall be controlled by proportional type thermostat.

v) One snap acting humidistat shall be provided for each humidifier.

vi) Where strip heaters are specified, maximum size of each heater bank shall not exceed 9 KW, distributed in three phases of 3 KW per phase.

vii) Every bank of strip heaters shall be controlled by a snap acting thermostat in case of temperature control requirement and by a snap acting humidistat for reheat control to maintain the specified RH condition.
viii) Where more than one bank of heaters is required to be provided for one AHU, thermostat shall be provided in each bank shall suitable for operation in stages.

ix) A safety thermostat (safety stat) shall be provided as high limit safety for each bank of heaters.

x) The heater banks intended for reheating during monsoon shall form part of heaters required for winter heating (where winter heating is specified). Necessary change-over switch shall be provided as part of the system wiring to change their control by thermostats or humidistats as required.

5.0 OPERATIONAL CONTROLS AND INTERLOCKS

i) The operation of refrigeration plant shall be either manual or automatic, as specified. The plant shall be started by an ON/OFF switch.

ii) The automatic operation shall be effected through the monitoring of return chilled water temperature, or the room conditions, as the case may be. In multi unit installations, one unit shall be arranged to be loaded fully before the next unit is switched on automatically. A similar operation system shall be followed in shutting off of the unit. Change over from one operating unit to another shall be possible through the status switch of the plant to be shut down by change to manual position and thus overriding its anti-cycle timer. It should be possible to introduce the changed unit by running it to speed and changing over the status switch to "auto" position.

iii) Pump down shut down shall be provided through low pressure (LP) safety irrespective of the status switch position, auto/manual.

iv) It should be possible to start the compressor motor only after the cooling tower fan motor (where provided), chilled water (where provided) and condenser water pumps are operated.

v) The compressor motor shall be able to be started or run, only after all the safeties as per para 12.2 are satisfied.

vi) The blower motor shall be interlocked with strip heaters (where provided) such that power supply to strip heaters will become ON, only after the blower has been started and run to full (designed) speed.

vii) Where only the blower motor and not heaters is connected to standby generating set in any particular application, a timer shall be provided, such that the heaters may get energised, only after a period of time, after the blower is run.
viii) In the event of signal from high limit safety of heaters the power supply to the blower motor and the heater bank shall automatically and instantly be switched off.

ix) The power supply to AHU shall be cut off on receipt of a signal from the Fire Alarm System.

6.0 REQUIREMENTS OF CONTROL ELEMENTS

The system control elements comprise controlling elements such as thermostats, humidistats, three way valves, heaters, humidifiers, dehumidifier etc as required for individual applications.

6.1 Thermostats

Thermostats shall be electric fixed differential type as indicated below, with sensing element located in the return air stream. All thermostats shall be supplied with the standard mounting boxes as recommended by the manufacturer. The profile, mounting arrangement and exact location of the thermostat shall be such as to suit the site.

I) Proportional control thermostats shall be provided for actuating the three way modulating valve at each air handling unit. Thermostat shall provide manual switching (heat-off-cool-in heating-cooling system).

II) Snap-acting fixed differential type thermostat for actuating the three-way diverting valve at each fan coil unit.

Thermostat shall have temperature adjustments WARM-NORMAL-COOL settings and fan switch. Switching off must break fan circuit.

III) Snap-acting fixed differential heating thermostat for electric winter heating and reheat applications for putting on/off power supply to electric heating or reheat coils in air handling units.

IV) Safety thermostat shall be provided for electric winter heating and reheat application for cutting off power supply to strip heaters in case air flow across strip heater is not established.

V) Air-stat shall be provided within air handling unit containing electric heating or reheat coils to prevent heaters from energizing unless the air flow is established.
6.2 Humidistats

Humidistat shall be provided with air handling unit for areas, which require humidity control. One humidistat shall activate the reheat coils in case the space humidity rises beyond the preset limit. Another humidistat shall energize the humidifier when the humidity falls below the preset limit. These humidistats shall also de-energize these devices when the desired humidity is reached.

Humidistats shall be snap-acting type having humidifier/dehumidifier control from 20-80 percent relative humidity, with differential of 5 percent. Humidistat shall have nylon element with three bobbins, and removable knob to prevent tempering of set point.

6.3 Three-way modulating valves (for AHUs)

Required size of these shall be provided in chilled/hot water lines as diverting valves at each air-handling unit and shall be actuated by a space thermostat. Space conditions shall be maintained by continuous proportional modulation of the chilled/hot water through the coil. The valve shall revert to fully bypass position when fan is shut off. Maximum pressure drop across valve shall not exceed 0.85 kg/sq.cm. Where VSD (to control chilled water flow) is provided, the AHUs shall be provided with 2 way diverting valve.

6.4 Three-way diverting valves for FCUs

Required size this shall be provided as 2 position diverting valves in chilled/hot water lines at each fan coil unit and shall be actuated by a space thermostat. Space conditions shall be maintained by allowing all of chilled/hot water to either pass through the coil or bypass the coil and mix with the chilled/hot water return. The valves shall revert to fully bypass position when fan is shut off. Pressure drop across the valve shall not exceed 0.14 kg/sq.cm. Valve shall have the facility to replace motor actuator without removing the valve body.

6.5 Pan humidifiers where provided shall be complete with necessary heater elements rated for 230 V supply. The pan shall be made of 1.6 mm thick GI sheet, with arrangements for make-up water, inlet and drain.

6.6 Strip heaters shall be of finned type construction with a surface temperature not exceeding 45 deg. C. The same shall be suitable for 230 V, AC supply. The heaters shall be adequately insulated electrically from their mountings unit/casing.
VENTILATION FANS

1.0 Codes and Standards:-

The design, materials, construction, manufacture, inspection, testing and field performance of the centrifugal fans shall comply with all currently applicable international / national codes / safety regulations. In particular the equipment shall conform to latest editions of all applicable codes and standards listed below.

AMCA-201 - Fans and systems - Application guide
AMCA-203 - Field performance measurement of fan systems
AMCA-210 -Laboratory Methods of testing Fans for Aerodynamic performance rating.
AMCA-2404 - Drive arrangements for centrifugal fans
BS:848, Part-1 - Fans for general purposes - Methods of testing performance
BS:4675, Part-1/ ISO-2372 - Mechanical vibrations in rotating and reciprocating machinery

2.0 Centrifugal Fans:-

2.1 Design Requirements:-

The design parameters for the centrifugal fans shall be as specified in Data Sheet-A (Filled up Data Sheets is enclosed in the Tender package). In the event of conflict between the requirements of this specification and Data Sheet or drawing, the later shall govern

2.2 Design and Constructional Features:-

a. General

a.i Centrifugal fans shall be DIDW / SISW in simply supported arrangement (i.e. Bearings on both the sides) construction complete with access door, squirrel cage induction motor, outlet damper, base frame, canvass connection, V belt drive set, belt guard, foundation bolts, nuts, slide rail and vibration isolators. Direction of discharge / rotation and motor position shall be as per the Good for construction shop drawings. All centrifugal ventilation fans shall be AMCA (Air Movement and Control Associates Incorporation of USA) certified for air & noise performance. Critical speed of the fan shall be minimum 125 % higher than the operating speed. Centrifugal Exhaust fans / motor and other accessories for toilet exhaust system shall be suitable for outdoor applications.

a.ii The Fans shall be AMCA Certified and performance certificate for the particular model of fans being supplied shall be submitted by Contractor.

b. Housing:-

b.i Housing shall be of welded construction, fabricated from carbon steel material with suitable reinforcement for rigidity. It shall be rigidly reinforced and supported by structural angles. Split casings shall be provided for large size fans, however neoprene packing shall be provided through split joints to make it airtight. Cut-off shall be designed to give smooth and quiet airflow from the outlet. Fan housing shall be of welded construction and provided with flanges at outlet for duct connection. Thickness of casing shall be as per manufacturer’s standard & factory practices but casing thickness shall not be less than 2.0 mm for side plate and 1.2 mm for back plates.
b.ii The distance between blade tips and cut-off shall be optimally fixed to reduce pressure pulsation. Inlet and outlet shall be flanged.

b.iii Housing shall be provided with standard clean out door with handles and neoprene gasket.

b.iv Inlet cone shall be spun to have deep smooth contour. Close tolerance shall be maintained between inlet edge and the impeller shroud. Inlet cone profile shall ensure a smooth flow of air to blades. Inlet screens shall be provided for open inlet fans. Inlet guards shall be of 18 gauge galvanized wire mesh with 5 mm sieves. Inlet guards shall allow access for lubrication as required.

c. Impeller (Rotor):-

c.i The impeller shall be backward curve or aerofoil sectioned blades of non – over loading type. The Impeller blades shall be welded to back plate/center and shroud all along the length. Shroud shall be spun to have a smooth contour. Shaft sleeves shall be furnished as required. The impeller, pulley, and shaft sleeves shall be positively secured to the shaft. The locking device shall be designed to take the full torque due to momentum of impeller when the shaft suddenly gets arrested while running at operating speed. Air passages shall be free of interference.

c.ii Maximum operating speed of the fans shall be selected to maintain the fan outlet velocity of 2000 FPM (10.15m/s) and Noise level shall not exceed 75 db(A) at 1 mt. Distance from the equipment. The impeller along with driven pulley shall be balanced statically and dynamically after assembly. Balancing shall conform to minimum G 6.3 grade (as per ISO-1940) or Superior grade.

d. Shaft:-

d.i Shaft shall be properly sized for single piece hollow or solid construction of hot rolled steel and it shall be turned, ground and polished. Fan shaft shall not pass through its first critical speed at rated speed.

d.ii Fan shaft shall be of EN8, SAE-1040, SAE-1035 or equivalent .

e. Bearings:-

Fans shall be equipped with amply sized taper roller or ball or spherical roller anti friction or self aligning pillow block type bearings with integral dust and grease seals. Bearings shall be charged with grease. The grease capacity of the bearings shall be such that the fans are suitable for continuous operation for at least 12 months before re-greasing is required. Bearings shall be selected for a life of 50,000 hours and same shall be as per IS-3824. Grease fittings shall be alemite 6mm button head type.

f. Drive Motor:-

The fan motor, suitable for the centrifugal fan drive shall be supplied by the contractor and the same shall be as per the specification. Motors shall be designed for continuous duty
operation and shall have high efficiency. Drive motor shall have minimum 20% margin over the fan limit load horse power. Motor shall be designed specially for quiet operation and motor speed shall not exceed 1440 rpm. The same shall be capable of accelerating to the rated rpm within safe stall time. The contractor shall submit the motor and fan torque characteristic curves along with other details for fan and motor in support of the selection. The fan and motor combination selected for particular required performance shall be of most efficient and shall be for quiet running characteristics and high efficiency. Fan motor selected shall be in such a way that sound level is lowest (max. 75 db) while running. The power and efficiency factor for all motors shall be submitted along with offer. Motor shall be capable of running continuously with a 5% drop in rated phase to phase voltage at 15% increase in design power. Motor of 0.75 KW and over shall be fitted with integral positive temperature coefficient thermistors selected to afford class 1 protection. Motors below 0.75 KW shall be fitted with inherent over heat protection. The Motors shall be TEFC type with IP-55 Protection & Class ‘F’ Insulation. Motors shall be designed for 415 V + 10% & 50 HZ + 3%.

g. Drives:-

Fans may be direct or belt driven. In case of belt driven fans, there shall be a minimum number of two belts per drive. All belt driven fans shall be equipped with fully enclosed belt guards with speed measurement openings and shall be easily removable. Belts shall be of oil resistant type. Belt guards shall not impede the airflow to the fan inlet. All belts shall be selected based on a service factor of 1.5 as applied to the drive motor KW rating. Should one belt fail the remaining belt(s) should be capable of carrying the full load. All belts shall be sized for 150% rated horsepower. The minimum number of belts to be provided will be as follows:

<table>
<thead>
<tr>
<th>BHP</th>
<th>NO. OF BELTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHP &lt; 5</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>BHP &gt;= 5 But &lt; =10</td>
<td>3 Nos.</td>
</tr>
<tr>
<td>BHP &gt; 10</td>
<td>4 Nos.</td>
</tr>
</tbody>
</table>

In case of direct drive, a hypoid gear coupling or flexible coupling of standard design shall be used. Pulleys shall be selected to provide the required speed. They shall be multi-groove type, with section and grooves selected to transmit 33% more load than the required power and shall be statically balanced. The belt guards shall be of M.S. sheet with angle iron reinforcements and 18 gauge expanded metal screen.

2.3 Accessories:-

a. Common Base Frame:-

Mounting skid of structural steel shall be provided for supporting the fan & motor base frames. Mounting skid shall be bolted / welded with the embedded plates provided on the floor. Fans shall be fixed on mounting skid with vibrations isolators mounted in between.

b. Access Door and Drain Connection:–

Access door shall be provided for periodic inspection or cleaning. The door can be either toggle clamp fixed or as per manufacturer's standard design. Drain point with plugs or
valves shall be provided if specified.

c. Outlet Damper:-

Fan shall be provided with a damper at outlet. Dampers at outlet of centrifugal fan shall be manually operated multi-louvered type with neoprene edging on blades for tight shut off. Each blade shall be provided with bronze/gun metal bearing at each end of spindle. Operating lever along with the necessary linkage shall be provided at an accessible position for operating the dampers. Suitable fixing device for locking the damper at desired position should be provided.

d. Flexible Connection:-

Flexible connections shall be provided on the suction / discharge ends of the fan as specified. The flexible connection shall be of heavy gauge double canvas / Neoprene impregnated glass fiber of length not less than 150mm.

e. Nuts & Bolts:-

All bolts, nuts & locknuts shall conform to IS: 1367. Self-tapping screws shall not be used.

2.4 NOISE & VIBRATION:-

a. The vibrations measured at bearings in both radial and axial direction shall not exceed the specified range in the "Good to very Good region" of General machinery vibration chart of VDI-2056. The vendor shall furnish along with their offer the overall fan sound power level for each fan and motor operating at the duty conditions.

b. Vibration isolators of proven design for specified isolation efficiency shall be provided. Double deflection rubber in U shear or Cushy foot vibration isolator or Spring type isolators shall be provided for each fan. Rubber bushes, washers, wherever needed for the vibration isolators shall be included in the supply. Sufficient number of such isolators shall be provided to ensure isolation of foundation from vibration of the equipment. At the commissioning stage the vibration amplitudes shall be measured to ensure that the vibrations are within the permissible limit of 30 microns. Generally fans / motors shall be selected to run at very minimum vibration level in accordance with the standards and the fans which are to be mounted on the terrace floor should be selected in such a way that it will not transmit any vibration and sound to the office floors below.

2.5 Painting:-

Fans shall be painted on exterior and interior with two coats of red – oxide zinc chrome primer confirming to IS: 2074 or superior, over which 2 coats of synthetic enamel of approved shade shall be applied on all surfaces. Centrifugal fans / accessories which are to be installed on the terrace floor shall be suitably painted on exterior and interior surface to avoid corrosion. If these fans are to be installed on the terrace floor in the open ambient temperature / climate. Hence these fans / accessories are to be specially treated to take care of the adverse weather condition.

2.6 Accessories
All necessary accessories shall be provided for proper operation and shall also include (as part of Unit Price).

a. Dunlop cushy foot vibration isolators for the blowers.
b. Double canvass connections at the outlet of each fan.
c. Nuts, bolts, shims etc. as required for the grouting of the equipment.
d. Slide rails for mounting the motor and belt adjustments.
e. 18 gauge galvanized wire mesh bird screens in the inlet.
f. Outlet damper.

3.0 Axial Flow Fan:-

a. Impeller:

The impeller shall be of die cast aluminium alloy with integrally cast aerofoil sectioned blades and hub. Impeller shall be fixed to motor shaft by a thrust plate and bolt reverse to direction of rotation, in addition to key lock. The critical speed of impeller shall be minimum 1.5 times of the operating speed. The impeller shall be statically and dynamically balanced to G 6.3 grade as per ISO: 1940.

b. Casing:-

Casing shall be of 2mm thick MS for impeller dia up to 600mm and 2.5mm thick MS for impeller dia above 600mm. Casing shall have flanged connection on both ends for ducted application. It shall be provided with suitable supports. Access door shall be provided in the casing for easy access to motor and impeller. Suitable arrangement for mounting of motor shall be provided.

c. Guide Vanes:-

In case of vane axial fans guide vane shall be provided on the discharge side.

d. Guards:-

Suitably designed guards shall be supplied.

e. Drive Motor:-

Motor shall be of totally enclosed fan cooled type squirrel cage induction of IP-55 protection and class-F insulation suitable to run on 415+10% Volts, 50+3% Cycles, 3-phase AC power supply. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible metal conduit. Fan motor shall be selected in such a way that sound level is lowest (max. 75 db at 1 m distance) while running. The motor shall be rated for continuous duty. The power and efficiency factor for all motors shall be submitted along with the offer. Motors shall be capable of running continuously with 5% drop in rated phase to phase voltage at 15% increase in design power. Motor of 0.75 KW and over shall be fitted with integral positive temperature coefficient thermistors selected to afford class 1 protection. Motors below 0.75 KW shall be fitted with inherent over heat protection.

f. Speed:-
The speed of the fan shall not exceed 960 RPM for fan with impeller diameter above 450mm and 1440 RPM for fan with impeller diameter 450mm and less.

g. Painting:-

Fans and accessories shall be painted with two coats of red-oxide primer zinc chrome primer confirming to IS: 2074 or superior, over which two coats of synthetic enamel of approved shade shall be applied.

4.0 Propeller Fan:-

Propeller fans shall be direct driven, three or four blade type, mounted on a steel mounting plate with orifice ring. The blades shall be of steel and designed such as to give maximum volume at minimum noise level for minimum power consumption. The impellor shall be directly coupled to a purpose designated motor for efficient operation. Fan / motor shall be suitable for continuous duty and shall perform satisfactorily in ambient temperature of above 50 deg. C. The contractor shall furnish along with their offer the overall fan sound power level for each fan and motor operating at the duty conditions.

a. Mounting Plate:

Mounting plate shall be of steel construction, square with stream lined venturi inlet (reversed for supply applications) coated with backed enamel paint. Mounted plate shall be of standard size, constructed of 12 to 16 gauge sheet depending up on the fan size. Orifice ring shall be correctly formed by spinning or stamping to provide easy passage of air without turbulence and to direct the air stream.

b. Fan Blades:-

Fan blades shall be constructed of mild steel. Fan hub shall be of heavy welded steel construction with blades to the hub. Fan blades and hub assembly shall be statically and dynamically balanced at the manufacturer’s works. Impellor hubs and blades, fan supports, wire guards and internal surfaces of fan chambers shall have smooth finish.

c. Shaft:-

Shaft shall be of steel, accurately ground and shall be of ample size for the load transmitted and shall not pass through first critical speed through the full range of specified fan speeds.

d. Motor:-

Motor shall be standard (easily replaceable) permanent split capacitor or shaded pole for small sizes, totally enclosed with pre – lubricated sleeve or ball bearings, designed for quiet operation with a maximum speed of 1000 rpm for fans 38 cm dia or larger and 1440 rpm for fans 30 cm dia and smaller. Motor for larger fans shall be suitable for 415 + 10% volts, 50 cycles + 3%, 3 phase power supply and smaller fans shall be suitable for 220V +10%, 50 cycles + 3 % single phase power supply. Motors shall be suitable for either horizontal or vertical services as indicated on drawings / Schedule of quantities. Motor selected shall fully comply with the specifications mentioned elsewhere. Fan / Motor selection shall be
for continuous and quiet operation and the measured noise level shall not exceed 50 db (A) at 1 meter distance from the equipments. Motors shall be TEFC type with IP-55 protection & class ‘F’ Insulation.

**e. Accessories:-**

The following accessories may be required and provided with propeller fans, as indicated in Schedule of quantities.

- Wire guard on inlet side and bird screen at the outlet.
- Fixed louvers built in to a steel frame.
- Regulators for controlling fan speed for single phase fan motors.

**5.0 Inline Fans:-**

a. Inline fans shall be complete with centrifugal impeller, casing, direct driven motor, vibration isolators, direction of discharge and rotation position shall be as per the job requirement and shall be marked on the fan assembly.

b. Housing shall be constructed of hot rolled 16g GSS sheet metal construction. Housing metal parts shall be either spot-welded or screwed or mounted together with rivets. Indication showing rotation arrow and make, model number and duty conditions of the fan shall be available on the housing.

c. Casing shall be with wide hinged doors which open easily inspection doors with handle and neoprene gasket shall also provided. Casing shall have flanged connection on both ends for ducted applications. Casing shall be primed and finish coated with synthetic enamel paint. Extended grease leads for external lubrication shall be provided.

d. Fan wheel shall be forward curved type, statically and dynamically balanced.

e. The fan shall be provided with ball bearings can be used in any mounting position at maximum indicated temperature. The bearing lubricant shall be suitable for a minimum ambient temperature of minus 150°C (admissible for a short time without reaching dew point at minus 300°C). For applications at maximum indicated ambient temperature life expectancy shall be 40000 hours minimum.

f. Fan motor, fans shall be supplied with built-in-thermal contact (TK) at the critical high temperature point (“B” = 1300°C. The thermal contact shall open and break the power supply to the fan, Fan motors have insulation class “F” and protection class IP55.

g. Motor shall be squirrel cage, totally enclosed, fan cooled standard round frame, constant speed, continuous duty, single winding, suitable for single phase supply. (220V+/−10%, 50 Hz+/−3%). Motor shall be specially designed for quiet operation and lead wires from the motor to be conduit box shall be protected from the air stream by enclosing in a flexible metal conduit.

h. Fans shall be direct driven type.

i. All fans are hot dipped galvanized.
j. The assembly of fan and motor shall be suspended from the ceiling by spring type vibration isolators.

6.0 Fire Rated Smoke Exhaust Axial Fan:

a. The fire rated smoke exhaust fans shall be axial type suitable for 250oC for minimum 2 hours.

b. The blades shall be of aluminum alloy fixed on an aluminium hub-flange assembly suitable for multiple blades which shall be adjustable when the fan is stationary.

c. The collar shall be constructed of rolled steel and joints welded. The flanges shall have suitable holes for fixing the fans, ducts etc. The collar and flanges shall be galvanized for protection.

d. The collar shall be long to cover fan and motor.

e. The fan shall be supplied with factory mounted TEFC motor suitable for 250oC for minimum 2 hours. The motor shall be foot mounted.

f. The fan shall be approved for 250oC for 2 hours by International / national authorized agency.

g. The speed of the fan shall not exceed 960 RPM for fan with impeller diameter above 450mm and 1440 RPM for fan with impeller diameter 450mm and less.

7.0 Fire Rated Centrifugal Fan:-

a. Fire rated centrifugal fan generally shall be as described above and may have varied construction features as required.

b. The fan shall be supplied with factory mounted TEFC motor suitable for 250oC for minimum 2 hours. The motor shall be foot mounted.

c. The fan shall be approved for 250oC for minimum 2 hours by International / National authorized agency.

8.0 Limitation:-

a. The air velocity limits shall be as per Schedule of Equipment and/or BOQ but in no case exceed.

b. Velocity at blower outlet shall not exceed 10.16 M/s (2000 FPM).

c. Inlet Velocity shall be limited to 5.08 M/S (1000 FPM).

8.1 Life of Ventilation & Smoke Exhaust Fans:-

Ventilation & Smoke Exhaust Fans shall be capable of providing Average Service Life of 25 years.
MOTOR STARTERS CONTROL PANELS

1. **General:**

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

2. **Control Panel:**

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

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

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

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

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

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

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

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

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

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

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

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

2.12 The ‘on’ and ‘off’ position of the switch handle shall be distinctly indicated and interlocks shall be provided to ensure that switch cover can not be opened unless the switch is in the ‘off’ position.

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

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

2.15 **415 Volts Bus Bars**

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

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

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

2.16 **Instruments and Meters**

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

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

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

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

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

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

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

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

4. **Indication:**

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

5. **Subsidiary Panels:**

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

6. **Contactor Starters:**

6.1 **Star Delta Starter**

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

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

7. **Squirrel Cage Induction Motors:**

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

(a) Cooling tower & exhaust blower - ip:55(TEFC)
(c) Pumps ip:55(TEFC).

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

8.0 **CENTRAL CONTROL CONSOLE**

A floor mounting control and indication console shall be provided in the main control room, as shown on the plans.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Push Buttons</th>
<th>Lamps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>on off</td>
<td>green</td>
</tr>
<tr>
<td>Water chilling units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine status</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Water circulation pumps</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Air handling unit motors</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Ventilation Fans, Centrifugal</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Blower, exhausters</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Flow switch in water lines   -   -   -   x
Hot water generator    x   x   x   x
In line/ Tube axial fan x   x   x   x
Cooling towers, AHUs    x   x   x   x

The console shall contain on/off push buttons and indication lamps for all the items as per the BOQ. Indicating light for strip heaters, if any shall be provided on the switch board, in the respective unit room.

The requirements given for the main panel are for one unit only. The actual number of switches and lights shall correspond to the number of units being installed. All controls and alarms shall be suitable for 230 volts on the panel.

The alarms shall be with reset buttons.

All controls circuits shall be functionally tested.

The red indicating lamps should switch on only in case of fault. Thus, the red light should come on in case of tripping of starter on overload or single phasing.

A common alarm shall be connected to all red indicating lamps through individual relays.

Lamp testing arrangements shall be provided in console.

All the airconditioning equipments shall be interlocked in sequence for safe and trouble free operations of the plant. Following should be the sequence of operation

8.1 Air handling units
8.2 Chilled / condenser water pumps
8.3 Water chilling units.

During switch off operations the sequence shall be reverse.

8.4 For winter heating the following should be the sequence of operations
8.5 Air handling unit
8.6 Hot water pumps.
8.7 Hot Water Generator/Boiler

During switch of operations the sequence shall be reverse.
Ultra Violet Germicidal Irradiation

The UVGI system is the latest technology which helps to maintain the Indoor Air Quality.

1. The UVGI System shall be designed to achieve Kill Rate not less than 90% per pass, based on the Kill Rate of Escherichia Coli, or default rate of 3,000 μwsec/cm². However, it shall be suitable to achieve Kill Rate of all air borne mold, spores, bacteria, and viruses, at varying extent of kill.

2. In the event specific bacteria, virus or disease is mentioned, the UVGI System shall be designed to achieve Kill Rate based on the specified bacteria that causes the defined disease.

3. The Manufacturer shall provide scientifically developed Selection Charts to prove the delivery of designed intensity of Kill Rate based on Air Velocity on UVGI, length of Contact Duct Downstream and Upstream of UVGI, and Lamp Energy intensity. An individual Selection Chart shall be provided for each unit. The Selection Charts shall incorporate all of the above parameters.

4. The contact duct length for design Kill Rate Upstream and Downstream of the UVGI shall be clearly defined by the manufacturer. The required length of straight duct shall be provided by the installer at site. These contact duct lengths shall correspond to the lengths used in the Selection Chart. As this is essential in establishing Kill Rate and system dependability, this clause cannot be waived.

5. As UV Lamps lose energy over time, selection shall be based on UV intensity at end of Lamp life, which shall be reckoned at 80% of energy at beginning of Lamp life. Manufacturer shall warrant this. Considering the impact on performance, this cannot be compromised.

6. The Lamps shall be high output type 800 mA each, with specially formulated internal coating to provide Rated Average Life of 16,000 Hrs. Lamps shall be environmentally friendly with mercury less than 10 Mg per Lamp. Low intensity Lamp 450 mA is not acceptable.

7. The design intensity of the Lamp shall be based on wavelength 254 nm. It shall be ensured the Lamp shall not perform at ultra low wavelength 180 nM or lower, to ensure no uncontrolled and unmodulated ozone is put out by the lamp.

8. Each Lamp shall be provided with externally and readily visible indication to show Lamp operation or failure, without the need to open any access door, or shut down the UVGI System.

9. Lamp shall be fitted with uniquely designed Holder and Pins to prevent Lamp replacement with unqualified and unsuitable Lamp.

10. The Lamps shall be installed in frame mounted specially formulated Glass Sleeve.
It shall be possible to replace lamp quickly, easily, and error safe without removing the Quartz Sleeve, without the need to open any access door, and without drawing the UVGI frame out of the duct.

11. The Lamps shall not be exposed, nor shall have direct contact with air in the duct.

12. The Glass Sleeve shall also prevent impregnation of dust, particle matter, and moisture from cooling coil or condensation, on the Lamp.

13. The Glass Sleeve shall also serve to confine and hold mercury spill for environmentally safe disposal, in the event of breaking of Lamp. This prevents mercury spill into the ventilation duct.

14. Ballasts shall be electronic type, life rated for greater than 15,000 starts, and conform to Sound Rating A, UL Listed to UL 935.

15. To prevent interference with hospital health care Monitors and Communication System, the Ballasts shall meet FCC Part 18 (Class A) for EMI and RFI non consumer limits, and ANSI Standard C62.41.

16. The Ballast shall be Listed to UL 935 (Class P, Type HL, Type 1) and CSA Certified.

17. To minimize fire hazards and ensure high safety standards, electrical components in the duct installed UVGI shall be confined to bare minimum; Lamps and Terminal Block only.

18. All other electrical components such as Ballasts, Disconnect Switch, Fuse, Hour Meter etc shall be housed in remotely mounted 18G CRS powder coated Electrical Box. UL Listed cable harness between Electrical Box and UVGI frame shall be factory provided, complete with UL Listed error safe Electrical Quick Connector. No field provided wiring will be required except power source and AHU Motor Interlock Wiring.

19. An Hour Meter shall be provided in the remotely mounted Electrical Box to indicate Lamp change. The Hour Meter shall have at least Two normally Open (NO) Dry Contacts, one to activate unit mounted indicating lamp to warn Lamp change, and the other for remote indication or interface to BMS. If specified, it shall have R 232 output to BMS to indicate Hours. The Hour Meter shall be UL Listed to 508.

20. The Electrical Box shall be provided with Terminal Block, fire rated to UL 94 V.0.

21. Installation of UVGI frame in the duct shall be with factory provided Guide Rails and Installation Rails. Cover Plates and all necessary hardware required for installation shall be factory provided by Manufacturer. No field provided material or hardware shall be required for installation of the system, except input power wiring and AHU Fan Motor Interlock wiring. This is to ensure no non listed parts are used, with aim to optimize safety in Hospitals and Health Care Facilities.

22. The UVGI shall be electrically interlocked to AHU FAN Motor Contactor. This allows the UVGI to operate only if the AHU Fan Motor in operation. Terminals
shall be provided in the Electrical Box to connect field provided interlock cable.

23. All wetted parts shall be SS 316 to render it suitable for use in Hospitals, Health Care Facilities, and in Food Processing Plants. All non wetted parts shall be 18 G CRS powder coated.

24. Placement of the Lamps in the Frame shall ensure entire cross sectional area of the duct is enveloped with UV rays with no possibility of bypass by pathogens.

25. The System shall be suitable for operation in air flow 32°F (0°C) to 140°F (60°C), RH 0 to 100% condensing or non condensing.

26. As an option, or if specified, UV Intensity Sensor shall be factory installed on the UVGI frame, together with UV Intensity Monitor. Control wiring between the two shall be factory provided. This shall indicate UV Intensity in µw/cm² The Monitor shall also deliver 0–10 VDC Analog Signal to BAS. It shall have at least 1 normally Open (NO) Dry Contact to activate alarm if UV Intensity drops below set level.

27. The operating voltage shall be 110 to 240 Volts, 1 Ph, 50/ 60 Hz. The equipment shall be properly grounded.

28. All Parts and Components shall be rated and UL Listed or UL Recognized to;
   - **Electronic Ballast:**
     ✓ UL 935 (Class P, Type HL, Type 1, Outdoor use
     ✓ CSA Certified
     ✓ Sound Rated A
     ✓ Compliance to FCC part 18 (Class A) for EMI and RFI non consumer limits)
     ✓ ANSI Standard C62.41
   - On OFF Switch: UL 1054
   - Hour Meter UL 508
   - Terminal Block: Fire Rated to UL 94 V.0
   - Quick Connect Electrical Coupling: Fire Rated to UL 94 V.0
   - Inter Connect Cable Harness: Fire Rated to UL 94 V.0
   - Lamp Holder: Fire Rated to UL 94 V.0
   - Indicating Lamps: E 20325
   - Heat Shrink Separator: Fire rated to UL 94 V.0

29. Appropriate Safety and Caution Notice shall be screen printed on the cover plate of UVGI frame and on the electrical box. Placing adhesive labels shall not be accepted, so as not to compromise on safety.
DUCT WORK AND OUTLETs

1. **General:**

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

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

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

2. **Duct materials**

2.1 The ducts shall be fabricated from galvanized steel sheets class VIII GSS sheets conforming to IS:277-1962 (revised) or aluminium sheets conforming to IS:737-1955(with latest amendments) (wherever aluminium ducts are specified).

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

The thickness of the sheet shall be as follows:

<table>
<thead>
<tr>
<th>size of duct</th>
<th>sheet thickness</th>
<th>type of joints</th>
<th>bracing if any</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GI</td>
<td>Aluminium</td>
<td></td>
</tr>
<tr>
<td>2.2.1 Upto 750mm</td>
<td>0.63 mm</td>
<td>0.80 mm</td>
<td>GI flange</td>
</tr>
<tr>
<td>2.2.2 751 mm to 1000 mm</td>
<td>0.80 mm</td>
<td>1.00 mm</td>
<td>25x25x3 mm Angle iron Frame With 8 mm dia. nuts &amp; bolts</td>
</tr>
<tr>
<td>2.2.3 1001 mm to 1500 mm</td>
<td>0.80 mm</td>
<td>1.00 mm</td>
<td>40x40x5 mm angle iron frame with 8 mm dia. Nuts &amp; bolts</td>
</tr>
<tr>
<td>2.2.4 1501 mm to 2250 mm</td>
<td>1.00 mm</td>
<td>1.50 mm</td>
<td>50x50x5 mm angle iron to be cross braced diagonally with 40x40x3 mm at the rate of 1.2</td>
</tr>
</tbody>
</table>
10 mm dia nuts & bolts at 125 mm centre.

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

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

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

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

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

3. Installations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. **Dampers**

4.1 At the junction of each branch duct with main duct and split of main duct, volume dampers must be provided. dampers shall be two gauges heavier than gauge of the large duct, and shall be rigid in construction to the passage of air.
4.2 The volume dampers shall be of an approved type, lever operated and complete with locking devices which will permit the dampers to be adjusted and locked in any positions.

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

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

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

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

4.7 **Motorised Combined Smoke & Fire dampers:**

The fire dampers shall be provided at all supply and return air ducts at AHU room crossings and at all floor crossings or wherever shown on the drawings. The fire & smoke dampers shall be of atleast 90 minutes fire rating certified by CBRI, Roorkee as per UL 555 : 1973. Fire damper blade & outer frame shall be formed of 1.6 mm galvanized sheet steel. The damper blade shall be in pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals will be provided on top & bottom of the damper housing made of 16 G galvanized 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 24 V operated electric actuators 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. Smoke detector shall be provided by the A/C contractor. The fire damper shall also close due to temperature rise in SA ducts through the electric temperature sensor factory set at 165 deg F micro switches with bakelite base will be provided to stop fan motor and give open & close signal at remote panel in case of motorised actuator.

Each fire dampers shall have its own panel which will incorporate necessary circuit required to step down voltage available from power supply to shown status of the damper (open or close), to allow remote testing of damper & indication in event of damper closure due to signal from smoke sensor/temperature sensor & reset button. Additional terminal will be provided to have signal (sound beep or visual) in Central Control Room.
Damper actuator shall be spring return Belimo make so as to close the damper in the event of power failure automatically and open the same in case of power being restored. Spring return action of the actuator shall be an in built mechanism and not mount externally.

The fire damper shall be mounted in fire rated wall with a duct sleeve 600 mm long. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be slip on type. Minimum thickness of GI sheet shall be 18 G.

5. **Access panel**

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

6. **Miscellaneous**

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

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

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

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

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

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

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

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

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

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

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

6.12 All the angle iron flanges to be connected to the gss ducts by rivets at 100 mm centres.
6.13 All the flanged joints, to have a 4 mm thick felt packing stack to the flanges with shellac varnish. the holes in the felt packing are to be burnt through.

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

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

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

7. **Grilles**

7.1 The supply and return air grilles shall be fabricated from aluminium extruded sections and the supply air grilles shall have single louvers and the return air grille shall have single horizontal extruded section fixed louvers the grilles may or may not be with an outer frame.

7.2 The grilles shall have opposed blade dampers of m.s. black sheets, which shall be key operated from the grille face wherever required.

7.3 The damper blades shall be of 1.00 mm (18 gauge) m.s. black sheets and shaped to form air tight joints the frame work for dampers shall be fabricated from 1.00 mm (18 gauge) m.s. black sheet the grill flange shall be fabricated out of 25 x 25 x 1.5 mm aluminium angle grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

7.4 **Linear Grille**

The linear grille shall be of 1.25 mm (18 G) aluminium extruded section with flush mounted with single louvers for air flow direction adjustment.

8. **Diffusers**

8.1 The ceiling type round or square diffusers shall be of 1.25 mm (18 gauge) aluminium extruded sections with flush or step down face, as specified with fixed pattern and round neck.

8.2 The diffusers shall be die formed for proper air diffusion.

8.3 All supply diffusers shall be provided with m.s. sheet dampers, with knurled knobs for adjustment from the bottom.

9. **Painting**

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

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

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

10. Testing

10.1 After completion, all duct system shall be tested for air leakage.

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

10.3 **Fire Rated Duct:**

All fire rated duct shall be fabricated from 1.25mm thick GI sheet irrespective of duct size. All accessories shall be suitably fire rated for 2 hours.
PIPE WORK

1. **General:**

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

2. **Pipes:**

2.1 All pipes in sizes up to 50 mm dia shall be m.s. e.r.w tube (black steel) heavy class as per i.s. 1239-79, part-i with amendment-i of January ‘81.

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

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

3. **Fittings:**

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

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

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

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

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

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

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

4. **Flanges:**

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

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

4.3 Flanges shall be used as follows:

4.3.1 Counter flanges for equipment having flanged connections.

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

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

5. **Valves:**

5.1 **Butterfly Valves**

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

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

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

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

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

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

5.2 **Motorized Butterfly Valves with actuator**

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

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

5.2.3 The valve seat shall be synthetic material suitable for water duty. It shall line the whole body.
5.2.4 The disc should move in slide bearings on both ends with ‘o’ ring to prevent leakage.

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

5.2.6 The valve should be suitable for 12 Kg/cm² working pressure.

5.2.7 The actuators of motorized butterfly valve shall be BMS compatible.

5.3 ON/OFF Motorized butterfly valve with actuator for Chillers, condenser & Cooling Towers

5.3.1 Motorized valve for chillers, cooling towers shall be 2 positions ON/OFF type Butterfly valve with standard train. The valve shall be controlled by an electric actuator mounted directly on the valve. The actuator shall have a reversible synchronous motor and generate the desired stroke by gear train. It shall be suitable for hook up to any major BMS.

5.4 Actuator
5.4.1 Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.

5.4.2 Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required flow.

5.4.3 Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.

5.5 The check valves shall be wafer type. The body shall be of cast iron and the plate of aluminium bronze. The valve shall have plain face and shall have a synthetic seal. The valve shall be suitable for 12 kg/cm² pressure.

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

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

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

6. Balancing Valves:

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

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

6.3 The port opening shall permit precise regulation of flow rate, by accurately measuring the pressure drop across the port.
6.4 The valve shall be complete with two ports for connections to a mercury manometer to measure the pressure drop, as well as a drain port.

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

6.6 This valve shall be used wherever specified.

7. **Strainers:**

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

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

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

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

8. **Jointing:**

8.1 All pipe lines shall be welded type.

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

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

9. **Miscellaneous:**

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

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

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

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

9.3 Provide necessary valves (included in piping) and capped connections for all low points in piping system, where necessary or required for draining systems. Provide isolating valves & drain valves in all risers to permit repairs without interfering with the rest of the system.
9.4 During construction, temporarily close, open ends of pipes with sheet metal caps, where necessary, or required to prevent debris from entering the piping system.

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

9.6 To facilitate the maintenance, repair and replacement:

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

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

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

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

<table>
<thead>
<tr>
<th>Nominal pipe size mm</th>
<th>Spacing (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>...</td>
</tr>
<tr>
<td>20 &amp; 25</td>
<td>...</td>
</tr>
<tr>
<td>32,30,50 &amp; 65</td>
<td>...</td>
</tr>
<tr>
<td>80,100 &amp; 125</td>
<td>...</td>
</tr>
<tr>
<td>150 &amp; above</td>
<td>...</td>
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</tbody>
</table>

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

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

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

10. **Hangers & Supports:**

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

10.2 All hangers and supports shall be made of steel or other durable and non-combustible materials, galvanized or plated. Wood wire or perforated strap iron shall not be used as permanent hangers or supports.

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

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

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

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

11. **Sleeves :**

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

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

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

12. **Expansion or Contraction :**

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

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

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

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

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

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

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

13.6 Anchors and supports shall be provided wherever necessary to prevent any misalignment of piping.

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

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

14. Testing:

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

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

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

14.4 All piping shall be tested to hydraulic test pressure of at least one and half times the maximum operating pressure but not less than 10 kg/sq.cm for a period of not less than 12 hours. All leaks and defects in the joints revealed during the testing shall be rectified to the satisfaction of the engineer-in-charge, without any extra cost.

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

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

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

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

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

15.0 Copper Piping:

15.1 Heavy gauge soft copper tubing, type m shall be used to make connections to equipment, wherever required or specified by engineer-in-charge.

15.2 Flare fittings e.g. flare nuts, tees, elbows, reducers etc. shall all be of brass.

16. Refrigerant Piping:

16.1 The refrigerant circuit piping shall be heavy class m.s the fittings shall be heavy class. The pipes and fittings shall be connected by means of welded joints. The connections to gauges, controls etc. shall be with soft copper tubing and flare fittings.

16.2 The refrigerant valves, required in the circuit shall be as follows.

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Valve Material</th>
<th>Type of Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.2.1</td>
<td>upto 12 mm</td>
<td>brass/packless type</td>
</tr>
<tr>
<td>16.2.2</td>
<td>16mm &amp; above</td>
<td>brass/steel packed type</td>
</tr>
</tbody>
</table>

note :- all valves shall be tested against leaks upto 20 kg/sq.cm.

16.3 The strainers for the refrigerant liquid line shall be 'y' type with gun metal body and bronze filter screen of fine mesh. The filter screen shall be easily removable type without dismantling the strainer from the circuit.

16.4 The moisture indicator in the liquid line shall have leak proof glass on opposite sides to permit easy inspection of the liquid refrigerant.
17. **Drain Piping:**

17.1 The drain piping shall be medium class galvanised steel as per is 1239/1979.

17.2 The fittings shall be of `R’ brand or equal forged with screwed connections.

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

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

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

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

18. **Painting:**

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

18.2 All pipes, which are not to be insulated, shall then be given one coat of finish paint, of a type and colour, as approved by the engineer-in-charge.
INSULATION

1. **General:**

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

2. **Materials:**

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

2.1 **Pipe Insulation:**

   The insulation for chilled water and drain piping, chillers, pump etc. shall be carried out from `TF' quality expanded polystyrene having a `K' value of 0.014 kcal/hr/°c. at mean temperature of 10°c. and a density of 24 to 28 kgs/cubm.

2.2 **Other Insulation**

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

   2.2.2 The materials for duct insulation shall be resin bonded glass wool, as described earlier but conforming to i.s. 8183 of 1976. The density of insulation shall not be less than 24 kg/cub/m. and material shall be in the form of blankets/rolls of uniform thickness. The `K' value at 10°c. shall not be less than 0.03 kcal/mhr/oc.

3. **Air Handling Units:**

   3.1 The casing of the sheet metal type air handling unit from the beginning of the fan section till the end of the coil section, including the drain pan, shall all be insulated.

   3.2 The insulation shall be 12 mm polyethylene flexible sheets.

   3.3 The insulation shall first be fixed to the casing by applying cold sticking compound both to the surface and the insulation and all joints shall be sealed completely.

4. **Cold Equipment Insulation:**

   4.1 The complete shell of the chiller as well as its two heads, the chilled water pumps, and high pressure AHUSs shall all be insulated.

   4.2 The insulation shall be `TF' quality expanded polystyrene as below:

   i) Chillers - 100 mm
ii) High pressure AHUs - 50 mm 
iii) Chilled water pumps - 50 mm

4.3 All insulation excepting chiller heads shall be covered with 0.63 mm 12 mm wire netting and finished with 12 mm thick sand cement plaster.

4.4 The insulation on the two end heads of the chiller shall be covered with 0.80 mm g.i. casing to permit easy removal.

4.5 **Insulation (Chiller)**

4.5.1 The cooler surface shall first be cleaned with wire brush.

4.5.2 Then one layers of cold setting compound shall be applied.

4.5.3 The insulation shall then be fixed in two layers, staggering the joints and sealing them with cold setting adhesive.

4.5.4 The insulation shall then be covered with 0.63 mm 19 mm mesh wire netting which shall be fixed to the insulation with brass 'U' nails.

4.5.5 The final finish shall be 12 mm sand cement plaster which shall be applied in two layers of 6 mm each and trovelled to a smooth round finish.

4.5.6 After the insulation is fixed on the head as above, it shall then be covered with a properly shaped jacket of 0.80 mm G.I. sheet. Pump casing shall be finished with aluminium cladding.

4.6 **Insulation (Others)**

  The AHUs and the chilled water pumps shall be insulated as above in 4.5 and finished with plaster excepting that the insulation of 30 mm shall be fixed in a single layer.

5. **Chilled Water Piping/Drain Piping :**

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

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

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

5.4 **Installation**

  **Chilled Water and Drain Piping**
5.4.1 The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.

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

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

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

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

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

6. **Refrigerant Piping:**

6.1 The suction line of refrigerant piping shall be insulated with 50 mm thick expanded polystyrene as specified for chilled water pipe lines.

7. **Ducting:**

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

7.2 Duct insulation thickness shall be as follows :

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

7.3 **Installation**

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

7.3.2 Apply one coat of cold setting compound.

7.3.3 Wrap the duct with insulation blankets of the thickness mentioned in item 7.2 above and then with 250 g polythene shee and covered with 0.1mm thick aluminium sheet using 50 mm wide aluminium adhesive tape of johnson make.

7.3.4 Reinforce and tie with G.I. wire of 1.0 mm at intervals of 450 mm.
7.3.5 The ducts in areas exposed to the weather shall be additionally covered with one layer of tar felt b.h. the tar felt shall be stuck with bitumen r 85/40 or 80/25.

8. **Acoustic Lining:**

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

8.2 **Installation**

8.2.1 The duct surface shall first be cleaned from inside.

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

8.2.3 Then the boards shall be fixed inside the duct.

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

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

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

9.1 **Material**

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

10. **Installation :**

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

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

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

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

**Note:** All the insulation used in the building shall be chloro fluoro carbon (CFCs) and hydro chloro fluoro carbon (HCFCs) free, as per GRIHA /ECBC.
ELECTRIC WIRING

1. **General**:

   The electric wiring of motors for compressors, pumps, air handling units etc. as well as controls, heaters etc. and earthing of all equipment shall be carried out as per specifications given hereunder.

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

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

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

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

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

3.0 **CONTROL WIRING**

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

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

3.3 ISI marked steel conduit pipes, wherever used, shall be of gauge not less than 1.6 mm thick for conduits upto 32 mm dia and not less than 2.0 mm thick for higher sizes. All conduit accessories shall be threaded type with substantial wall
3.4 Control cables shall be of adequate cross section to restrict the voltage drop.

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

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

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

4.0 Laying

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

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

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

5. Earthing:

5.1 Pipe Earth Electrode

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

5.2 Plate Earth Electrode

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

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

ii. Copper plate electrode: 60cm x 60cm x 3mm thick.
The electrode shall be buried in ground with its faces vertical and top not less than 3 m below ground level.

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

5.3 **Loop Earthing**

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

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

<table>
<thead>
<tr>
<th>Size of phase wire sq.mm</th>
<th>Size of G.I. conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium tape/wire (swg)</td>
<td></td>
</tr>
<tr>
<td>185</td>
<td>25 mm x 4 mm (strip)</td>
</tr>
<tr>
<td>150</td>
<td>25 mm x 4 mm (strip)</td>
</tr>
<tr>
<td>120</td>
<td>20 mm x 3 mm (strip)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of phase wire sq.mm</th>
<th>Size of G.I. conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium tape/wire (swg)</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>20 mm x 3 mm (strip)</td>
</tr>
<tr>
<td>70</td>
<td>4 swg</td>
</tr>
<tr>
<td>50</td>
<td>4 swg</td>
</tr>
<tr>
<td>35</td>
<td>6 swg</td>
</tr>
<tr>
<td>25-6</td>
<td>6 swg</td>
</tr>
<tr>
<td>4</td>
<td>8 swg</td>
</tr>
</tbody>
</table>

6. **Miscellaneous :**

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

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

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

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

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

1. **General:**

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

2. **Compressors/Condensers/Chillers/Evaporators/Pumps etc.**

   2.1 Identification of materials in accordance with test certificates.

   2.2 Inspection of various laboratory test certificates for physical properties and technical composition conducted on test samples of materials to be used for fabrication, forgings etc. for all important components of various equipment.

   2.3 Hydraulic test for various components and assembled equipments at 1.5 times design pressure or double the operating pressure whichever is higher.

   2.4 Pneumatic leak test after assemblies at design pressure

   2.5 Static and dynamic balancing on electronic precision machine for rotating parts, links, impeller/crank shaft assemblies etc.

   2.6 Inspection of assemblies and dis-assemblies of various parts of equipments and complete equipments themselves as desired by inspection engineer.

   2.7 Noise level test for various rotating/reciprocating equipments.

   2.8 Pressure drop test for condenser, chiller and evaporator.

   2.9 Inspection of manufacturer's test certificates shall be supplied for all electrical motors.

   2.10 Inspection of welding including welders qualifications as desired by inspection engineers.

   2.11 For compressor assembly, electronic leak, air running test, pneumatic test with dry nitrogen and leak test in water.

3. **Air Handling Units:**

   3.1 **Blowers**

   3.1.1 Identification of material in accordance with test certificates.

   3.1.2 Dynamic/static balancing of impeller.

   3.1.3 Performance test as per applicable codes.
3.2 **Coils**

3.2.1 Identification of material in accordance with test certificates.

3.2.2 Pneumatic test.

3.3 **Filters**

3.3.1 Manufacturer's test certificates also to be produced for the assembled A.H.U. final dimensional check will be done. Inspection will be done during assembly of components for quality of workmanship, painting etc.

Piping : materials check for specifications and size.

3.4 **Valves**

Hyd./Pneumatic test certificates.

3.5 **Motors**

Manufacturer's test certificate as per motor data sheet.

3.6 **Instruments and Controls**

Visual examination.

4. **For Associates Works at Site :**

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

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

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

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

4.5 Pressure testing, leak testing of complete piping network for chilled water. Condenser water and refrigerant/services.

4.6 Vacuummissing and gas/oil charging for refrigeration system.

4.7 Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of air conditioning plant.

4.8 Checking of calibration of controls and instrumentation
4.9 Checking of assemblies for electrical control panel, instruments panels, local panels (dimensional and functional) annunciator panels etc.

4.10 Inspection of complete electrical installation at site.

4.11 Installation of main equipments like compressor, condenser, chiller, evaporator.

4.12 Performance testing of complete A/C plant as per specifications.

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

6. **Piping System**:

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

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

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

6.4 **Water Piping**

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

7. **Duct Work**:

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

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

8. **Balancing and Adjustment**:

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

9. **Electrical Equipment:**

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

9.2 The following tests shall be carried out:

9.2.1 Wire and cable continuity tests.

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

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

9.5 Phasing out and phase rotation tests.

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

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

10. **Performance Tests:**

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

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

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

10.1.3 Static pressure in each air duct.

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

10.1.5 Continuous recording over a specified period, of ambient wet and dry bulb temperatures under varying degrees of internal heat loads and use and occupation, in each zone of each part of the building.

10.2 Daily records should be maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream "on-coil" of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine.

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

11. **Miscellaneous:**

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

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

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

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

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

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

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

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

1. Unit Prices in the Schedule of Quantities:

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

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

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

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

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

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

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

1.2.6 Storage and insurance of all equipment apparatus and materials.

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

2. Measurements of Sheet Metal Ducts, Grilles/Diffusers etc.

2.1 Sheet Metal Ducts

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

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

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

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

2.2 **Grilles/Diffusers**

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

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

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

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

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

3. **Measurements of Piping, Fittings, Valves, Fabricated Items:**

3.1 **Pipe**

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

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

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

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

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

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

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

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

3.2.3 The rates quoted shall be inclusive of making connections to the equipment, tanks, pumps etc. and the connection made with an installed pipe line shall be included in the rates as per the b.o.q.

3.3 Structural Supports

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

3.4 Copper Connections for Fan Coil Units

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

4. Insulation:

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

4.2 Pipes, Ducts & Vessels

4.2.1 Pipes

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

4.2.2 Ducts

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

4.2.3 Vessels

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

4.3 Accessories Insulation

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

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

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

4.4 Acoustic Duct Lining

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

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

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

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

<table>
<thead>
<tr>
<th>ITEM</th>
<th>APPROVED MAKES/SUBCONTRACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcontractors:</td>
<td>Voltas/ ETA/ Blue Star/ Suvidha/ Sterling &amp; Wilson/ Unique Engineers</td>
</tr>
<tr>
<td>Water chilling machines</td>
<td></td>
</tr>
<tr>
<td>Screw Type water chilling machine</td>
<td>Carrier / Dunham Bush / Mcquay / York / Trane</td>
</tr>
<tr>
<td>Air Handling Unit all types</td>
<td>Carrier Aircon/Caryaire/Blue Star/ZECO/Saiver/Waves</td>
</tr>
<tr>
<td>with heating/cooling colis</td>
<td></td>
</tr>
<tr>
<td>Centrifugal fan of double skin type</td>
<td>Nicotra/Comefri/Flakt/Kruger/GEC</td>
</tr>
<tr>
<td>AHU</td>
<td></td>
</tr>
<tr>
<td>Air Washer</td>
<td>Roots Cooling / Ambassador / Humidin</td>
</tr>
<tr>
<td>Scrubber system</td>
<td>Thermax / Peema / Batliboi</td>
</tr>
<tr>
<td>End suction back pull out pump</td>
<td>Kirloskar/Beacon-weir/Mather &amp; Platt/KSB/Greaves</td>
</tr>
<tr>
<td>Pumps coupled with VFD</td>
<td>ITT / Bell &amp; Goset / Grundfos/wilo</td>
</tr>
<tr>
<td>VFD for AHUs</td>
<td>Danfoss/Siemens/AllenBradley/ABB</td>
</tr>
<tr>
<td>Humidifier</td>
<td>Rapid cool/Emerald/Khokar</td>
</tr>
<tr>
<td>FCUs</td>
<td>Blue Star/Carrier/Zeco/Voltas/Waves</td>
</tr>
<tr>
<td>Ventilation Fans</td>
<td></td>
</tr>
<tr>
<td>Centrifugal fan</td>
<td>Swent / Krugger/Flakt/ Nicotra /Nadi / Divine/ comefri</td>
</tr>
<tr>
<td>Inline Fan</td>
<td>Krugger/Flkt/ Nicotra/system air</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Component</th>
<th>Brands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propeller Fan</td>
<td>GEC (Alsthom)/Crompton Greaves/ Khaitan/Usha/Polar</td>
</tr>
<tr>
<td>Axial Fan</td>
<td>Kruger/ Flakt/ Nicotra</td>
</tr>
<tr>
<td><strong>Pipes</strong></td>
<td></td>
</tr>
<tr>
<td>GI</td>
<td>ITC/ Jindal/Tata/SAIL/HSL</td>
</tr>
<tr>
<td>MS upto 150 mm dia</td>
<td>ITC/ Jindal/Tata/SAIL/HSL</td>
</tr>
<tr>
<td>MS 200 to 300 dia</td>
<td>ITC/ Jindal/Tata/SAIL/HSL</td>
</tr>
<tr>
<td>GI Sheets</td>
<td>TATA/SAIL/Jindal/Bhushan Steel</td>
</tr>
<tr>
<td>Aluminium Sheet</td>
<td>Balco/Nalco/Hindalco</td>
</tr>
<tr>
<td>Grilles/Diffusers</td>
<td>Ravistar/Caryaire/ Mapro/Dynacraft/Servex</td>
</tr>
<tr>
<td>Fire dampers (Motorized)</td>
<td>Caryaire/Dynacraft / Ravistar</td>
</tr>
<tr>
<td>Cooling Tower</td>
<td>Paharpur/Bell/Mihir/Aadi/Advance</td>
</tr>
<tr>
<td>Electric Hot Water Generator</td>
<td>Rapid cool/Emerald/Khokar</td>
</tr>
<tr>
<td>Window /Split Airconditioner</td>
<td>Carrier Aircon/LG/Hitachi/Voltas/Bluestar</td>
</tr>
<tr>
<td><strong>Valves</strong></td>
<td></td>
</tr>
<tr>
<td>Gate Valve</td>
<td>Leader/Divine/Sant/Bankim Sarkar</td>
</tr>
<tr>
<td>Butterfly Valves</td>
<td>Advance/Castle/Audco/Intervalve /Arrow/C&amp;R</td>
</tr>
<tr>
<td>Balancing Valves</td>
<td>Advance/Castle/Audco/Arrow/C&amp;R</td>
</tr>
<tr>
<td>Non-return Valves</td>
<td>Advance/Castle/Kirloskar/C&amp;R/Arrow</td>
</tr>
<tr>
<td>Pot &amp; Y- Strainer</td>
<td>Emerald/Sant/Rapid cool</td>
</tr>
<tr>
<td>Three way mixing valves</td>
<td>Stafea/Johnson/Honeywell/Danfoss/Anergy/Rapid controls</td>
</tr>
<tr>
<td>Two way motorized valve</td>
<td>Stafea/Johnson/Honeywell/Danfoss/Anergy/Rapid controls</td>
</tr>
<tr>
<td>Actuating motor for 3 way &amp; 2 way</td>
<td>Staefajohnson/Honeywell/Danfoss/Anergy</td>
</tr>
<tr>
<td>Ball Valve with &amp; without strainer</td>
<td>Rapid Control/Sant/Leader</td>
</tr>
</tbody>
</table>
## Insulation

- **Fibre glass**: FGP Ltd./UP Twiga/Kimmco / Owens Corning
- **Expanded Polystyrene**: Beardsell Ltd./ BASF/Styrene Packing/ Indian Packaging Industries/ Lloyd
- **Air Filters**: Thermadyne/Klenzaids/Kirloskar /Anfilco/Johnflower/Dynafilter
- **Thermometers/Pressure Gauge**: Fiebig/Emerald/H Guru/Japsin
- **Thermostats/Humidistats**: Honeywell/Penn /Staefa/Johnson/ Anergy/Rapid Controls
- **Electric Strip Heaters**: Escorts/Daspass
- **Electric Panels**: CPRI approved make (To be approved by HSCC)
- **Electric Motors**: Siemens/Kirloskar/ABB/ Bharat Bijlee./Crompton Greaves
- **Starters/Contactors**: L&T/ GE Power/ Siemens/ ABB
- **ACB/MCCB**: L&T/ GE Power/ Siemens/ ABB
- **Switch Fuse/ Fuse Switch Units**: L&T/ GE Power/ Siemens/ ABB

## Cables

- **Power Cables & Control cable**: CCI/Universal/ICC/NICCO/INCAB/ National/Rallison Cables
- **Lamps & Push Buttons**: L&T/GE/ Siemens/ Schneider
- **Relays Current Transformer/ Ammeter/Voltmeter**: L&T/GE/ Siemens/ Schneider
END OF VOLUME-IV
Tender

For

Renovation of CCU at CN Centre at AIIMS, Ansari Nagar, New Delhi

Volume-V

Bill of Quantities (B.O.Q.)

December’ 2012

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

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

Tender No. HSCC/ AIIMS/ CCU/2012/03
BILL OF QUANTITIES (B.O.Q.)

CIVIL
# PROJECT NAME: Renovation and facelift of CCU in AIIMS, New Delhi.

<table>
<thead>
<tr>
<th>Item No</th>
<th>Description Of Item</th>
<th>Total Qty</th>
<th>Unit</th>
<th>Rate in Figures (Rs)</th>
<th>Rate in Words (Rs)</th>
<th>Amount in Figures (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Concrete/ RCC Work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.01</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>2.00</td>
<td>cum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size)</td>
<td>50.00</td>
<td>cum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.02</td>
<td>Reinforced cement concrete work in beams, suspended floors, roofs having slope up to 15°, landings, balconies, shelves, chajjas, lintels, bands, plain window sills, staircases and spiral stair cases up to floor five level excluding the cost of centering, shuttering, finishing and reinforcement with 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).</td>
<td>5.00</td>
<td>cum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.03</td>
<td>Centering and shuttering including strutting, propping etc. and removal of form for:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Shelves (Cast in situ)</td>
<td>30.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>lintels, beams, plinth beams, girders, bressumers and cantilevers.</td>
<td>30.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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**PROJECT NAME:** Renovation and facelift of CCU in AIIMS, New Delhi.

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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>c) Small lintels not exceeding 1.5m clear span, moulding as in cornices, window sills, string courses, bands, copings, bed plates, anchor blocks and the like.</td>
<td>5.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.04</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Thermo-Mechanically Treated bars</td>
<td>500.00</td>
<td>Kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
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# Project Name: Renovation and Facelift of CCU in AIIMS, New Delhi

## Bill of Quantities

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<tbody>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2.00</td>
<td><strong>BRICK WORK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.01</td>
<td>Brick work with F.P.S. bricks of class designation 75: in superstructure above plinth level up to floor V level in all shapes and sizes in:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Cement mortar 1:6 (1 cement: 6 coarse sand)</td>
<td>20.00</td>
<td>cum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.02</td>
<td>Half brick masonry with F.P.S. bricks of class designation 75 in superstructure above plinth level up to floor V level.</td>
<td>150.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Cement mortar 1:4 (1 cement :4 coarse sand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.03</td>
<td>Extra for providing and placing in position 2 Nos. 6mm dia. M.S. bars at every third course of half brick masonry (with F.P.S. bricks).</td>
<td>150.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
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<th>Rate in Words (Rs)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>3.00</td>
<td><strong>DOORS, WINDOWS AND PARTITIONS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.01</td>
<td>Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections / appropriate Z sections and other sections of approved make conforming to IS: 733 and IS : 1285, fixed with rawl plugs and screws or with fixing clips, or with expansion hold fasteners including necessary filling up of gaps at junctions, at top, bottom and sides with required PVC/neoprene felt etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / panelling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing and panelling to be paid for separately):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.01.1</td>
<td>For fixed portion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Powder coated aluminium (minimum thickness of powder coating 50 micron)</td>
<td>200.00</td>
<td>kg</td>
<td></td>
<td></td>
<td>200,00</td>
</tr>
<tr>
<td>Item No</td>
<td>Description Of Item</td>
<td>Total Qty</td>
<td>Unit</td>
<td>Rate in Figures (Rs)</td>
<td>Rate in Words (Rs)</td>
<td>Amount in Figures (Rs)</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------------------</td>
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<td>--------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>3.01.2</td>
<td>For shutters of doors, windows &amp; ventilators including providing and fixing hinges, pivots and making provision for fixing of fittings wherever required including the cost of PVC / neoprene gasket required (Fittings shall be paid for separately).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Powder coated aluminium (minimum thickness of powder coating 50 micron)</td>
<td>50.00</td>
<td>kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.02</td>
<td>Sandwich windows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>uPVC window frame work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### PROJECT NAME: Renovation and facelift of CCU in AIIMS, New Delhi.

| Item No | Description Of Item                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Total Qty | Unit | Rate in Figures (Rs) | Rate in Words (Rs) | Amount in Figures (Rs) |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Providing and Fixing factory made pristine white (series 3000) Fenesta or approved equivalent high impact modified grade uPVC casement/sliding window / door, made of extruded profiles conforming to BS 7413, BS 7412 and EN 12608 and should pass test of classification P for ignitability and class I for surface spread of flames as per Bs 476 Part 7. The profile shall be a hollow 3- chamber (across depth) profile with an outer wall of min. 1.5 mm thickness. Profiles of frames and sash will be mitered cut and fusion welded at all corners, including drilling of holes for fixing hardware and drainage of water etc., making arrangement for fixing of hardware, EPDM gasket, 2 mm thick galvanised steel profile to be inserted in required profile, frame will be fixed to the wall with 8 mm x 100 mm long fasteners, all complete as per direction of Engineer-in-charge. (Glazing, hardware hinges and fitting etc. to be paid separately.) | 36.00     | Sqm   |                              |                             |                          |

Rate to be quoted for uPVC frame work only. Area of window shall be measured for payment.
## Bill of Quantities

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<th>Amount in Figures (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>i) Providing and fixing automatic/ motorized sandwich glass blind in uPVC door, window and partitions etc. with EPDM/ special gasket etc complete as per architectural drawings and directions of engineer in charge. The blind may be run with automatic control system according to different parameters like outdoor temperature, indoor temperature, time control, light control and sun control.</td>
<td>36.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With two 6 mm thick toughened solar control glass panes and 12 mm air gap (filled with Argon gas) (hermatically sealed units) of approved manufacture and aluminium slats venetian blinds of approved brand and manufacture run with approved motorized system etc all complete as per specifications and direction of engineer in charge. A sample need to be got approved before carrying out the work. Area of unit shall be measured for payment. (The cost to include 5 year warrantee against any defect).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>c) Extra for Remote control option for the above Sandwitch Glass Blind</td>
<td>24.00</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.03 **Sandwich Partitions**
### PROJECT NAME: Renovation and facelift of CCU in AIIMS, New Delhi.

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</table>
| 1       | a) Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections / appropriate Z sections and other sections of approved make conforming to IS: 733 and IS : 1285, fixed with rawl plugs and screws or with fixing clips, or with expansion hold fasteners including necessary filling up of gaps at junctions, at top, bottom and sides with required PVC/neoprene felt etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, imported Aluminium snap beading for sandwich glass panels, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing and panelling to be paid for separately) :  

| i) Anti-bacterial Powder coated aluminium partition (minimum thickness of powder coating 50 micron) as per specification | 490.00   | Kg   |

| b) Providing and fixing motorized (switch operation) sandwich glass blind in uPVC /aluminium/SS door, window and partitions etc. with complete motorized system to run the blind and EPDM/ special gasket etc. complete as per architectural drawings and directions of Engineer in charge. | 490.00   | Kg   |
# Project Name: Renovation and facelift of CCU in AIIMS, New Delhi.

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<tbody>
<tr>
<td>1</td>
<td>i) With two 6 mm thick toughened clear glass panes (hermatically sealed units) of approved manufacture and aluminium slats venetian blinds of approved brand and manufacture run with approved motorized system (switch operation) etc all complete as per specifications and direction of engineer in charge. A sample need to be got approved before carrying out the work. Area of unit shall be measured for payment. (The cost to include 5 year warrantee against any defect).</td>
<td>130.00 Sqm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Extra for Remote control option for Sandwich Glass Blind</td>
<td>45.00</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Sliding Door Frame</td>
<td></td>
<td></td>
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<tbody>
<tr>
<td>1</td>
<td>Providing and fixing stainless steel (Grade 304) sliding door of approved size, design, brand and manufacture using suitable extruded sections made from 1.20 mm SS sheet making section of 100x50 mm (min.) or as approved by engineer in charge, for top rail, bottom rail and side rails, to hold sandwich glass blind (to be paid for separately), including welding, buffing, polishing and fitting the same with necessary SS nuts bolts screws etc. The door shall run on a suitable floor sliding arrangement of approved brand and manufacture, etc all complete including all hardware handles, lock etc complete to the entire satisfaction of engineer in charge. Area of door shall be measured for payment. (Manual sliding system shall be paid for extra)</td>
<td>60.00</td>
<td>Sqm</td>
<td>60.00</td>
<td>60.00</td>
<td>3600.00</td>
</tr>
<tr>
<td>e)</td>
<td>Extra for complete Manual door sliding system (Load capacity about 120 kg) of approved brand and manufacture</td>
<td>21.00</td>
<td>Each</td>
<td>21.00</td>
<td>21.00</td>
<td>434.00</td>
</tr>
<tr>
<td>3.04</td>
<td>Providing and fixing ISI marked flush door shutters conforming to IS: 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters:</td>
<td></td>
<td></td>
<td></td>
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<tbody>
<tr>
<td>3.05</td>
<td>Extra for providing lipping with 2nd class teak wood battens 25 mm minimum depth on all edges of shutters (overall area of door shutter to be measured) Over item no. 9.20 and 9.21.</td>
<td>30.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td>30.00</td>
</tr>
<tr>
<td>3.06</td>
<td>Extra for providing vision panel not exceeding 0.1 sqm in all type of flush doors (cost of glass excluded) (overall area of door shutter to be measured) :</td>
<td>30.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td>30.00</td>
</tr>
<tr>
<td>a)</td>
<td>Rectangular or square.</td>
<td>20.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.07</td>
<td>Providing &amp; Fixing decorative high pressure laminated sheet of plain / wood grain in gloss / matt / suede finish with high density protective surface layer and reverse side of adhesive bonding quality conforming to IS : 2046 Type S including cost of adhesive of approved quality.</td>
<td>60.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td>60.00</td>
</tr>
<tr>
<td>a)</td>
<td>1.0 mm thick.</td>
<td>60.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.08</td>
<td>Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions etc. with PVC/ neoprene gasket etc. complete as per the architectural drawings and the directions of engineer-in-charge. (Cost of aluminium snap beading shall be paid in basic item) :</td>
<td>10.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td>10.00</td>
</tr>
<tr>
<td>a)</td>
<td>With float glass panes of 5.50 mm thickness</td>
<td>10.00</td>
<td>Sqm</td>
<td></td>
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## PROJECT NAME: Renovation and facelift of CCU in AIIMS, New Delhi.

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<tr>
<td>3.09</td>
<td>Providing and Fixing approved manufacture 12 mm thick Corian® or equivalent White Cap colour sheets wall cladding on a Frame work of Aluminum Box Sections and Marine Ply Substrate as specified below: Providing and fixing aluminum sections preferably box sections of 50mm x 25mm x 3mm thick aluminum on the walls so as to form a grid of 760mm x 600mm with section running all along the perimeter of the wall including screwing the sections together with Aluminum angle of 25x25x25x3mm and CP/SS self drilling counter sunk screws of approved quality. The Aluminum sections to be fixed directly to the wall with Metal anchor fasteners of approved quality with a pull out strength around 180 Kg. Insulation: Filling 8Kg Density 75mm thick DuPont Tyvek-subtex or approved equivalent, in between two panels on either side of the frame. Substrate: providing and fixing approved quality 12mm thick marine ply of approved brand and manufacture on the Aluminum frame. Marine ply should be fixed in staggered format and should go up from floor to the ceiling level and from one end to the other.</td>
<td></td>
<td></td>
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**PROJECT NAME:** Renovation and facelift of CCU in AIIMS, New Delhi.

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</thead>
<tbody>
<tr>
<td>1</td>
<td>Providing and fixing Corian® White Cap sheets (or approved equivalent), with structural silicon of approved quality on the marine ply substrate. The Corian panel should start from floor level and go up to the ceiling level and from one end of the wall to the other to meet panel coming from the perpendicular wall. A cove joint (cove dia 100 mm approx.) to be provided at the internal corners while all external corners to be rounded. Join the two panels of Corian with a matching adhesive as described in the fabrication manual of the manufacturer. Finish the joints between two sheets as per the procedure recommended by manufacturer to give a inconspicuous seam on the wall. Make provisions for expansion joints if required. Fabrication of Corian® white cap color to be done by manufacturer authorized fabricator and/or as approved by engineer only.</td>
<td>3</td>
<td>Sqm</td>
<td>400.00</td>
<td></td>
<td>400.00</td>
</tr>
</tbody>
</table>

3.10 Providing and Fixing Partitions made of approved manufacture 12 mm thick Corian® or equivalent White Cap colour sheets on either side of Frame work made of Aluminum Box Sections with Marine Ply Substrate as specified below:
# PROJECT NAME: Renovation and facelift of CCU in AIIMS, New Delhi.

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</thead>
<tbody>
<tr>
<td>1</td>
<td>Framing: Providing and fixing angles of 25mm x 50mm x 3mm with 25mm side facing towards ceiling and floor on either side of the ceiling line so as to leave a 50mm gap in between the two vertical flanges of the angles. Fix an aluminum section of 50mm x 50mm x 3mm at every 750mm in between the angles and erect them vertically from floor to ceiling between the floor line and ceiling line. Fix a horizontal box sections (50x50x3 mm) of 760mm width at every 600mm from floor between two vertical aluminium sections. Screw the sections together with Aluminum angle of 25x25x25x3 mm and CP/SS self-drilling counter sunk screws of good quality. The Aluminum Angle sections to be fixed to the Floor and Ceiling with Metal anchor fasteners of approved quality with a pull out strength around 180 Kg. Insulation: Fill 8Kg Density 75mm thick Tyvek-subtex or approved equivalent, in between two panels of ply Substrate: Providing and fixing 12mm thick marine plywood of approved quality on either side of the Aluminum frame. Marine ply should be fixed in staggered format and should go up from floor to the ceiling.</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Item No</td>
<td>Description Of Item</td>
<td>Total Qty</td>
<td>Unit</td>
<td>Rate in Figures (Rs)</td>
<td>Rate in Words (Rs)</td>
<td>Amount in Figures (Rs)</td>
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<td>------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Cladding: providing and fixing Corian® White Cap sheets with structural silicon of approved quality on the marine ply substrate on either side of the frame. The Corian panel should start from floor level and go up to the ceiling level and from one end of the wall to the other to meet panel coming from the perpendicular wall. A cove joint (cove dia 100 mm approx.) to be provided at the internal corners while all external corners to be rounded. Join the two panels of Corian with a matching adhesive of approved quality as recommended in the fabrication manual of the manufacturer. Finish the joints between two sheets as per the procedure recommended by the manufacturer to give an inconspicuous seam on the wall. Make provisions for expansion joints if required. Fabrication of Corian® white cap color to be done by authorized manufacturer fabricators or as approved by engineer in charge, only.</td>
<td>220.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td></td>
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Cladding: providing and fixing Corian® White Cap sheets with structural silicon of approved quality on the marine ply substrate on either side of the frame. The Corian panel should start from floor level and go up to the ceiling level and from one end of the wall to the other to meet panel coming from the perpendicular wall. A cove joint (cove dia 100 mm approx.) to be provided at the internal corners while all external corners to be rounded. Join the two panels of Corian with a matching adhesive of approved quality as recommended in the fabrication manual of the manufacturer. Finish the joints between two sheets as per the procedure recommended by the manufacturer to give an inconspicuous seam on the wall. Make provisions for expansion joints if required. Fabrication of Corian® white cap color to be done by authorized manufacturer fabricators or as approved by engineer in charge, only.
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<tr>
<td>3.11</td>
<td>Providing and fixing Guard Rail as specified here; Fix Aluminum box section of 4” x 1.5” 3mm thick horizontally along the wall at a height of 1200mm from the floor level. Fix a Marine ply of 18mm thickness and 6” wide on the panel with self driven counter sunk screws. Paste approved make Corian® or approved equivalent Beige-Fieldstone color ( 8” wide and with lips 1.5” on top and bottom curving towards the wall ) with help of Structural Silicon. Finish the joints as per the procedure recommended by the manufacturer to give an inconspicuous seam on the Guard Rail.</td>
<td>30.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.12</td>
<td>Providing and fixing signages made out of Corian or equivalent material where the desired text in desired format and size is engraved with C n C equipment on to 12mm thick approved manufacture Corian ® or approved equivalent of Glacier White Color. The engraved text is then inlayed with approved manufacture Corian® or approved equivalent Cocoa Brown / Pompeii Red color or as desired by engineer in charge and matching joint adhesive. The Signage when dry is finished to the desired level of gloss / matt. Provisions are made for hanging / displaying the signage.</td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>The Signage when dry is finished to the desired level of gloss / matt. Provisions are to be made for hanging / displaying the signage using CP brass/ stainless steel hangers at no extra cost.</td>
<td>1.00</td>
<td>Sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.13</td>
<td>Providing and fixing IS : 3564 marked Aluminium die-cast body tubular type universal hydraulic door closer with necessary accessories and screws etc. complete.</td>
<td>15.00</td>
<td>each</td>
<td></td>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td>3.14</td>
<td>Providing and fixing aluminium sliding door bolts ISI marked anodised (anodic coating not less than grade AC 10 as per IS: 1868) transparent or dyed to required colour or shade with nuts and screws etc. complete:</td>
<td>15.00</td>
<td>each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>250x16 mm</td>
<td>15.00</td>
<td>each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.15</td>
<td>Providing and fixing aluminium tower bolts ISI marked anodised (anodic coating not less than grade AC 10 as per IS : 1868 ) transparent or dyed to required colour or shade with necessary screws etc. complete:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>250x10 mm</td>
<td>30.00</td>
<td>each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>150x10 mm</td>
<td>30.00</td>
<td>each</td>
<td></td>
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<tr>
<td>3.16</td>
<td>Providing and fixing aluminium hanging floor door stopper ISI marked anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour and shade with necessary screws etc. complete.</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Twin rubber stopper</td>
<td></td>
<td></td>
<td>15.00 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.17</td>
<td>Providing and fixing stainless steel (SS 304 grade) adjustable friction windows stays of approved quality with necessary stainless steel screws etc. to the side hung windows as per direction of Engineer-in-charge complete.</td>
<td>10</td>
<td></td>
<td>10.00 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>255 X 19 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.18</td>
<td>Extra for Providing etching on glass panes in doors, windows shutters, partition etc in desired pattern complete as per drawing and as directed,(Area of etching shall be measured for payment)</td>
<td>50</td>
<td></td>
<td>50.00 sqm</td>
<td></td>
<td></td>
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</thead>
<tbody>
<tr>
<td>3.19</td>
<td>Providing and fixing of Hollow metal door at all levels from ISO 9001-2000 certified Manufacturer. All hollow metal general doors with or without vision panel, Pressed Galvanised steel Single /Double leaf to required sizes of approved make which consists of frame, shutter, infill and finish as detailed below and conforming to IS 277. Door frame shall be Single rebate profile of size 100 x 57 mm made out of 1.25mm thick galvanised steel sheet (18 gauge). Frames should be Mitered and field assembled with self tabs. All doors should be factory prepared for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks and door closers. Frames should be provided with back plate brackets and anchor fasteners for installation on required nos of masonry wall opening. Once frame installed should be grouted with cement slurry if recommended on the clear masonry opening.</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>7</td>
</tr>
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<tr>
<td>1</td>
<td>Door leaf should be 46mm thick fully flush double skin door with or without vision lite. Door leaf shall be manufactured from 0.8mm (22 gauge) thick galvanised steel sheet. The internal construction of the door should be rigid with steel stiffeners/ pads and reinforcement. The infill material shall be resin bonded honeycomb core. All doors should be factory prepared for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, and door closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite where ever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned glass. Doors shall be fixed to frame with required numbers of SS Ball Bearing Butt hinges 101 X 89 X 3 mm of approved brand and manufacture.closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned glass. Doors shall be fixed to frame with required numbers of SS Ball Bearing Butt hinges 101 X 89 X 3 mm of approved brand and manufacture.closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned glass. Doors shall be fixed to frame with required numbers of SS Ball Bearing Butt hinges 101 X 89 X 3 mm of approved brand and manufacture.closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned glass. Doors shall be fixed to frame with required numbers of SS Ball Bearing Butt hinges 101 X 89 X 3 mm of approved brand and manufacture.closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned glass. Doors shall be fixed to frame with required numbers of SS Ball Bearing Butt hinges 101 X 89 X 3 mm of approved brand and manufacture.closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned glass. Doors shall be fixed to frame with required numbers of SS Ball Bearing Butt hinges 101 X 89 X 3 mm of approved brand and manufacture.closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be asper joinery details with screws on glass beeding on the inside. The glass should be 5mm clear toughned gla</td>
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**PROJECT NAME:** Renovation and facelift of CCU in AIIMS, New Delhi.

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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All doors and frames shall be finished with etched primer coating, stove zinc phosphate primer and thermosetting polyurethane aliphatic grade paint of approved colour. The door leaf and frame shall have passed minimum 250 hours of salt sprey test.</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rate should include supply and installation of door/Shutter, Frame and hardware as mentioned above. Payment shall be made per sqm of door opening.</td>
<td>12.00</td>
<td>sqm</td>
<td></td>
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**Total**
## Project Name: Renovation and Facelift of CCU in AIIMS, New Delhi.

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<tbody>
<tr>
<td>4.00 Flooring</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.01 Marble stone flooring with pre-polished marble stone of approved quality (sample of marble shall be approved by Engineer-in-charge) over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with grey cement slurry including rubbing and polishing complete with:</td>
<td>600.00 sqm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Factory processed, pre-polished, surface calibrated 20 mm thick natural marble stone of approved quality (Base rate Rs 300 per sft). Base rate includes the cost of material FAR site inclusive of all taxes.</td>
<td>600.00 sqm</td>
<td></td>
<td></td>
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</table>

<p>| 4.02 Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption's less than 0.08% and conforming to IS : 15622 of approved make in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand) including grouting the joints with white cement and matching pigments etc., complete. | 70.00 sqm |          |      |                      |                    |                       |
| a) Size of Tile 60x60 cm                     | 70.00 sqm |          |      |                      |                    |                       |</p>
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<tbody>
<tr>
<td>4.03</td>
<td>Marble stone work in skirting, risers of steps and dado with pre-polished marble stone of approved quality (sample of marble shall be approved by Engineer-in-charge) (upto ceiling height) over 12 mm thick bed of cement mortar 1:3 (1 cement :3 coarse sand) and jointed with white cement slurry @ 3.3 kg/sqm including pointing in white cement mixed with pigment of matching shade complete.</td>
<td>400.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Factory processed, pre-polished, surface calibrated 20 mm thick natural marble stone of approved quality (Base rate Rs 300 per sqft). Base rate includes the cost of material FAR site inclusive of all taxes.</td>
<td></td>
<td></td>
<td>400.00</td>
<td>sqm</td>
<td></td>
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<tr>
<td>4.04</td>
<td>Providing and laying vitrified tiles in different sizes (thickness to be specified by the manufacturer) with water absorption's less than 0.08% and conforming to IS : 15622 of approved make in all colours and shades, in skirting, risers of steps and dado over 12 mm thick bed of cement mortar 1:3 (1 cement :3 coarse sand) including grouting the joints with white cement and matching pigments etc., complete.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Size of Tile 60x60 cm</td>
<td>80.00</td>
<td>sqm</td>
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<tbody>
<tr>
<td>4.05</td>
<td>Providing and fixing 18mm thick gang saw cut mirror (polished premoulded and prepolished) machine cut for work platforms, vanity counters, window sills, facias and similar locations of required size of approved shade, colour and texture laid over 20mm thick base cement mortar 1:4 (1 cement : 4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, moulding and polishing to edge to give high gloss finish etc. complete at all levels</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Granite of any colour and shade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i Area of slab over 0.50 sqm.</td>
<td>30.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.06</td>
<td>Extra for providing edge moulding to 18mm thick Granite stone counters, Vanities etc. including machine polishing to edge to give high gloss finish etc. complete as per design approved by Engineer-in-Charge.</td>
<td>30.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Granite work.</td>
<td>30.00</td>
<td>metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.07</td>
<td>Extra for fixing marble /granite stone over and above corresponding basic item, in facia and drops of width upto 150 mm with epoxy resin based adhesive including cleaning etc. complete.</td>
<td>30.00</td>
<td></td>
<td></td>
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<td>------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Extra for providing opening of required size &amp; shape for wash basins/kitchen sink</td>
<td>6.00</td>
<td>Nos</td>
<td>6.00</td>
<td>No</td>
<td>#REF!</td>
</tr>
<tr>
<td></td>
<td>in kitchen platform, vanity counters and similar location in marble/Granite/stone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>work including necessary holes for pillar taps etc. including rubbing and polishing</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>of cut edges etc. complete.</td>
<td></td>
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<td></td>
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## Project Name: Renovation and Facelift of CCU in AIIMS, New Delhi.

**Bill of Quantities**

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<th>Amount in Figures (Rs)</th>
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<tbody>
<tr>
<td>5.00</td>
<td><strong>Finishing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.01</td>
<td>Providing and fixing Insulated double skin walkable totally flush sandwich panel false ceiling having PCGI sheet panels of suitable sizes designed according to room size made with stand alone two layers of Pre Coated GI (Pre coating on the sheet to be done with polyester of 18-20 micron along with the protective coating on outer side and epoxy coating of 7-8 micron on the inner side) sheets having thickness of 0.8 mm each and injected with Polyurethane Foam forming 50mm composite thickness having effective thermal insulation and higher compressive strength including filling of all joints and cavities with epoxy filler and sanded flush to provide a seamless finish, with antibacterial and antifungal paint with 300 micron thickness with suitable suspension material in anodised (thickness of anodising not less than 15 micron) aluminium of min. 18 gauge thickness, turn buckles, threaded rods and other hardware for easy and faster levelling of the system, factory finished and sealed cut outs of required sizes for filters, light fixtures etc. all complete as per drawing and to the sat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>(PUF density : 40 ± 2 kg/m3, K value (Temperature Conductivity at 0oC : 0.018 KCal/m-hm/oC ).</td>
<td>500.00</td>
<td>sqm</td>
<td></td>
<td></td>
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<tbody>
<tr>
<td>5.02</td>
<td>12 mm cement plaster of mix:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>1:6 (1 cement: 6 fine sand)</td>
<td></td>
<td></td>
<td>250.00</td>
<td>sqm</td>
<td></td>
</tr>
<tr>
<td>5.03</td>
<td>15 mm cement plaster on the rough side of single or half brick wall of mix:</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>1:6 (1 cement: 6 fine sand)</td>
<td></td>
<td></td>
<td>250.00</td>
<td>sqm</td>
<td></td>
</tr>
<tr>
<td>5.04</td>
<td>6 mm cement plaster of mix:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>1:3 (1 cement: 3 fine sand)</td>
<td></td>
<td></td>
<td>200.00</td>
<td>sqm</td>
<td></td>
</tr>
<tr>
<td>5.05</td>
<td>Providing and applying plaster of paris putty of 2 mm thickness over plastered surface to prepare the surface even and smooth complete</td>
<td></td>
<td></td>
<td>700.00</td>
<td>sqm</td>
<td></td>
</tr>
<tr>
<td>5.06</td>
<td>Painting with synthetic enamel paint of approved brand and manufacture of required color to give an even shade:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Two or more coats on new work over an under coat of suitable shade with ordinary paint of approved brand and manufacture.</td>
<td></td>
<td></td>
<td>50.00</td>
<td>sqm</td>
<td></td>
</tr>
<tr>
<td>5.07</td>
<td>Wall painting with plastic emulsion paint of approved brand and manufacture to give an even shade:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Two or more coats on new work</td>
<td></td>
<td></td>
<td>700.00</td>
<td>sqm</td>
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<tbody>
<tr>
<td>1</td>
<td>5.08 Applying one coat of cement primer of approved brand and manufacture on wall surface:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Cement primer.</td>
<td>700.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
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<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>6.00</strong></td>
<td>MISCELLANEOUS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.01</td>
<td>Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer-in-charge.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>1:3:6 or richer mix</td>
<td></td>
<td></td>
<td>10.00</td>
<td><strong>Rs. 10.00</strong></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>1:4:8 or leaner mix</td>
<td></td>
<td></td>
<td>50.00</td>
<td><strong>Rs. 50.00</strong></td>
<td></td>
</tr>
<tr>
<td>6.02</td>
<td>Demolishing R.C.C. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge.</td>
<td></td>
<td></td>
<td>10.00</td>
<td><strong>Rs. 10.00</strong></td>
<td></td>
</tr>
<tr>
<td>6.03</td>
<td>Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>In cement mortar</td>
<td></td>
<td></td>
<td>20.00</td>
<td><strong>Rs. 20.00</strong></td>
<td></td>
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<tr>
<td>6.04</td>
<td>Dismantling doors, windows and clerestory windows (steel or wood) shutter including chowkhats, architrave, holdfasts etc. complete and stacking within 50 metres lead :</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>Of area 3 sq. metres and below</td>
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<td></td>
<td>10.00</td>
<td><strong>Rs. 10.00</strong></td>
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<tbody>
<tr>
<td>6.05</td>
<td>Dismantling tile work in floors and roofs laid in cement mortar including stacking material within 50 metres lead.</td>
<td>50.00</td>
<td>sqm</td>
<td></td>
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<tr>
<td>a)</td>
<td>For thickness of tiles 10 mm to 25 mm</td>
<td>50.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>For thickness of tiles above 25 mm and upto 40 mm</td>
<td>50.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6.06</td>
<td>Dismantling stone slab flooring laid in cement mortar including stacking of serviceable material and disposal of unserviceable material within 50 metres lead.</td>
<td>800.00</td>
<td>sqm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6.07</td>
<td>Dismantling cement asbestos, Celotax or other hard board ceiling or partition walls including stacking of serviceable materials and disposal of unserviceable materials within 50 metres lead.</td>
<td>600.00</td>
<td>sqm</td>
<td></td>
<td></td>
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<tr>
<td>6.08</td>
<td>Dismantling old plaster or skirting raking out joints and cleaning the surface for plaster including disposal of rubbish to the dumping ground within 50 metres lead.</td>
<td>500.00</td>
<td>sqm</td>
<td></td>
<td></td>
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<tr>
<td>6.09</td>
<td>Dismantling aluminium/ Gypsum partitions, doors, windows, fixed glazing and false ceiling including disposal of unserviceable surplus material and stacking of serviceable material with in 50 meters lead as directed by Engineer-in-charge.</td>
<td>150.00</td>
<td>sqm</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
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<td>Concrete/ RCC Work</td>
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<td>BRICK WORK</td>
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<td>3</td>
<td>DOORS &amp; WINDOWS</td>
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<tr>
<td>4</td>
<td>FLOORING</td>
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</tr>
<tr>
<td>5</td>
<td>FINISHING</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MISCELLANEOUS</td>
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<tr>
<td></td>
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BILL OF QUANTITIES (B.O.Q.)

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<th>Rate in words (in Rupees)</th>
<th>Rate in figures (in Rs.)</th>
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<tr>
<td>Note: Based on tender drawings the agency has to prepare the internal &amp; external plumbing shop drawing and obtain the approval of the same before execution.</td>
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<tr>
<td><strong>1.00</strong></td>
<td><strong>SANITARY FIXTURES</strong></td>
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<tr>
<td><strong>1.01</strong></td>
<td><strong>17.1</strong></td>
<td>Providing &amp; fixing water closet squatting pan (Indian W.C. Pan) with 100 mm sand cast iron P or S strap, 10 litre low level white P.V.C flushing cistern with manually controlled device (handle lever) conforming to IS:7231 with all fittings &amp; fixture complete including cutting and making good the walls &amp; floors wherever required.</td>
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<tr>
<td></td>
<td><strong>17.1.1</strong></td>
<td>White vitreous china orissa pattern W.C. pan of size 580 x 440 mm with integral type foot rests</td>
<td>Each</td>
<td>1</td>
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<tr>
<td><strong>1.02</strong></td>
<td><strong>17.3</strong></td>
<td>Providing and fixing white vitreous china pedestal type water closet (European type) with seat and lid, 10 litre low level white vitreous flushing cistern and C.P. flush bend with fittings &amp; C.I. brackets, 40mm flush bend, overflow arrangement with specials of standard make and mosquito proof coupling of approved municipal design complete including painting of fittings and brackets, cutting and making good the walls and floors wherever required:</td>
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<tr>
<td></td>
<td><strong>17.3.2</strong></td>
<td>W.C. pan with ISI black solid plastic seat &amp; lid.</td>
<td>Each</td>
<td>4</td>
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</table>
### Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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</tr>
</thead>
<tbody>
<tr>
<td>1.03</td>
<td>17.4</td>
<td>Providing and fixing white vitreous China flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I. clamps complete, including painting or fittings and brackets, cutting and making good the walls and floors wherever required.</td>
<td>Each</td>
<td>2</td>
<td>17.4</td>
<td>34.8</td>
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<tr>
<td>a)</td>
<td>17.4.1</td>
<td>One urinal basin with 5 litre white PVC automatic flushing cistern</td>
<td>Each</td>
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<tr>
<td>1.04</td>
<td>17.7</td>
<td>Providing and fixing wash basin with C.I. brackets, 15mm C.P. brass pillar taps, 32mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required:</td>
<td>Each</td>
<td>6</td>
<td>17.7</td>
<td>106.2</td>
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<tr>
<td>a)</td>
<td>17.7.3</td>
<td>White vitreous china wash basin size 550x400 mm with a pair of 15mm C.P. brass pillar tap.</td>
<td>Each</td>
<td>6</td>
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<tr>
<td>1.05</td>
<td>17.10</td>
<td>Providing and fixing Stainless Steel A ISI 304 (18/8) kitchen sink as per IS 13983 with C.I. brackets and stainless steel plug 40 mm including painting of fittings and brackets, cutting and making good the walls wherever required:</td>
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<td>17.10</td>
<td>17.10</td>
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<tr>
<td>a)</td>
<td>17.10.1.3</td>
<td>510x1040 mm bowl depth 200mm. With drain board</td>
<td>Each</td>
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<td>1.06</td>
<td>17.16</td>
<td>Extra for using coloured pedestal type W.C. pan (European type) with low level cistern of same colour instead of white vitreous china W.C. pan and cistern</td>
<td>Each</td>
<td>4</td>
<td>17.16</td>
<td>68.4</td>
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## Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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<tbody>
<tr>
<td>1.07</td>
<td>17.32</td>
<td>Providing and fixing superior glass (of approved quality) and of required shape and size with plastic moulded frame of approved make and shape with 6 mm thick hard board backing.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>a) 17.32.2 Rectangular shape 453x357 mm</td>
<td>Each</td>
<td>6</td>
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<tr>
<td></td>
<td></td>
<td>NS Rectangular shape of any size (as per drawing)</td>
<td>Sqmt</td>
<td>2</td>
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<tr>
<td>1.08</td>
<td>17.34</td>
<td>Providing and fixing toilet paper holder.</td>
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<tr>
<td></td>
<td></td>
<td>a) 17.34.2 Vitreous china</td>
<td>Each</td>
<td>4</td>
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<tr>
<td>1.09</td>
<td>NS</td>
<td>Providing and fixing liquid soap dispenser about 100ml capacity SS body and push button complete.</td>
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<tr>
<td>1.10</td>
<td>NS</td>
<td>Providing and Fixing WC jet with SS plate graded 304 - 18/8 and nylon braided pipe complete.</td>
<td>Each</td>
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<tr>
<td>1.11</td>
<td>NS</td>
<td>Providing and fixing CP brass towel rail size of 600x20 mm of approved make complete with CP brackets fixed to wooden cleats with CP brass screws</td>
<td>Each</td>
<td>6</td>
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<tr>
<td>1.12</td>
<td>NS</td>
<td>Providing and fixing brass coat hook of approved quality and make complete with material of fixing</td>
<td>Each</td>
<td>10</td>
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<tr>
<td>1.13</td>
<td>NS</td>
<td>Extra for providing and fixing white vitreous china oval shape wash basin in place of normal wash basin with CI/MS brackets painted white, 15 mm CP brass pillar taps, 32 mm CP brass waste of standard pattern, including painting of fittings and brackets cutting and making good the walls wherever required</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>a) Counter top oval shape wash basin size 550x470 mm with centre tap hole, single 15 mm CP brass swan neck type pillar tap</td>
<td>Each</td>
<td>4</td>
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<td>Amount in figures (in Rs.)</td>
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<tr>
<td>1.14</td>
<td>Providing and fixing stainless steel grab bar 25mm dia. of required length with PVC cleats, C.P. brass screws etc. complete.</td>
<td>RM</td>
<td>4</td>
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<tr>
<td>1.15</td>
<td>Extra for white vitreous china wall hung type water closet (European type) in place of normal pedestal type water closet &amp; 10 lts. flushing cistern (DSR item 17.3) with white solid plastic seat and lid concealed flushing cistern 9 ltr. capacity (min) approximate size (400x300x100) comprising of SS actuating panel with dual flush with fittings, specials of standard make (Viega, ACO, Kohler, Jaquar) and complete including painting, cutting and making good the walls and floors wherever required:</td>
<td>Each</td>
<td>4</td>
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<tr>
<td>1.16</td>
<td>Providing and fixing bowl type water less urinal including 6 no. additional cartige &amp; spare, cutting and making good the walls complete in all respect as per drawing / sample approved by Engineer-in-charge</td>
<td>Each</td>
<td>2</td>
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**SUB TOTAL (SANITARY FIXTURES)**
Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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<th>Amount in figures(in Rs.)</th>
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<td>2.00</td>
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<td>SOIL, WASTE AND VENT PIPES</td>
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<td>Providing and fixing soil, waste and vent pipes.</td>
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<tr>
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<td>a)</td>
<td>17.35.1</td>
<td>100 mm dia.</td>
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<tr>
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<td>a i)</td>
<td>17.35.1.2</td>
<td>Centrifugally cast (spun) iron socketed pipe as per IS:3989</td>
<td>Metre</td>
<td>300</td>
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<tr>
<td></td>
<td>b)</td>
<td>17.35.2</td>
<td>75 mm dia</td>
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<tr>
<td></td>
<td>b i)</td>
<td>17.35.2.2</td>
<td>Centrifugally cast (spun) iron socketed pipe as per IS:3989</td>
<td>Metre</td>
<td>50</td>
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<tr>
<td>2.02</td>
<td>17.37</td>
<td>Providing and fixing M.S holder-bat clamps of approved design to Sand Cast iron/ cast iron (spun) pipe embedded in and including cement concrete blocks 10x10x10 cm of 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) including cost of cutting holes and making good the walls etc.</td>
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<td></td>
<td>a)</td>
<td>17.37.1</td>
<td>for 100 mm dia. pipe</td>
<td>Each</td>
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<td>b)</td>
<td>17.37.2</td>
<td>for 75 mm dia. pipe</td>
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<td>17.38</td>
<td>Providing and fixing bend of required degree with access door, insertion rubber washer 3 mm thick, bolts and nuts complete.</td>
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<tr>
<td></td>
<td>a)</td>
<td>17.38.1</td>
<td>100 mm</td>
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<tr>
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<td>a ii)</td>
<td>17.38.1.2</td>
<td>Sand cast iron S&amp;S as per IS-3989</td>
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<td>9</td>
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<tr>
<td></td>
<td>17.38.2</td>
<td>75 mm</td>
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<td>17.38.2.2</td>
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<tr>
<td>2.04</td>
<td>17.39</td>
<td>Providing and fixing plain bend of required degree.</td>
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<td>100 mm</td>
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<td>Providing and fixing heel rest sanitary bend.</td>
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<td>100 mm dia</td>
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<td>17.40.2</td>
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<td>2.06</td>
<td>17.43</td>
<td>Providing and fixing single equal plain junction of required degree with access door, insertion rubber washer 3mm thick, bolts and nuts complete.</td>
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<td>17.44.1.2</td>
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<th>Amount in figures (in Rs.)</th>
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<tbody>
<tr>
<td>2.08</td>
<td>17.55</td>
<td>Providing and fixing door piece, insertion rubber washer 3mm thick, bolts and nuts complete</td>
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<td>a)</td>
<td>17.55.1</td>
<td>100 mm</td>
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<td>2.09</td>
<td>17.56</td>
<td>Providing and fixing terminal guard.</td>
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<td>75 mm</td>
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<td>17.56.2.2</td>
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<td>2.10</td>
<td>17.57</td>
<td>Providing and fixing collar</td>
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<td></td>
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<td>a)</td>
<td>17.57.1</td>
<td>100 mm</td>
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<td>17.57.1.2</td>
<td>Sand cast iron S&amp;S as per IS-3989</td>
<td>Each</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>17.57.2</td>
<td>75 mm</td>
<td></td>
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</tr>
<tr>
<td>b.ii)</td>
<td>17.57.2.2</td>
<td>Sand cast iron S&amp;S as per IS-3989</td>
<td>Each</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>2.11</td>
<td>17.58</td>
<td>Providing lead caulked joints to sand cast iron / centrifugally cast (spun) iron pipes and fittings of diameter:</td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>17.58.1</td>
<td>100 mm</td>
<td>Each</td>
<td>150</td>
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<tr>
<td>b)</td>
<td>17.58.2</td>
<td>75 mm</td>
<td>Each</td>
<td>10</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2.12</td>
<td>17.59</td>
<td>Providing and fixing M.S. stays and clamps for sand cast iron / centrifugally cast (spun) iron pipes of diameter:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>17.59.1</td>
<td>100 mm</td>
<td>Each</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>17.59.2</td>
<td>75 mm</td>
<td>Each</td>
<td>1</td>
<td></td>
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### Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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</tr>
</thead>
<tbody>
<tr>
<td>2.13</td>
<td>17.60</td>
<td>Providing and fixing trap of self cleansing with screwed down or hinged grating with or without vent arm complete, including cost of cutting and making good the walls and floors:</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>17.60.1</td>
<td>100 mm inlet and 100 mm outlet</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>a i)</td>
<td>17.60.1.1</td>
<td>Sand cast iron S&amp;S as per IS-3989</td>
<td>Each</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.14</td>
<td>17.61</td>
<td>Cutting chases in brick masonry walls for following diameter sand cast iron/centrifugally cast (spun) iron pipes and making good the same with cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 12.5 mm nominal size) including necessary plaster and pointing in cement mortar 1:4 (1 cement:4 coarse sand):</td>
<td></td>
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<td></td>
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<tr>
<td>a)</td>
<td>17.61.1</td>
<td>100 mm diameter pipe</td>
<td>Metre</td>
<td>20</td>
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<td></td>
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<tr>
<td>b)</td>
<td>17.61.2</td>
<td>75 mm diameter pipe</td>
<td>Metre</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.15</td>
<td>17.65</td>
<td>Painting sand cast iron / centrifugally cast (spun) iron soil, waste vent pipes and fittings with paint of any colour such as chocolate, grey, or buff etc. over a coat of primer (of approved quality) for new work:</td>
<td></td>
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<tr>
<td>a)</td>
<td>17.65.1</td>
<td>100 mm diameter pipe</td>
<td>Metre</td>
<td>280</td>
<td></td>
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<tr>
<td>b)</td>
<td>17.65.2</td>
<td>75 mm diameter pipe</td>
<td>Metre</td>
<td>45</td>
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<td></td>
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<tr>
<td>2.16</td>
<td>18.7</td>
<td>Providing and fixing CPVC pipes complete with CPVC fittings including painting, jointing, testing the cost of cutting the chases and making good the same for waste water disposal complete as per direction of engineer incharge.</td>
<td></td>
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<tr>
<td>18.7.4</td>
<td></td>
<td>32 mm dia nominal bore (Wash basin to floor trap/floor drain)</td>
<td>Metre</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.7.5</td>
<td></td>
<td>40 mm dia nominal bore (Sink, Urinal to floor trap)</td>
<td>Metre</td>
<td>5</td>
<td></td>
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</tr>
<tr>
<td>18.7.6</td>
<td></td>
<td>50 mm dia nominal bore (Floor Drain to Floor Trap)</td>
<td>Metre</td>
<td>3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2.17</td>
<td>NS</td>
<td>Providing and fixing floor drain points formed out of 65 mm dia GI elbow, including with 75mm dia Stainless Steel grating with frame, embedded in floor, all complete as directed.</td>
<td>Each</td>
<td>2</td>
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<tr>
<td>2.18</td>
<td>NS</td>
<td>Providing and fixing C.P. brass bottle trap for wash basin including CP waste fittings complete 32 mm dia complete in all respect of approved quality.</td>
<td>Each</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.19</td>
<td>NS</td>
<td>Providing and fixing C.P. brass bottle trap for sinks &amp; urinal basin including CP waste fittings complete 40 mm dia complete in all respect of approved quality.</td>
<td>Each</td>
<td>3</td>
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<tr>
<td>2.20</td>
<td>NS</td>
<td>Providing and laying cement concrete 1:2:4 (1 cement:2 coarse sand:4 graded stone aggregate 20 mm nominal size) 80 mm thick all-round the SCI/centrifugally S&amp;S pipe diameter.</td>
<td>a) 100 mm dia</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) 75 mm dia</td>
<td>5</td>
<td></td>
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<tr>
<td>2.21</td>
<td>NS</td>
<td>Providing and fixing dash fastner made of rust proof plated steel for holding the soil/waste supply pipes complete in all respect</td>
<td>a)</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td>2.22</td>
<td>Providing and fixing clean out/floor clean out plug consist of CI bend &amp; GI socket heavy class with cap &amp; key for opening male threaded cap etc. including lead caulked to CI pipes complete in all respects as per drawing/ sample approved by Engineer in -ChargeFCO (floor clean out plug shall be flushed with floor finish)</td>
<td></td>
<td>150/100/75 mm dia</td>
<td>Each 5</td>
<td></td>
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<tr>
<td>2.23</td>
<td>Providing and fixing G.I EXTENSION PIECE for 100 mm dia floor trap formed out of main pipe( Type A) with multiple side inlets, suitable for various dia pipes, side connections, including all fixtures and fittings as per site conditions and as per standard details and water tight sealing of joints and area surrounding the grating and as directed.</td>
<td>Each</td>
<td>6</td>
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**SUB TOTAL(SOIL, WASTE AND VENT PIPES)**
<table>
<thead>
<tr>
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<tr>
<td><strong>3.00</strong></td>
<td>WATER SUPPLY</td>
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<tr>
<td><strong>3.01</strong></td>
<td>18.7</td>
<td>Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes having thermal stability for hot &amp; cold water supply including all CPVC plain &amp; brass threaded fittings i/c fixing the pipe with clamps at 1.0 m spacing. This includes jointing of pipes &amp; fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in charge.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Internal work – Exposed on wall</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>a)</td>
<td>18.7.1</td>
<td>15 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>18.7.2</td>
<td>20 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>20</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>c)</td>
<td>18.7.3</td>
<td>25 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>d)</td>
<td>18.7.4</td>
<td>32 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>18.7.5</td>
<td>40 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>40</td>
<td></td>
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<tr>
<td><strong>3.02</strong></td>
<td>18.8</td>
<td>Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot &amp; cold water supply including all CPVC plain &amp; brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes &amp; fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Concealed work including cutting chases and making good the walls etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>a)</td>
<td>18.8.1</td>
<td>15 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>20</td>
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<tbody>
<tr>
<td>b)</td>
<td>18.8.2</td>
<td>20 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>10</td>
<td>3.03</td>
<td>18.13</td>
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<tr>
<td>c)</td>
<td>18.8.3</td>
<td>25 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>5</td>
<td>3.03</td>
<td>18.13</td>
<td></td>
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<tr>
<td>d)</td>
<td>18.8.4</td>
<td>32 mm nominal outer dia pipes (SDR-11)</td>
<td>Metre</td>
<td>5</td>
<td>3.03</td>
<td>18.13</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Making connection of G.I. distribution branch with G.I. main of following sizes by providing and fixing tee, including, cutting and threading the pipe etc. complete including obtaining approval for connection from DJB/Municipal corporation:</td>
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<td>a)</td>
<td>18.13.2</td>
<td>50 to 80 mm nominal bore (SDR-11)</td>
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<tr>
<td></td>
<td></td>
<td>providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end)</td>
<td></td>
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<tr>
<td>a)</td>
<td>18.17.1</td>
<td>25 mm nominal bore</td>
<td>Each</td>
<td>4</td>
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<td>b)</td>
<td>18.17.2</td>
<td>32 mm nominal bore</td>
<td>Each</td>
<td>2</td>
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<td></td>
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<tr>
<td>c)</td>
<td>18.17.3</td>
<td>40 mm nominal bore</td>
<td>Each</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Providing and fixing ball valve (brass) of approved quality, high or low pressure with plastic floats complete</td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>18.18.2</td>
<td>20mm</td>
<td>Each</td>
<td>2</td>
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<td></td>
<td></td>
<td>Providing and fixing unplasticised PVC connection pipe with brass unions:</td>
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<tr>
<td>a)</td>
<td>18.21.2</td>
<td>45 cm length</td>
<td>Each</td>
<td>18</td>
<td></td>
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<tr>
<td>a i)</td>
<td>18.21.2.1</td>
<td>15 mm nominal bore</td>
<td>Each</td>
<td>18</td>
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<tbody>
<tr>
<td>3.07</td>
<td>18.38</td>
<td>Painting CPVC/G.I. pipes and fittings with synthetic enamel white paint over a ready mixed priming coat, both of approved quality for new work</td>
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<tr>
<td>a)</td>
<td>18.38.1</td>
<td>15 mm nominal outer dia pipes</td>
<td>Metre</td>
<td>20</td>
<td>18.38</td>
<td>20</td>
<td></td>
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<tr>
<td>b)</td>
<td>18.38.2</td>
<td>20 mm nominal outer dia pipes</td>
<td>Metre</td>
<td>20</td>
<td>18.38</td>
<td>20</td>
<td></td>
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<tr>
<td>c)</td>
<td>18.38.3</td>
<td>25 mm nominal outer dia pipes</td>
<td>Metre</td>
<td>20</td>
<td>18.38</td>
<td>20</td>
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<tr>
<td>d)</td>
<td>18.38.4</td>
<td>32 mm nominal outer dia pipes</td>
<td>Metre</td>
<td>20</td>
<td>18.38</td>
<td>20</td>
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<tr>
<td>e)</td>
<td>18.38.5</td>
<td>40 mm nominal outer dia pipes</td>
<td>Metre</td>
<td>40</td>
<td></td>
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<tr>
<td>3.08</td>
<td>18.48</td>
<td>Providing and placing on terrace (at all floor levels) polyethylene water storage tank ISI:12701 marked with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td></td>
<td>Treated water Tank and Untreated water tank</td>
<td>per litre</td>
<td>4000</td>
<td></td>
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<tr>
<td>3.09</td>
<td>18.49</td>
<td>Providing and fixing C.P brass bib cock of approved quality.</td>
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<tr>
<td>a)</td>
<td>18.49.1</td>
<td>15 mm nominal bore</td>
<td>Each</td>
<td>4</td>
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<tr>
<td>3.10</td>
<td>18.50</td>
<td>Providing and fixing C.P. brass long nose bib cock of approved quality conforming to IS standards and weighing not less than 810 gms. (Jaquar 5043, model of equivalent make of Marck &amp; Aquaplus)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>18.50.1</td>
<td>15 mm nominal bore</td>
<td>Each</td>
<td>6</td>
<td></td>
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<td>Amount in figures(in Rs.)</td>
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<tr>
<td>3.11</td>
<td>18. 53</td>
<td>Providing and fixing C.P. brass angle valve for basin mixer and geyser points of approved quality conforming to IS:8931.(Jaquar15053,model of equivalent make of Marck &amp; Aquaplus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>18.53.1</td>
<td>15 mm nominal bore</td>
<td>Each</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.12</td>
<td>18. 62</td>
<td>Providing and fixing PTMT ball cock of approved quality, colour and make complete with Epoxy coated aluminium rod with L.P./H.P.H.D. plastic ball.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>18.62.4</td>
<td>40 mm nominal bore, 206 mm long weighin not less than 690 gms</td>
<td>Each</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.13</td>
<td>18.76</td>
<td>Cutting holes upto 30x30 cm in walls including making good the same</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>18.76.1</td>
<td>with F.P.S bricks</td>
<td>Each</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.14</td>
<td>18. 77</td>
<td>Cutting holes up to 15x15 cm in R.C.C. floors and roofs for passing drain pipe etc. and repairing the hole after insertion of drain pipe etc. with cement concrete 1:2:4 (1 cement:2 coarse sand: 4 graded stone aggregate 20 mm nominal size) including finishing complete so as to make it leak proof</td>
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<td></td>
<td></td>
<td></td>
<td>Each</td>
<td>2</td>
<td></td>
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<tr>
<td>3.15</td>
<td>NS</td>
<td>Providing &amp; fixing full way lever operated forged brass ball valve of brass body with forged brass hard chrome plated steel ball tested to a pressure not less than 10 Kg / sqcm with threaded / flanged joints complete with nuts, bolts, gaskets, washers etc.</td>
<td></td>
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</tr>
<tr>
<td>a)</td>
<td>15 mm diameter</td>
<td></td>
<td>Each</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>20 mm diameter</td>
<td></td>
<td>Each</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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<th>Amount in figures(in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.16</td>
<td>NS</td>
<td>Providing and fixing mosquito proof coupling of approved Municipal design for scour and vent pipes for RCC overhead tanks complete in all respects</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>a) 15 mm diameter</td>
<td>Each</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>b) 20 mm diameter</td>
<td>Each</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>c) 40 mm diameter</td>
<td>Each</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.17</td>
<td>NS</td>
<td>Providing &amp; fixing 9 mm thick thermal insulation tubing of elastomeric flexible material on hot water supply/return pipes having hermetic blistered closed cell structure of expanded synthetic rubber over pipes/fitting as per manufacturer's specifications etc.complete.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>a a) 15 mm to 25 mm diameter</td>
<td>Each</td>
<td>10</td>
<td></td>
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<tr>
<td>3.18</td>
<td>NS</td>
<td>Extra for providing and installing INFRA-RED controlled electrically operated (220V, AC mains) automatic flushing system of approved make instead of urinals with flushing cistern. The automatic flushing system shall comprising of: Light sensing device fixed in recessed metallic box with tamper resistant stainless steel outercase Solenoid valve housed in a recessed metallic box with openable cover mounted at high level (at desired height from finished floor level) complete with interconnecting control wiring in recessed PVC conduit between solenoid valve and sensing unit, including cutting and making good the walls &amp; floor complete and all necessary fittings to make it operational as directed</td>
<td></td>
<td>Each</td>
<td>2</td>
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</tr>
<tr>
<td>Sl. No.</td>
<td>DSR-2007 No.</td>
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<td>Unit</td>
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<td>Rate in words (in Rupees)</td>
<td>Rate in figures (in Rs.)</td>
<td>Amount in figures (in Rs.)</td>
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<tr>
<td>3.19</td>
<td>NS</td>
<td>Providing &amp; fixing solid state fully hygienic no touch hand drier of approved make rated for continuous repeat usage with solid state time delay LSF protection, with independent ambient light level &amp; seasonal control temperatures including providing necessary C.I./M.S. brackets painted with two or three coats of enamel paint of approved shade over a coat of primer, wiring cables from drier to plug, plug tops etc. complete including cutting and making good the walls wherever required.</td>
<td>Each</td>
<td>4</td>
<td></td>
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<tr>
<td>3.20</td>
<td>NS</td>
<td>Supplying, fixing, testing and commissioning of storage type water heater (Geyser) etc. with Stainless steel body, copper container, automatic thermostatic control electric element, pressure release valve, M.S. nuts and bolts etc. conforming to IS: 2082</td>
<td>Each</td>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>b)</td>
<td>25 Litre Capacity</td>
<td></td>
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<tr>
<td>3.21</td>
<td>NS</td>
<td>Providing &amp; fixing water storage cooler of approved make and brand with SS body having minimum flow rate of 40 ltrs. Per hour and storage capacity 40 ltrs. Complete in respects. (VOLTAS/ BLUE-STAR/ USHA SHRIRAM)</td>
<td>Each</td>
<td>1</td>
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### Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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<th>Amount in figures (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.36</td>
<td>NS</td>
<td>Providing and fixing approved make &amp; suitable model of R.O. plant 25 ltrs. Per hour flow rate having capacity to treat the raw water having TDS 1200 ppm and not less than 40%. The treated water should have TDS less than 100 ppm and hardness less than 50 ppm. The operating voltage to 230 volt AC +/- 10% along with required capacity pump and solenoid valves, dry run protection of pump, automatic tank level control, inbuilt auto flush timer for periodic flushing of membranes, hydro pneumatic tank, over voltage and over current protection with switch mode power supply system complete in all respects including installation and fittings with the following provisions: (IONIEXCHANGE/KENT/AQUAPROCESS, Pantair)</td>
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<tr>
<td></td>
<td></td>
<td>a) 10 micron polypropylene sediment pre filter</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>b) 10 micron bacteriostatic activated carbon block on line micron filter with 5 micron rating</td>
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<tr>
<td></td>
<td></td>
<td>c) 3 Nos. of reverse osmosis membrane with 0.0001 micron pore size energy saving poly amide type</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>d) UV lamp of minimum capacity 25 LPM and minimum lamp wattage 9W</td>
<td>Each</td>
<td>1</td>
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SUB TOTAL (Water Supply)
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<tr>
<th>Sl. No.</th>
<th>Description of Item</th>
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<tr>
<td></td>
<td><strong>SEWARAGE &amp; DRAINAGE</strong></td>
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</table>

**4.00**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description of Item</th>
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<tr>
<td>4.01</td>
<td>Providing laying and jointing glazed stoneware pipes grade 'A' with stiff mixture of cement mortar in the proportion of 1:1 (1 cement : 1 fine sand) including testing of joints etc. complete.</td>
</tr>
<tr>
<td></td>
<td><strong>4.02</strong> Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size) all-round S.W. pipes including bed concrete as per standard design:</td>
</tr>
<tr>
<td></td>
<td><strong>4.03</strong> Providing and fixing square-mouth S.W. gully trap grade 'A' complete with C.I. grating, brick masonry chamber with water tight C.I. cover with frame of 300x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design:</td>
</tr>
<tr>
<td></td>
<td><strong>4.04</strong> Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement:2 fine sand) including testing of joints etc. complete</td>
</tr>
</tbody>
</table>

### 4.01 19.1

- **19.1.1** 100 mm diameter

### 4.02 19.2

- **19.2.1** 100 mm diameter S.W. pipe/RCC NP2
- **19.2.2** 150 mm diameter S.W. pipe/RCC NP2

### 4.03 19.4

- **19.4.2** 150x100mm size P type
- **19.4.1.1** F.P.S. Bricks class designation 75

### 4.04 19.6

- **19.6.2** 150 mm dia R.C.c. pipe
## Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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<th>Amount in figures(in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) 19.6.3</td>
<td>250 mm dia R.C.C. pipe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) 19.6.3 250 mm dia R.C.C. pipe</td>
<td></td>
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</tr>
<tr>
<td>4.05</td>
<td>19.7 Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand), R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size), inside plastering 12mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement, and making necessary channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) finished with a floating coat of neat cement complete as per standard design.</td>
<td></td>
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</tr>
<tr>
<td>a) 19.7.1</td>
<td>Inside size 90x80 cm and 45 cm deep including C.I. cover with frame (light duty) 455x610 mm internal dimensions total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg):</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>a i) 19.7.1.1</td>
<td>With F.P.S. bricks with class designation 75</td>
<td>Each</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.06</td>
<td>19.8 Extra depth for manholes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 19.8.1</td>
<td>Size 90 x 80 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a i) 19.8.1.1</td>
<td>With F.P.S. bricks class designation 75</td>
<td>Metre</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sl. No.</td>
<td>DSR-2007 No.</td>
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<tr>
<td>4.07</td>
<td>19. 9</td>
<td>Constructing brick masonry circular type manhole 0.91 m internal dia at bottom and 0.56 m dia at top in cement mortar 1:4 (1 cement :4 coarse sand), in side cement plaster 12 mm thick with cement mortar 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement, foundation concrete 1:3:6 mix (1 cement: 3 coarse sand: 6 graded stone aggregate 40 mm nominal size), and making necessary channel in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement all complete as per standard design: a) 19.9.1 0.91 m deep with S.F.R.C. cover and frame (heavy duty, HD-20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg, fixed in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) including centering shuttering all complete. (Excavation, foot rests and 12 mm thick cement plaster at the external surface shall be paid for separately): a i) 19.9.1.1 With F.P.S. bricks class designation 75 Each 2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.08</td>
<td>19. 10</td>
<td>Extra depth for circular type manhole 0.91 m dia (at bottom) with beyond 0.91 m to 1.67 m a) 19.10.1 With F.P.S. bricks class designation 75 Metre 1</td>
<td></td>
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<tr>
<td>Sl. No.</td>
<td>DSR-2007 No.</td>
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<td>Unit</td>
<td>Total Qty.</td>
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<td>Rate in figures (in Rs.)</td>
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<tr>
<td>4.09</td>
<td>19.16</td>
<td>Providing and fixing orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS: 10910 on 12 mm dia steel bar conforming to IS: 1786 having minimum cross section as 23 mm x 25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to withstand the bend test and chemical resistance test as per specification mark to be visible even after fixing, including fixing in manholes with 30x20x15 cm cement concrete block 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) complete as per design.</td>
<td>Each</td>
<td>10</td>
<td>Each</td>
<td></td>
</tr>
<tr>
<td>4.10</td>
<td>19.21</td>
<td>Making connection of drain or sewer line with existing manhole including breking into and making good the walls, floors with cement concrete 1:2:4 mix (1 cement:2 coarse sand:4 graded stone aggregate 20 mm nominal size) cement plastered on both sides with cement mortar 1:3 (1 cement:3 coarse sand) finished with a floating coat of neat cement and making necessary channels for the drain etc. complete (including obtaining approval from DJB/Municipal corporation a) 19.21.1 For pipes 100 to 230 mm dia</td>
<td>Each</td>
<td>1</td>
<td>Each</td>
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<th>Amount in figures (in Rs.)</th>
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<tbody>
<tr>
<td>4.11</td>
<td>19.27</td>
<td>Constructing brick masonry road gully chamber 50x45x60 cm with bricks of class designation 75 in cement mortar 1:4 (1 cement:4 coarse sand) including 500x450 mm pre-cast R.C.C. horizontal grating with frame complete as per standard design:</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>19.27.1 With F.P.S. bricks</td>
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**SUB TOTAL (SEWERAGE AND DRAINAGE)**
## Name of Work: BOQ of Plumbing work of Renovation of CCU Ward at AIIMS Delhi

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<th>Amount in figures (in Rs.)</th>
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<tr>
<td>5.00</td>
<td>EARTH WORK</td>
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<tr>
<td>5.01</td>
<td>2.6</td>
<td>Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed.</td>
<td></td>
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</tr>
<tr>
<td>a)</td>
<td>2.6.1</td>
<td>All kinds of soil</td>
<td>cum 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.02</td>
<td>2.10</td>
<td>Excavating trenches of required width for pipes, cables, etc including excavation for sockets, and dressing of sides, ramming of bottoms, depth up to 1.5 m including getting out the excavated soil, and then returning the soil as required, in layers not exceeding 20 cm in depth including consolidating each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed, within a lead of 50 m:</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>2.10.1</td>
<td>All kinds of soil</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>a) ii)</td>
<td>2.10.1.2</td>
<td>Pipes, cables etc, exceeding 80 mm dia but not exceeding 300 mm dia</td>
<td>metre</td>
<td>20</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5.03</td>
<td>2.25</td>
<td>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m</td>
<td>cum 2</td>
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**SUB TOTAL (EARTH WORK)**
Name of Work: BOQ of Plumbing work of Renovation of CCU Ward of AIIMS Delhi

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<tr>
<td>A</td>
<td>INTERNAL PLUMBING,</td>
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<td>1. 00</td>
<td>SANITARY FIXTURES</td>
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<td>2. 00</td>
<td>SOIL, WASTE AND VENT PIPES</td>
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<td>3. 00</td>
<td>WATER SUPPLY</td>
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<td>4. 00</td>
<td>SEWERAGE AND DRAINAGE</td>
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<td>5. 00</td>
<td>EARTH WORK</td>
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BILL OF QUANTITIES (B.O.Q.)

FIRE FIGHTING
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<th>Unit</th>
<th>Qty.</th>
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<th>Rate in figures(in Rs.)</th>
<th>Amount in figures(in Rs.)</th>
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<tr>
<td>1.00</td>
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<td>FIRE FIGHTING SYSTEM</td>
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</tr>
<tr>
<td>1.01</td>
<td></td>
<td>Heavy class G.I. pipes conforming to IS with accessories like tees, elbows, flanged joints, rubber insertion, nuts, bolts or welded joints including fixing the pipe with suitable flat iron strip clamps/brackets, structural members, dash fastener, cutting hole and chases in walls, floor, R.C.C. slab etc. and making good the same, including painting pipes and fittings with a primer coat of steel primer and two coats of postal red enamel paint etc. complete as required. (All the fitting i.e. tee/elbow, Valve shall be joint the pumps with flanged joints)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>NS</td>
<td>150 mm dia (with Flanged joints)</td>
<td>Metre</td>
<td>60.0</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>c)</td>
<td>NS</td>
<td>100 mm dia (with Flanged joints)</td>
<td>Metre</td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>NS</td>
<td>50 mm dia</td>
<td>Metre</td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g)</td>
<td>NS</td>
<td>32 mm dia</td>
<td>Metre</td>
<td>70.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h)</td>
<td>NS</td>
<td>25 mm dia</td>
<td>Metre</td>
<td>270.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.02</td>
<td></td>
<td>Providing and fixing Single headed hydrants flanged inlet with 63 mm female instantaneous outlet of gunmetal complete with male blank caps, chains conforming to IS:5290 type A with stainless steel orifice plate (if required) to keep the pressure not more than 3.5 kg/sq.cm at any point.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>NS</td>
<td>Providing 63mm dia 15 m long reinforced rubber lined hose pipe conforming to IS: 636-1992 Part-II with gunmetal male &amp; female coupling wire wound with pipe as required.</td>
<td></td>
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<tr>
<td>Item No</td>
<td>Ref. No.</td>
<td>Description Of Item</td>
<td>Unit</td>
<td>Qty.</td>
<td>Rate in words (in Rupees)</td>
<td>Rate in figures (in Rs.)</td>
<td>Amount in figures (in Rs.)</td>
</tr>
<tr>
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<td>------------------------------------------------------------------------------------</td>
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<td>---------------------------</td>
</tr>
<tr>
<td>1.04</td>
<td>NS</td>
<td>Providing and fixing Gunmetal branch pipe with 20mm dia nozzle conforming to IS:903. suitable for installation connections to hose coupling etc. as required.</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.05</td>
<td>NS</td>
<td>Providing and fixing glazed door shutter and frame for Fire hose cabinet with hold fasts (frame fabricated from 40 x 40 x 5mm and shutter from angle) 2100 mm high x 1200 mm wide x 600mm deep with locking arrangement, 4mm thick glass with M.S. flats including all accessories, painting with one coat of steel primer and two coats of postal red enamel paint complete as per drawing and as directed. The words &quot;hose cabinet&quot; to be painted on the box complete in all respects.</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.06</td>
<td>NS</td>
<td>Providing and fixing cast iron body IS: 210 FG 220 and double flange gear simple operation type butterfly valve conforming to IS: 13095 with SS304 disc and shaft NITNLE rubber replaceable seat of the following size complete with bolts, nuts, washers and rubber insertions as per specification.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>NS</td>
<td>150 mm dia</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>NS</td>
<td>80 mm dia</td>
<td>Each</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.07</td>
<td></td>
<td>Supplying and Fixing First Aid Hose Reel, wall mounting swinging type complete with drum &amp; bracket of MS construction, spray painted in Post office Red, confirming to IS 884/1995 with upto date amendments, complete with the following as required.</td>
<td></td>
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</tbody>
</table>
### Project Name: Renovation of CCU Ward, AIIMS New Delhi

#### Name of Works: BOQ of Fire Fighting Works

<table>
<thead>
<tr>
<th>Item No</th>
<th>Ref. No</th>
<th>Description of Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Rate in Words (in Rupees)</th>
<th>Rate in Figures (in Rs.)</th>
<th>Amount in Figures (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>36 Meter long 20 mm dia water hose Thermoplastic (Textile reinforced) Type - 2 as per IS : 12585</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>20 mm dia gun metal ball valve &amp; nozzle.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Drum and brackets for fixing the equipments on wall.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Connection from riser with stop valve (gun metal) &amp; M.S. Pipe</td>
<td></td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.08</td>
<td>NS</td>
<td>Supply, Installation, Testing and Commissioning of 100 mm dia Bourden type, Stainless Steel dial type Pressure Gauge including brass isolation valve and siphon pipe having calibration of 0 - 16 Kg / cm².</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.09</td>
<td>NS</td>
<td>Supplying and Fixing of Fire Man's axe with heavy insulated rubber as per standard conforming to IS 926</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.10</td>
<td>NS</td>
<td>Supplying and Fixing vane type waterflow switch with contacts suitable for installation on 50 mm to 150 mm dia pipeline for a service pressure upto 20 Kg/sq.cm.</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.11</td>
<td>NS</td>
<td>Supplying, Installation, Testing &amp; Commissioning modular construction master control annunciation panel for sprinkler with provision for requider No. of Zone (30% additional spares), each sprinkler hydrant will have at least 2 zone on each floor as approved by engineer. The panel shall have but not limited to the following arrangement.</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a) Indication of Zone sprinkler</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) Indication of zone fault</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c) Fire/fault hooter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Name of Works: BOQ of Fire Fighting Works

<table>
<thead>
<tr>
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<th>Unit</th>
<th>Qty.</th>
<th>Rate in words(in Rupees)</th>
<th>Rate in figures(in Rs.)</th>
<th>Amount in figures(in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>d)</td>
<td></td>
<td>Alarm cancel for fire/fault</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td></td>
<td>Battery for emergency back up of 4 Hrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f)</td>
<td></td>
<td>Required size wiring &amp; accessories</td>
<td>Set</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.12</td>
<td></td>
<td>Providing, Fixing, Testing and Commissioning of <strong>Sprinkler Installation Control Valve</strong> of Cast iron body and brass / bronze working parts comprising of water motor, alarm, bronze seat clapper and clapper arm, hydraulically driven mechanical gong bell to sound continuous alarm when the Sprinkler system activates, pressure gauges, emergency releases, strainer, pressure switch, cock valve complete with drain valve and bypass, test control box, ball valves, MS pipe of required size, flanges, orifice plate, gasket etc. of size 200/150 mm dia, as required.</td>
<td>Each</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.13</td>
<td></td>
<td>Providing and Fixing 15 mm dia gunmetal / brass quartzoid type <strong>Sprinkler Head</strong> with quartz bulb and set to operate at specified temperature.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td></td>
<td>Pendent / Upright type, 68 C, Chrome plated</td>
<td>Each</td>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td></td>
<td>Side wall extended throw 20 mm dia 68 C, Chrome plated</td>
<td>Each</td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.14</td>
<td></td>
<td>Supply, erection, testing &amp; commissioning of exit glow sign board of size 200mm x 350 mm wall mounting signage consisting of photo luminescent coating on acrylic cover</td>
<td>Each</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### PROJECT NAME: Renovation of CCU Ward, AIIMS New Delhi

Name of Works: BOQ of Fire Fighting Works

<table>
<thead>
<tr>
<th>Item No</th>
<th>Ref. No.</th>
<th>Description Of Item</th>
<th>Unit</th>
<th>Qty.</th>
<th>Rate in words(in Rupees)</th>
<th>Rate in figures(in Rs.)</th>
<th>Amount in figures(in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.15</td>
<td></td>
<td>Providing and fixing fire extinguisher of carbon dioxide type consisting of brand new high pressure steel cylinder bearing IS: 7285 mark and having the approval of controller of explosives Nagpur, wheel type valve bearing IS:3224 mark internal discharge tube, 1 meter long high pressure discharge hose, non conducting horn, suspension bracket, fully charged bearing IS: making fixed to wall as directed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>NS</td>
<td>4.5kg capacity cylinder</td>
<td>Each</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.16</td>
<td>NS</td>
<td>Providing and fixing 9 liters capacity fire extinguisher water type gas pressure conforming to IS marking, fixed to wall.</td>
<td></td>
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<tr>
<td>1.17</td>
<td></td>
<td>Providing and fixing ABC type fire extinguishers complete in all respects.</td>
<td></td>
<td></td>
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<tr>
<td>a)</td>
<td>NS</td>
<td>Capacity 5.0 Kg.</td>
<td>Each</td>
<td>2.0</td>
<td></td>
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</tr>
</tbody>
</table>

| Sub Total |
**PROJECT NAME:** Renovation of CCU Ward, AIIMS New Delhi

## ABSTRACT OF COST: FIRE FIGHTING

<table>
<thead>
<tr>
<th>S.No</th>
<th>DESCRIPTION OF WORK</th>
<th>Amount in Figures (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FIRE FIGHTING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sub Total (Fire Fighting work)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Grand Total (Rs.)</strong></td>
<td></td>
</tr>
</tbody>
</table>
BILL OF QUANTITIES (B.O.Q.)

ELECTRICAL
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description.</th>
<th>Qty.</th>
<th>Unit.</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>SUB HEAD 1 : MV PANEL</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Supply, installation, testing and commissioning of following: M.V. cubicle type totally enclosed, wall mounted type, powder coated, dust, damp and vermin proof, indoor type Distribution Board/Panel complete with busbars, M.V. danger notice plate, interconnections with suitable capacity aluminium leads/solid aluminium strips/rods, connection of incoming and outgoing cables with thimbles, and having following incoming and outgoing switchgears complete as required.</td>
<td></td>
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<tr>
<td></td>
<td>a) INCOMER:</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1 nos. 400 Amp 415 volts, 50 KA (Ics), four pole microprocessor based MCCB with variable current settings and having microprocessor based O/L, S/C &amp; E/F protection release.</td>
<td></td>
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<tr>
<td></td>
<td>Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.</td>
<td></td>
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<tr>
<td></td>
<td>R,Y&amp;B phase indicating lamp (LED type) with 2A control SP MCB.</td>
<td></td>
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<tr>
<td></td>
<td>1 No. 0 to 500 V digital voltmeter.</td>
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</tr>
<tr>
<td></td>
<td>1 No. 0 to 400 Amp digital ammeter with 400/5-5 A C.T.'s.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1 Set of phase indicating lamp with HRC fuses</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1 Set of Digital energy meter with CT &amp; PT</td>
<td></td>
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<tr>
<td></td>
<td>b) BUSBARS:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S.No.</td>
<td>Description.</td>
<td>Qty.</td>
<td>Unit.</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
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</tr>
<tr>
<td>1</td>
<td>500 Amp TPN Aluminium busbars</td>
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<tr>
<td></td>
<td><strong>OUTGOING:</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>a. 1 Nos. MCCB as per following details / specifications:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>250 Amp 415 volts, 50 KA (Ics), TPN microprocessor based</td>
<td></td>
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<tr>
<td></td>
<td>MCCB with variable settings and having microprocessor</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>based O/L, S/C &amp; E/F protection release. Extended</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>rotary operating mechanism with door interlock with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>defeat feature and padlock facility. MCCB should be</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>with spreader link and phase barriers. &quot;ON&quot; and</td>
<td></td>
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<tr>
<td></td>
<td>&quot;Trip&quot; LED indicating lamp and 2A control SP MCBs.</td>
<td></td>
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<tr>
<td></td>
<td>b. 3 no. 32 Amps , 415 volts, 9 KA ,Four Pole,</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Miniature Circuit Breaker (MCB).</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>c. 3 no. 63 Amps , 415 volts, 9 KA ,Four Pole,</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Miniature Circuit Breaker (MCB).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MV Panel as mentioned above</td>
<td>1</td>
<td>Set</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**TOTAL SUB HEAD 1 : MV PANELS**

**SUB HEAD- 2: MCB DISTRIBUTION BOARDS.**

2.00 MCB DISTRIBUTION BOARD
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Qty.</th>
<th>Unit.</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
</table>
| 2.01  | Supplying & fixing following way, three pole and neutral, prewired, sheet steel, MCB distribution board, 415 volts, on recess/surface complete with loose wire box, terminal blocks, tinned copper busbar, neutral link, earth bar, din bar, detachable gland plate, interconnections, phosphatized and powder coated including earthing etc. Before procurement of DB the contractor has to take approval of DB schedule/ drawing of each DB from the Electrical Engineer, HSCC, as per technical specifications and as required (but without MCB & RCCB).  
   i 6 way (8+12), Double door  
   ii 8 way (8+36), Double door | 2 | Each |  |  |  |
| 2.02  | Supplying & fixing 6 Amps to 32 Amps rating, 240 volts, B series, miniature circuit breaker suitable for lighting & other loads of following poles in the existing MCB DB complete with connections, testing & commissioning etc. as per technical specifications & as required.  
   i Single pole  
   ii Triple pole & neutral (FP) | 63 | Each |  |  |  |
| 2.03  | Supplying & fixing following rating, four pole, 415 volts, Miniature Circuit Breaker (MCB), in the existing MCB DB complete with connections, testing & commissioning etc. as per technical specifications and as required.  
   i 63 Amps  
   ii 63 Amps | 2 | Each |  |  |  |
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Qty.</th>
<th>Unit</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.04</td>
<td>Supplying &amp; fixing following rating, four pole, 415 volts, Residual Current Circuit Breaker (RCCB) having a sensitivity current upto 300 mA in the existing MCB DB complete with connections, testing &amp; commissioning etc. as per technical specifications and as required.</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>32 Amps</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>63 Amps</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SUBHEAD: 2- MCB DISTRIBUTION BOARD.**

**3.00**

**SUB HEAD: 3 - WIRING**

**3.01**

**WIRING**

i  Wiring for light point/fanpoint/exhaust fan point/call bell point with 1.5 sq.mm. PVC insulated, fire retardant low smoke (FRLS) copper conductor cable, single core/ multi-strand, in MS conduit (Including supplying & recess laying of MS conduit and accessories) including the following and complete as required.

ii  Supplying and Fixing Modular type switches (modular Bell push in case of call bell points) in suitable size modular metal boxes, base plate & modular cover plates, space for fixing electronic fan regulator in case of fan point wiring & space for fixing 5A socket on the board etc.

iii Supplying and fixing Hexagonal fan Boxes with 3 mm thick hylem sheet covers in case of Fan Points

iv  Supplying & Fixing Ceiling Rose in case of Exhaust Fan Points etc.

*Note:*
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Qty.</th>
<th>Unit</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>i) Unless otherwise specified all the conduiting work to be done in recess</td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Point wiring as mentioned above</strong></td>
<td>103</td>
<td>Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.02</td>
<td>i Wiring for twin control light points with 1.5 sq.mm. PVC insulated, FRLS copper conductor cable in ISI marked MS conduit (including supplying and recess laying of MS conduit &amp; accessories) including the following and complete as required.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>ii Supplying and Fixing Modular type two numbers 2 Way switches in suitable size modular metal boxes, base plate &amp; modular cover plates etc.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td><strong>Note:</strong></td>
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<tr>
<td></td>
<td>i) Unless otherwise specified all the conduiting work to be done in recess</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td><strong>Wiring for twin control light points as mentioned above</strong></td>
<td>10</td>
<td>Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.03</td>
<td>Wiring for 5A light plugs with 1.5 sq.mm. PVC insulated, FRLS copper conductor cable for earthing in surface/recessed MS conduit (including supply and recess laying of MS conduit &amp; accessories) as per technical specifications and as required.</td>
<td>10</td>
<td>Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.04</td>
<td>Wiring for 16 amp power plug with 2X4 sqmm PVC insulated, FRLS copper conductor, single core cable in surface/recessed MS conduit (including supply and recess laying of MS conduit with all accessories) along with 4.0 sqmm PVC insulated, copper conductor, single core cable for loop earthing etc per technical specifications &amp; as required.</td>
<td>19</td>
<td>Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
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<tr>
<td>3.05</td>
<td>Wiring for computer points (Three sockets &amp; one switch) with 2.5 sq.mm. PVC insulated, FRLS copper conductor cable including one number 1.5 sq.mm. PVC insulated, copper conductor cable for earthing in surface/recessed MS conduit (including supply and recess laying of MS conduit &amp; accessories) as per technical specifications and as required.</td>
<td>8</td>
<td>Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.06</td>
<td>Wiring for <strong>Bed Head Unit</strong> with 2X6 sq.mm. PVC insulated, FRLS copper conductor, single core/multistrand cable in recessed MS conduit (including supply and recess laying of MS conduit with all accessories) along with 6 sqmm PVC insulated, copper conductor, single core/multistrand cable for loop earthing, including box as per technical specifications &amp; as required.</td>
<td>20</td>
<td>Point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.07</td>
<td>Wiring for submain/ circuit wiring with following sizes of PVC insulated, FRLS copper conductor single core cable in surface/recessed MS conduit (including and recess laying of MS conduit &amp; accessories) as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>2X2.5 Sqmm with 1 No. 2.5 sqmm PVC insulated, copper conductor for earthing for circuit wiring.</td>
<td>223</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>4X6 Sqmm with 2 nos 6 sq mm PVC insulated, copper conductor for earthing.</td>
<td>34</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>4X16 Sqmm with 2 nos 16 sq mm PVC insulated, copper conductor for earthing.</td>
<td>34</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty</td>
<td>Unit</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
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</tr>
<tr>
<td>3.08</td>
<td>Supplying and fixing suitable Module metal box on surface or in recess including providing and fixing 3 pin 5/6 amps. modular socket outlet with shutters and 5/6 amps. modular type switch, base plate, modular cover plate, connections etc. and all civil works 'complete as required.</td>
<td>10</td>
<td>Each</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.09</td>
<td>Supplying and fixing suitable module modular metal box on surface or in recess including providing and fixing 6 pin 15/16 A modular socket outlet with shutters and 15/16 A modular switch, base plate, modular cover plate, connections, etc. and all civil works complete as required.</td>
<td>19</td>
<td>Each</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.10</td>
<td>Supplying and fixing suitable Module metal box on surface or in recess including providing and fixing three nos 6 pin 5/6 amps. modular socket outlet with shutters and one no. 10 amps. modular type switch, base plate, modular cover plate, connections etc. and all civil works 'complete as required. (For computer Points)</td>
<td>8</td>
<td>Each</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.11</td>
<td>Supply, Installation, Testing &amp; Commissioning 63 Amps, TPN MCCB in a sheet steel enclosure, extended rotary operating mechanism complete with all accessories as required.</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SUBHEAD: 3- WIRING**

**SUB HEAD: 4 - LIGHT FIXTURE AND FANS**

**4.00** **LIGHT FIXTURES AND FANS**
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Qty</th>
<th>Unit</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.01</td>
<td>Supply of following light fixture with high efficiency</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>electronic ballast, starter, capacitor, tubes/lamps, reflector,</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>diffuser, MS body/housing holder etc. complete with all</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>fixing accessories as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>1X28 watt box type fluorescent light fixture with reflector</td>
<td>10</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Philips TMS 122M1XTL328W EBT or approved equivalent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ii</td>
<td>1X36watt recess mounted fluorescent light fixture (Philips</td>
<td>20</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TBS050 1XTLD36 W EBE MI or approved equivalent) RMSQ1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>3X36 watt recess mounted mirror optic fluorescent light</td>
<td>31</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fixture (Philips FBS 300 M 3XPLL36W EBP P5 or approved</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>equivalent) RMSQ1</td>
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<tr>
<td>4.02</td>
<td>Supply of following compact fluorescent light fixture with</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>electronic ballast, starter, capacitor, lamps, reflector,</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>diffuser, MS body/housing holder etc. complete with all</td>
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</tr>
<tr>
<td></td>
<td>fixing accessories as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>1x9 watt Bulk Head light fixture (Philips FXC 101 1xPL-S/2P</td>
<td>3</td>
<td>Each</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>11W AC or approved equivalent)</td>
<td></td>
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<tr>
<td>ii</td>
<td>2 x 18 watt CFL recessed Down Light fixture of super low</td>
<td>45</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>depth &amp; low glare Type-1 (PHILIPS FBH 145 M 2XPLC/4P 18W</td>
<td></td>
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<td></td>
<td>EBW 240V LH or approved equivalent) DL1</td>
<td></td>
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<tr>
<td>iii</td>
<td>2X10 watt Mirror top (Decon 05UB or approved equivalent)</td>
<td>6</td>
<td>Each</td>
<td></td>
<td></td>
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<td></td>
<td>Wtoilet</td>
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<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit.</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
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</tr>
<tr>
<td>iv</td>
<td>2X11 watt Mirror optics compact fluorescent light fixture (PHILIPS FCS 518 2XPLS/2P11W I 240V) 211CFLRECT</td>
<td>20</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.03</td>
<td>Supply of following ceiling fans (Crompton Greaves High Breeze or approved equivalent) complete with double ball bearing, motor, blades, downrod, canopies, capacitor, modular type electronic fan regulator, suitable for operation on 230 volts, 50 Hz., 1 phase, AC supply complete as required</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>i</td>
<td>1200 mm sweep</td>
<td>4</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>900 mm sweep</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.04</td>
<td>Supply of 900 RPM, 225 mm heavy duty exhaust fan suitable for single phase 230 volts, 50 Hz., AC supply complete with motor, louvers/shutters etc. complete as required</td>
<td></td>
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<td></td>
<td></td>
<td>5</td>
<td>Each</td>
<td></td>
<td></td>
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<tr>
<td>4.05</td>
<td>Supply of 300 mm sweep, crompton greaves model cromair or approved equivalent wall mounted fan complete with double ball bearing, motor, blades, capacitor etc suitable for single phase 230 volts, 50 Hz., AC supply, complete as required</td>
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<td></td>
<td></td>
<td>4</td>
<td>Each</td>
<td></td>
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<tr>
<td>4.06</td>
<td>Installation, testing and commissioning of prewired, fluorescent fittings of all types, complete with all accessories and tube etc. directly on ceiling/wall, including connections with 1.5 sq.mm. PVC insulated, FRLS copper conductor, single core/ multi strand cable etc. as required</td>
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<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty</td>
<td>Unit</td>
<td>Rate in Figures (in Rs.)</td>
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<tr>
<td>4.07</td>
<td>Installation, testing and commissioning of prewired, compact fluorescent lamp fixture (CFL fixtures) of all types, complete with all accessories and lamp etc. directly on ceiling/wall, including connections with 1.5 sq.mm. PVC insulated, FRLS copper conductor, single core/multi strand cable etc. as required.</td>
<td>74</td>
<td>Each</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.08</td>
<td>Installation, testing and commissioning of ceiling fan and modular type electronic fan regulator (Electronic regulator to be fixed in switch board) including wiring the down rod and connection with 1.5 sqmm PVC insulated, copper conductor single core cable as required.</td>
<td>5</td>
<td>Each</td>
<td></td>
<td></td>
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<tr>
<td>4.09</td>
<td>Installation, testing and commissioning of exhaust fan up to 300 mm sweep in the opening, including making the hole to suit the size of the above fan including, fixing of louvers/shutters with frame making good the damages etc. as required.</td>
<td>5</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.10</td>
<td>Installation, testing and commissioning of wall mounted fan up to 300 mm sweep including supply and fixing wall bracket arrangement complete as required.</td>
<td>4</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td><strong>TOTAL SUBHEAD 4: LIGHT FIXTURE &amp; FANS</strong></td>
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<td><strong>SUB HEAD 5: TELEPHONE SYSTEM</strong></td>
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<tr>
<td>5.00</td>
<td><strong>TELEPHONE SYSTEM</strong></td>
<td></td>
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</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit.</td>
<td>Rate in Figures (in Rs.)</td>
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<td>Amount (in Rs.)</td>
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<tr>
<td>5.01</td>
<td>Supply &amp; laying two pair 0.5 Sq. mm solid, annealed bare copper conductor insulated with high density polythlene. The insulated cores twisted to from pairs, helically wrapped with polyster tape, over all insulation of FR PVC, unarmoured telephone cable in ISI marked MS conduit including providing &amp; fixing of two module modular metal box on surface or on recess with following pair cord outlet, connections etc. complete as required. This also includes conduiting, wiring from floor Tag blocks to individual telephone outlets.</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i 1 pair cord outlet (Jack Type)</td>
<td>25</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii 2 pair cord outlet (Jack Type)</td>
<td>3</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.02</td>
<td>Supplying, Installation, testing and commissioning of following sizes of telephone distribution board in M.S. hinged type lockable box duly painted complete with Krone type tag block etc. including terminations of cable as required.</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i 40 Pair</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.03</td>
<td>Supplying and drawing of following pairs 5 mm dia annealed bare copper conductor Polythene insulated, core twisted into pairs armoured telephone cable on surface/tray with saddels etc. complete as required.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i 20 Pair</td>
<td>50</td>
<td></td>
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TOTAL SUBHEAD 5: TELEPHONE SYSTEM

SUB HEAD 6: FIRE DETECTION AND ALARM

6.00 FIRE DETECTION AND ALARM SYSTEM
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Qty.</th>
<th>Unit</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.01</td>
<td>Supply and drawing of following sizes of PVC insulated FRLS copper conductor single core cable in surface/recessed ISI marked MS conduit (including Supplying and fixing of ISI marked MS Conduit) complete as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>2X1.5 sqmm</td>
<td>504</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.02</td>
<td>Supply, installation, testing and commissioning of the following manual type fire detection and alarm system including accessories etc., as per technical specification &amp; complete with connections etc. as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>Optical type Smoke Detector</td>
<td>40</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>Manual Break call point.</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv</td>
<td>Fire Alarm Hooter cum speaker of suitable range to cover the complete floor, in enclosure.</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>Response indicator</td>
<td>10</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.03</td>
<td>Supply testing and commissioning of isolator module as per specifications.</td>
<td>3</td>
<td>Set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.04</td>
<td>Supply, installation, testing and commissioning of addressable control modules.</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.05</td>
<td>Supply, Installation, testing and commissioning of addressable monitor modules.</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
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</tr>
<tr>
<td>6.06</td>
<td>Supply, Installation, testing and commissioning of 1 loop microprocessor based addressable type networkable Fire Detection &amp; Alarm Panel complete with inbuilt power supply, battery charger with SMF batteries for minimum 24 hours back-up. The panel shall be able to connect up to 99 panels on a network and each panel shall have a communication module and HI 485 network card. The panel should have rectifier, loop card, min 80 character LCD unit to indicate fire/ fault signals with address including external/ internal printer to print the details complete as per technical specifications and requirement of Local Fire Authority and as required.</td>
<td>1</td>
<td>Each</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>TOTAL SUB HEAD 6 : FIRE DETECTION AND ALARM</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SUB HEAD 7: CONDUITING FOR COMPUTER SYSTEM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.00</td>
<td>CONDUITING FOR COMPUTER SYSTEM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.01</td>
<td>Supply and fixing of following sizes of rigid PVC conduit alongwith the accessories in recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>20 mm dia</td>
<td>120</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>25 mm dia</td>
<td>96</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.02</td>
<td>Supplying and fixing two module modular plate (suitable for RJ-45 computer socket) with GI box complete as required.</td>
<td>8</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit.</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>1</td>
<td>TOTAL SUB HEAD 7: CONDUITING FOR COMPUTER SYSTEM.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB HEAD 8: NURSE CALL BELL SYSTEM.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.00</td>
<td>NURSES CALL BELL SYSTEM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.01</td>
<td>Supplying, fixing testing and commissioning of nurses station terminal monitor with in built LED display &amp; alarm, suitable for following way complete with back up, batteries, battery charger etc. as per technical specifications and as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) 10 Way</td>
<td>3</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.02</td>
<td>Supplying, fixing testing and commissioning of call push button (with cord), call reset, call indication station for each bed complete as required.</td>
<td>20</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.03</td>
<td>Supply and fixing of following sizes of steel conduit along with the accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of conduit as recessed required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i) 25 mm dia</td>
<td>300</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.04</td>
<td>Supply &amp; laying of CAT 5 cable copper conductor in the existing MS conduit.</td>
<td>5</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.05</td>
<td>Supplying, fixing testing and commissioning of LED's Indicators outside each ward</td>
<td>20</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL SUB HEAD 8: NURSE CALL BELL SYSTEM.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit.</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
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<tr>
<td>-------</td>
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</tr>
<tr>
<td>9.00</td>
<td>LT CABLES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.01</td>
<td>Supply of following sizes of 1.1 kV grade multicore aluminium conductor PVC sheathed armoured AYFY cable as per IS 1554.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i 3.5 Core 25 Sqmm.</td>
<td>10</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii 3.5 Core 70 Sqmm.</td>
<td>200</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii 3.5 Core 400 Sqmm.</td>
<td>150</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.02</td>
<td>Laying of one number PVC insulated and PVC sheathed power cable 1.1kV grade direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc. as required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i Size not exceeding 25 sq.mm</td>
<td>10</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii Size exceeding 25 sq.mm but not exceeding 120 sq.mm</td>
<td>150</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size not exceeding 400 Sq.mm</td>
<td>120</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.03</td>
<td>Laying of one number PVC insulated and PVC sheathed power cable 1.1kV grade direct in the existing RCC/Hume/Stoneware/Metal pipe as required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i Size not exceeding 25 sq.mm</td>
<td>10</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii Size exceeding 25 sq.mm but not exceeding 120 sq.mm</td>
<td>5</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.04</td>
<td>Laying of one number PVC insulated and PVC sheathed power cable 1.1kV grade on surface or on existing cable tray complete as required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i Size not exceeding 25 sq.mm</td>
<td>10</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii Size exceeding 25 sq.mm but not exceeding 120 sq.mm</td>
<td>15</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size not exceeding 400 Sq.mm</td>
<td>10</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Description</td>
<td>Qty.</td>
<td>Unit.</td>
<td>Rate in Figures (in Rs.)</td>
<td>Rate in Words (in Rs.)</td>
<td>Amount (in Rs.)</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>9.05</td>
<td>Supplying and making end termination with suitable size Copper lugs including double compression glands of following sizes of 1.1. kv grade multicore aluminium conductor PVC insulated and PVC sheathed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i 3.5 Core 25 Sqmm.</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii 3.5 Core 70 Sqmm.</td>
<td>4</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii 3.5 Core 400 Sqmm.</td>
<td>2</td>
<td>Each</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.06</td>
<td>Fabricating and installing following size of perforated M.S. cable trays including horizontal and vertical bends, reducers, tees, cross members and other accessories as required and duly suspended from the ceiling with M.S. suspenders and including painting etc. as required :-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii 300 mm. width x 62.5 mm. depth x 2.0 mm. thickness</td>
<td>25</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii 450 mm. width x 62.6 mm. depth x 2.0 mm. thickness</td>
<td>20</td>
<td>Metre</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SUB HEAD 9: LT CABLES**

**SUB HEAD 10: EARTHING, SAFETY EQUIPMENTS AND MISC. ITEMS**

10.00 EARTHING, SAFETY EQUIPMENTS AND MISC. ITEMS

10.01 Earthing with GI plate 600mmX600mmX6mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) complete as required          | 2    | Set   |

10.02 Extra for using charcoal and salt for GI or copper plate earth electrode as required                                        | 2    | Set   |
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description.</th>
<th>Qty.</th>
<th>Unit.</th>
<th>Rate in Figures (in Rs.)</th>
<th>Rate in Words (in Rs.)</th>
<th>Amount (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.03</td>
<td>Supplying and laying 25mmX5mm GI strip at 0.5m below ground level as strip earth electrode, including soldering etc. as required.</td>
<td>15</td>
<td>Metre</td>
<td>10.03</td>
<td>10.03</td>
<td></td>
</tr>
<tr>
<td>10.04</td>
<td>Providing and fixing 25mmX5mm GI strip on surface/on existing cable trench/RCC pipe/GI pipe or in recess for earth electrode as required.</td>
<td>50</td>
<td>Metre</td>
<td>10.04</td>
<td>10.04</td>
<td></td>
</tr>
<tr>
<td>10.05</td>
<td>Providing and fixing M.V. danger notice plate of 200mmX150mm made of mild steel, atleast 2mm thick and vitreous enameled white on both sides and with inscription in signal red colour on front side as required.</td>
<td>1</td>
<td>Each</td>
<td>10.05</td>
<td>10.05</td>
<td></td>
</tr>
<tr>
<td>10.06</td>
<td>Supply and fixing shock treatment chart in English, Hindi and local language mounted on 5mm thick Plywood and 3mm thick plain glass front complete as required.</td>
<td>1</td>
<td>Set</td>
<td>10.06</td>
<td>10.06</td>
<td></td>
</tr>
<tr>
<td>10.07</td>
<td>Supplying and fixing CO2 type 4.5 Kg capacity fire extinguishers as approved by ISI complete as required.</td>
<td>2</td>
<td>Set</td>
<td>10.07</td>
<td>10.07</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL SUB HEAD 10: EARTHING, SAFETY EQUIPMENT AND MISC. ITEMS**

| 11.00 | Dismantling and handing over in store exiting electrical panel light fixtures, fans, switches, sockets, fans etc. (not required)                                                                                   | 1    | Set   | 11.00                    | 11.00                  |                 |

**GRAND TOTAL FOR ALL ELECTRICAL WORKS**
### SUMMARY OF COST ESTIMATE - ELECTRICAL WORKS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Amount In Figure (In Rs.)</th>
<th>Amount in Words (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sub Head 1: MV Panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sub Head 2: MCB Distribution Board</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sub Head 3: Wiring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sub Head 4: Light Fixtures &amp; Fans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sub Head 5: Telephone Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Sub Head 6: Fire Detection &amp; Alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sub Head 7: Conduiting For Computer System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sub Head 8: Nurse Call Bell System</td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Sub Head 9: LT Cables</td>
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<td></td>
</tr>
<tr>
<td>10</td>
<td>Sub Head 10: Earthing, Safety Equipments &amp; Misc. Items</td>
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</tr>
<tr>
<td>11</td>
<td>Dismantling</td>
<td></td>
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</tbody>
</table>

GRAND TOTAL FOR ALL ELECTRICAL WORKS
BILL OF QUANTITIES (B.O.Q.)

HVAC
B.O.Q. FOR CCU RENOVATION AT AIIMS, NEW DELHI (HVAC WORKS)

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>DESCRIPTION OF ITEM</th>
<th>Qty.</th>
<th>UNIT</th>
<th>RATE IN FIGURES (')</th>
<th>RATE IN WORDS (')</th>
<th>AMOUNT (')</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inline Fans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply, installation, testing and commissioning of Inline Fans as shown in drawings and as per equipment schedule. Each fan shall be complete with centrifugal blowers, totally enclosed fan cooled motor. Fan motor shall be suitable for single phase, 220 +/- 6% V, 50 Hz AC supply. Item shall be complete with starter &amp; cabling.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1.1</td>
<td>Air Quantity :1350 CFM</td>
<td>1</td>
<td>Nos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Static Pressure :35 mm wg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Air Quantity :200 CFM</td>
<td>1</td>
<td>Nos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Static Pressure :15 mm wg</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1.3</td>
<td>Air Quantity :150 CFM</td>
<td>1</td>
<td>Nos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Static Pressure :15 mm wg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Air Quantity :100 CFM</td>
<td>1</td>
<td>Nos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Static Pressure :15 mm wg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The prices are to be quoted in the below mentioned form and shall include the supply, installation, testing & commissioning at site of all the equipments, ancillary materials as specified and all such items what so ever which may be required to fulfill the intent and purpose as laid down in the specifications and or the drawings.

The tenderer shall quote rates in figures and in words under column 5&6 and extend amount to column 7.
<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>DESCRIPTION OF ITEM</th>
<th>Qty.</th>
<th>UNIT</th>
<th>RATE IN FIGURES (₹)</th>
<th>RATE IN WORDS (₹)</th>
<th>AMOUNT (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Tube Axial Fans (Fire rated)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Supply, installation, testing and commissioning of tube axial flow fans as shown in drawings, Each fan shall be direct driven. Fan motor shall be suitable for 3 Phase, 415+/– 10% V, 50Hz AC supply. Fan shall be complete with gravity louvers. Fan shall be 250 deg C, 2hrs fire rated.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Duty: Corridor Ventilation</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>2.1</td>
<td>Air Quantity: 3000 CFM, 25 mm st. pr.</td>
<td>2</td>
<td>Nos.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>UVGI SYSTEM</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Supply, installation, testing, commissioning and handing over of the imported Ultra Violet Germicidial Irradiations (UVGI) System for maintaining indoor Air Quality. The System must be UL listed for fire safety. The components of the system must be in strict conformity with the specifications and shall be including freight from Delhi Airport to site, Insurance, Lifting, Shifting etc. as required. The prices to include all interconnected wiring between the UVGI Lamps.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>For ICU</td>
<td>1</td>
<td>SET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>CHILLED WATER PIPING</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply, laying/fixing, testing and commissioning of M.S. heavy class ERW piping confirming to IS: 3589/IS:1239 with necessary clamps, supports, anti vibration mountings, hangers and fittings such as bends, tees, reducers etc. duly insulated and painted as per specifications:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>80 mm dia</td>
<td>120</td>
<td>RM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM NO 1</td>
<td>DESCRIPTION OF ITEM 2</td>
<td>Qty.</td>
<td>UNIT 4</td>
<td>RATE IN FIGURES (’`) 5</td>
<td>RATE IN WORDS (’`) 6</td>
<td>AMOUNT (`) 7</td>
</tr>
<tr>
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<td>------------------------</td>
<td>----------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>4.2</td>
<td>65 mm dia</td>
<td>20</td>
<td>RM</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.3</td>
<td>50 mm dia</td>
<td>120</td>
<td>RM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>40 mm dia</td>
<td>20</td>
<td>RM</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.5</td>
<td>32 mm dia</td>
<td>30</td>
<td>RM</td>
<td></td>
<td></td>
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<tr>
<td>4.6</td>
<td>25 mm dia</td>
<td>20</td>
<td>RM</td>
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</table>

### 5.0 VALVES & STRAINERS

Supply, fixing and testing of following valves, strainers, in the chilled water piping complete with companion flanges, nut bolts, gaskets, supports etc. duly insulated and painted as per specifications:

#### 5.1 Butterfly valves:

- **5.1.1** 80 mm dia 10 Nos
- **5.1.2** 50 mm dia 10 Nos
- **5.1.3** 32 mm dia 2 Nos
- **5.1.4** 25 mm dia 2 Nos

#### 5.2 Balancing valves:

- **5.2.1** 80 mm dia 3 Nos
- **5.2.2** 50 mm dia 3 Nos
- **5.2.3** 32 mm dia 1 Nos
- **5.2.4** 25 mm dia 1 Nos

#### 5.3 Y- strainers with drain valve
<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>DESCRIPTION OF ITEM</th>
<th>Qty.</th>
<th>UNIT</th>
<th>RATE IN FIGURES ('')</th>
<th>RATE IN WORDS ('')</th>
<th>AMOUNT ()</th>
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<td>3</td>
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<td>50 mm dia</td>
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<td>Nos</td>
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<td>5.3.3</td>
<td>32 mm dia</td>
<td>1</td>
<td>Nos</td>
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<td>5.3.4</td>
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<td>5.4</td>
<td>Non return valve</td>
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<td>5.4.1</td>
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<td>2</td>
<td>Nos</td>
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<td>5.4.2</td>
<td>50 mm dia</td>
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<tr>
<td>5.5</td>
<td>Supply, installation, testing and commissioning cooling thermostats for various Air Handling Units</td>
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<td>5.5.1</td>
<td>Proportional thermostats for Air Handling Units</td>
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<td>DRAIN PIPING</td>
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<td>Supply, laying/fixing, testing and commissioning of G.I. medium class ERW piping confirming to IS:1239 with necessary clamps, supports, anti vibration mountings, hangers and fittings such as bends, tees, reducers etc. duly insulated and painted as per specifications for condensate drain from air handling units and chillers etc.</td>
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<td>7.1</td>
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<td>Supply, installation, testing and balancing of G.S.S ducting of following thickness including necessary supports, hangers, nut bolts, gaskets, splitter dampers, vanes canvass connections etc. complete as per specifications &amp; drawings:</td>
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<td>7.1.1</td>
<td>1.25 mm (18 G) GSS</td>
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<td>1.0 mm (20 G) GSS</td>
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<td>0.80 mm (22 G) GSS</td>
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<td>Supply, fabrication, installation and testing of aluminium ducts in accordance with the approved shop floor drawing and specifications. Material should confirm to IS 737 latest edition.</td>
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<td>60</td>
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<td>7.2.3</td>
<td>18 gauge</td>
<td>12</td>
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<td>8.1</td>
<td>Supply, installation, testing and commissioning of motorized combined smoke &amp; fire dampers made out of GI sheet of at least 90 minutes fire rating complete with GI damper of required size, smoke sensor, etc as per specifications and shop drawings.</td>
<td>4</td>
<td>Sqm</td>
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<tr>
<td>8.2</td>
<td>Actuator &amp; control panel</td>
<td>2</td>
<td>nos.</td>
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<td>9.0</td>
<td>CEILING DIFFUSERS</td>
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<td>9.1</td>
<td>Supply, installation, testing and balancing of square/circular supply air diffusers of powder coated extruded aluminium construction with attached volume control dampers as per specs. &amp; drawings and duly approved by architects.</td>
<td>4</td>
<td>Sqm</td>
<td></td>
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<tr>
<td>9.2</td>
<td>Supply, installation, testing and balancing of square/circular return air diffusers of powder coated extruded aluminium construction without volume control dampers and duly approved by architects.</td>
<td>4</td>
<td>Sqm</td>
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<tr>
<td>10.1</td>
<td>Supply, installation, testing and commissioning of extruded aluminium constructed supply air perforated ceiling diffuser with volume control damper as per specification and approved drawings. (Quantity of the diffusers shall be measured as per diffuser face area.)</td>
<td>15</td>
<td>Sqm.</td>
<td></td>
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<tr>
<td>10.2</td>
<td>Supply, installation, testing and commissioning of extruded aluminium constructed supply air perforated ceiling diffuser without volume control damper as per specification and approved drawings. (Quantity of the diffusers shall be measured as per diffuser face area.)</td>
<td>15</td>
<td>Sqm.</td>
<td></td>
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<tr>
<td>11.0</td>
<td><strong>VOLUME CONTROL DAMPERS</strong></td>
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<tr>
<td></td>
<td>Supply, installation and testing of volume control dampers of GI sheet, box type to be provided in ducts complete with suitable links, levers and quadrants for manual control of air volume and air balancing as per specifications and drawings.</td>
<td>8</td>
<td>Sqm</td>
<td></td>
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<tr>
<td>12.0</td>
<td><strong>GRILLES</strong></td>
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<tr>
<td></td>
<td>Supply, installation, testing and balancing of supply/return air grilles with/without volume control dampers of powder coated extruded aluminium construction suitable for installation in walls, false ceiling boxing etc as per specifications &amp; drawings and duly approved by architects.</td>
<td></td>
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<tr>
<td>12.1</td>
<td>Supply air grilles in single louvers with volume control dampers.</td>
<td>2</td>
<td>Sqm</td>
<td></td>
<td></td>
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<tr>
<td>12.2</td>
<td>Return air grilles in single louvers without volume control dampers.</td>
<td>10</td>
<td>Sqm</td>
<td></td>
<td></td>
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<tr>
<td>13.0</td>
<td><strong>DUCTING INSULATION</strong></td>
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<tr>
<td>13.1</td>
<td>Supply and fixing of 15 mm thick foil faced FR Closed Cell Chemically Crossed Linked Poly Ethylene Foam (Fire Retardant type) insulation for supply air ducting as per the specifications and approved shop drawings.</td>
<td>350</td>
<td>Sqm.</td>
<td></td>
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<tr>
<td>14.0</td>
<td><strong>CABLING</strong></td>
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<tr>
<td></td>
<td>Supplying, laying, effecting proper connections, testing &amp; commissioning of following size of 1.1 kv PVC insulated aluminium conducting armoured cables as per IS 1554 Part- 1 laid underground/cable tray/on surface of wall/hume pipe etc. &amp; termination with brass compression glands as required.</td>
<td></td>
<td></td>
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<tr>
<td>14.1</td>
<td>3.5C x 50 sq.mm cable</td>
<td>100</td>
<td>Metre</td>
<td></td>
<td></td>
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<tr>
<td>14.2</td>
<td>3.5C x 25 sq.mm cable</td>
<td>90</td>
<td>Metre</td>
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<tr>
<td>14.3</td>
<td>4 C X10 sq. mm. Cable</td>
<td>50</td>
<td>Metre</td>
<td></td>
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<tr>
<td>14.4</td>
<td>4 C X 6 sq. mm. Cable</td>
<td>60</td>
<td>Metre</td>
<td></td>
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</tr>
<tr>
<td>14.5</td>
<td>3 C X 6 sq. mm. Cable</td>
<td>40</td>
<td>Metre</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>14.6</td>
<td>3 C X 4 sq. mm. Cable</td>
<td>70</td>
<td>Metre</td>
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<tr>
<td>14.7</td>
<td>4 C X 4 sq. mm. Cable</td>
<td>30</td>
<td>Metre</td>
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<tr>
<td>15.0</td>
<td><strong>CABLE TRAYS</strong></td>
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<td>Supply &amp; installation of following sizes of perforated MS cable trays including horizontal &amp; vertical bends, reducers, tees, cross members and other accessories as required and duly supported from the ceiling/wall/floor with MS suspenders/supports and including painting etc. as required</td>
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<tr>
<td>15.1</td>
<td>100 mm widthx50 mm deep x1.6 mm thickness</td>
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<td>Metre</td>
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<td>16.0</td>
<td><strong>EARTHING</strong></td>
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<tr>
<td>16.1</td>
<td>Earth pits with GI earth plate of size 600mmx600mmx6mm thick</td>
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<td>Set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>including all accessories, down watering GI pipes 40mm dia and</td>
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<tr>
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<td>providing masonry enclosure with cover plate having interlocking</td>
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<tr>
<td></td>
<td>arrangement and watering pipe etc. with charcoal of or coke and</td>
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<tr>
<td></td>
<td>salt) complete as required</td>
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<td>16.2</td>
<td>Providing &amp; fixing GI earth strip 40mm x 6mm on surface or in</td>
<td>50</td>
<td>Metre</td>
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<td>recess for earth connections etc. as required</td>
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<tr>
<td>16.3</td>
<td>Providing and fixing GI earth strip on walls/ trenches complete as</td>
<td></td>
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<tr>
<td></td>
<td>per specifications and as required</td>
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<td>Providing and fixing earth wire of complete as per specifications</td>
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<td>as required</td>
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<td>6 SWG wire</td>
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<td>RATE IN WORDS (`)</td>
<td>AMOUNT (`)</td>
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<tr>
<td></td>
<td>Supply, laying, effecting proper connections, testing &amp; commissioning of 1.5 sq.mm. PVC insulated copper multicore cables from AHU's and AC equipments to central control console</td>
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<td>10 core cable</td>
<td>80</td>
<td>Metre</td>
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<td>6 core cable</td>
<td>40</td>
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<td>17.5</td>
<td>4 core cable</td>
<td>40</td>
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<td><strong>Total for HVAC Works</strong></td>
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<td>Civil</td>
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<td>PHE</td>
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<td>3.</td>
<td>Fire Fighting</td>
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</table>

**Total (in Rs. figure)**

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For

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