OFFICE OF THE EXECUTIVE ENGINEER (SPECIAL PROJECT)
CIVIL ENGINEERING DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL
3rd FLOOR, PRAGATI BHAWAN,
JAI SINGH ROAD, NEW DELHI – 110001

e-Procurement Tender Notice

NIT NO 02/EE (Spl. Project)/AB/2022-23

Name of Work: - Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway(Composite Work) .

Estimate Cost: Rs. 26,46,90,399/- (Civil Rs. 19,17,49,332/- + Electrical Rs.6,46,11,792/- + Fire work Rs. 83,29,275/-)

Date of release of tender through e-procurement solution : **20.10.2022(By Civil deptt.)**

Last date/time for receipt of tenders through e-procurement solution: **11.11.2022upto 4.00 PM**

Further details can be seen at http://govtprocurement.delhi.gov.in

Note: - To participate in e-tender in NDMC registration with e-tendering system, Government of NCT of Delhi is mandatory.

Executive Engineer (Spl. Project)
NDMC, New Delhi

OFFICE OF THE EXECUTIVE ENGINEER (SPECIAL PROJECT)
CIVIL ENGINEERING DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL
3rd FLOOR, PRAGATI BHAWAN,
JAI SINGH ROAD, NEW DELHI – 110001

No. /EE (Spl. Project)/2022-2023 Dated:

TENDER NOTICE

NIT No. 02/EE (Spl. Project)/AB/2022-23

Executive Engineer (Special Project), NDMC on behalf of NDMC invites online **Percentage Rate Two Envelope Bids,** appropriate Agencies / firms/contractors/ companies of repute who have experience in conservation/ restoration/rehabilitation/retrofitting work of any type of Building for "**Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway** at the Estimated Cost of **Rs. 26,46,90,399/ - (Civil Rs. 19,77,44,000 + Electrical Rs. 6,46,11,792/- + Fire work Rs. 83,29,275/-)** with EMD **Rs. 36,46,904/-** a time period of completion of **24 (Twenty Four) Months. Rs. 36,46,904/- as** earnest money shall have to be deposited in the office of the any Executive Engineer, NDMC through Insurance Surety Bonds / Account Payee Demand Draft/Fixed Deposit receipt/Banker's Cheque/e-Bank Guarantee (For Balance Amount as prescribed) from any of the Commercial Banks **in favour of Secretary, NDMC** payable at **local branch of Delhi/New Delhi**. It should be ensured that FDR is pledged **in favour of the Secretary, NDMC**.
Note: The Scanned Receipt of payment of earnest money and tender papers should be uploaded with the tender documents (online), otherwise the same are liable not to be opened.

1	**Last date and time for downloading tender documents**	: **11.11.2022(up to 4.00 P.M.)**
2	**Date and time for pre-bid meeting in the office of CE (C-II) Room No. 8021, 8th Floor, Palika Kendra on**	: **01.11.2022(at 3.00 P.M.)**
3	**Last date and time for submission of tender**	**: 11.11.2022 (up to 4.00 P.M.)**
4	**Date and time of opening of tender**	: **11.11.2022(at 4.30 P.M.)**

Eligible bidders may download the bid documents for reference only from Delhi Government E-procurement Portal **https://govtprocurement.delhi.gov.in** for bidding purpose. However, bids shall be quoted through e- tendering only.

The bidder may inspect the site on any working day and may contact for any query or technical clarification to Executive Engineer (Special Project)/ Head of Department. The duly filled up bid documents shall be submitted online up to **4:00 PM 11.11.2022** on and the same shall be opened on the same day in presence of the tenderer or their authorized representative who may desire to attend.

NDMC reserves the right to reject the whole or any part of the bid without assigning any reason.

Executive Engineer (Special Project)

INFORMATION AND INSTRUCTIONS FOR BIDDERS FOR e-TENDERING FORMING PART OF BID DOCUMENT AND TO BE POSTED ON WEBSITE

(Applicable for inviting two bid system)

Executive Engineer (Special Project), NDMC on behalf of NDMC invites online **Percentage Rate Two Envelope Bids** appropriate Agencies / firms/contractors/ companies of repute who have experience in conservation /restoration/rebabilitation/retofitting work of any type of Buildings for the work:

S. No.	Description	Details
1	**NIT No.**	**02/EE (Spl. Project)/AB/2022-23**
2	Name of Work & Location	**Name of work: Conservation & restoration of main Gole Market building as a Museum and Redevelopment of surrounding area including construction of Service Block & Subway.**
3	Estimated Cost Put to Bid	**Rs. 26,46,90,399/ -**
4	Civil Work (Major Component)	**19,77,44,000/-**
5	Electrical Work (Minor Component)	**Rs. 6,46,11,792/-**
6	Fire Fighting Work (Minor Component)	**Rs. 83,29,275/-)**
7	Earnest Money (EMD)	**Rs. 36,46,904/- The Contractor has to upload "**Insurance Surety Bonds / Account Payee Demand Draft/Fixed Deposit receipt/Banker's Cheque/e-Bank Guarantee (For Balance Amount as prescribed) from any of the Commercial Banks (Drawn in favour of Secretary, NDMC) against EMD and copy of receipt for deposition of original EMD issued from tender issuing authority i.e. EE, NDMC**" in the prescribed format as specified at Annexure 'F' at Page No. 46.** **A part of the Earnest Money is acceptable in the form of Bank Guarantee also. In such cases 50% of earnest money or Rs. 20 Lakhs whichever is less, will have to be deposited in shape prescribed above and balance can be accepted in form of bank guarantee issued by a Commercial bank.** **100 % amount of EMD through Bank Guarnatee is not acceptable** The Bank Guarantee submitted as a part of Earnest Money is valid for a period of 90 days for Single Bid works and 180 days for 2 Bid system or more from the date of submission of the Tender.

8	Period of Completion	**24 (Twenty Four) Months**
9	Last date and time for downloading bid documents	**Up to 04:00 PM on 11.11.2022**
10	Date and time for pre-bid meeting	**At 03:00 PM on 01.11.2022**
11	Last date and time of online submission of bid	**Up to 04:00 PM on 11.11.2022**
12	Date and Time of online opening of documents	**At 04:30 PM on 11.11.2022**

1. **General Features and major Components of the work are as under**:

i. Glass Dome Roof Structure at Central Court Yard
ii. Recasting of 1st floor level
iii. Insulated roof structure including false ceiling
iv. Central Air Conditioning
v. Ornamentals fitting and fixtures
vi. Subway and lifts

Design:- The complete design, details & drawings, Nomenclature of Items,, Analysis of items and Market Rates of items shall be provided by the Appointed Consultant.

Scope:- Demolition and Reconstruction of existing Royal Block, Conservation & restoration of main Gole Market building and converted into a museum including holistic Repair, Rehabilitation of Building, up-gradation of building, construction of service block, service-tunnel and subway including services up-gradation.

2. **General Information**:

2.1 Letter of transmittal form for deciding eligibility is given in **Annexure 'A'**.

2.2 All information called for in the enclosed forms should be furnished against the relevant columns in the forms. If for any reason, information is furnished on a separate sheet, this fact should be mentioned against the relevant column. Even if no information is to be provided in a column, a "nil" or "no such case" entry should be made in that column. If any particular/query is not applicable in case of the bidder, it should be stated as "not applicable". The bidders are cautioned that not giving complete information called for in the application forms or not giving it in clear terms or making any change in the prescribed forms or deliberately suppressing the information may result in the bid being summarily disqualified. Bids made by telegram or telex and those received late will not be entertained.

2.3 References, information and certificates from the respective clients certifying suitability, technical knowledge or capability of the bidder should be signed by an officer not below the rank of Executive Engineer or equivalent.

2.4 The bidder may furnish any additional information which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. He is, however,

advised not to furnish superfluous information. No information shall be entertained after submission of eligibility criteria document unless it is called for by the Employer.

3. **Definitions**: In this document the following words and expressions have the meaning hereby assigned to them:

3.1 **Employer**: Means the NDMC, acting through the Executive Engineer (SPL. PROJ).

3.2 **Bidder**: Means the Individual, Proprietary Firm, Firm in Partnership, Limited Company Private or Public or Corporation.

3.3 'Year' means 'Financial Year' unless stated otherwise.

4. **Method of Application**:

4.1 If the bidder is an individual, the application shall be signed by him above his full type written name and current address.

4.2 If the bidder is a proprietary firm, the application shall be signed by the proprietor above his full type written name, full name of his firm and its current address.

4.3 If the bidder is a firm in partnership, the application shall be signed by all the partners of the firm above their full type written names and current addresses, or, alternatively, by a partner holding power of attorney for the firm. In the latter case a certified copy of the power of attorney should accompany the application. In both cases, a certified copy of the partnership deed and current address of all the partners of the firm should accompany the application.

4.4 If the bidder is a limited company or a corporation, the application shall be signed by a duly authorized person holding power of attorney for signing the application accompanied by a copy of the power of attorney. The bidder should also furnish a copy of the Memorandum of Articles of Association duly attested by a Public Notary.

5. **Final Decision Making Authority**:

The employer reserves the right to accept or reject any bid and to annul the process and reject all bids at any time, without assigning any reason or incurring any liability to the bidders.

6. **Particulars Provisional**:

The particulars & scope of work given in this document are provisional. They are liable to change and must be considered only as advance information to assist the bidder.

7. **EVALUATION CRITERIA/ INITIAL CRITERIA OF ELIGIBILITY:**

The initial criteria in respect of experience of eligible similar works completed, loss, solvency, financial turn over and bidding capacity etc. will first be scrutinized and the bidder's eligibility will be determined as under:

7.1 Intending bidder should have satisfactorily completed similar works of magnitude specified below, in accordance to clause 1.2.1 of Form 'NDMC-6' as under:

Three similar works each of value not less than **Rs. 10.59 Crore** or two similar works each of value not less than **Rs. 15.89 Crore** or one similar work of value not less than

Rs. 21.18 Crore in last **7 years** ending last day of month previous to the one in which tenders are invited.. The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of **7%** per annum, calculated from the date of completion to the last day of bid submission.

7.2 The bidder should have had average **annual financial turn over 30% of ECPT or Rs. 7.95 Crore** on Civil, Electrical & Fire Fighting Works during the immediate last **Three** consecutive year's **balance sheets**, duly **audited** by Chartered Accountant. Year in which no turnover is shown would also be considered for working out the average.

7.3 The bidder should not have incurred any loss (i.e. **profit after tax should be positive**) in more than **two** years during available last **five** consecutive year's **balance sheets**, duly certified and **audited** by the Chartered Accountant, as per **Performa 'A'**.

7.4 The bidder should have a **solvency** 40% of ECPT or **Rs. 10.59 Crore** and certified by his Bankers as per **Performa 'B'**.

Or

Net worth certificate of minimum **10% or Rs. 2.65 Crore** of the estimated cost put to tender issued by certified Chartered Accountant as per **Performa 'B-1'**.

The **bidding capacity** of the contractor should be **equal to or more than the estimated cost of the work** put to tenderand **The bidding capacity shall be worked out by the following formula:**

Bidding Capacity = {[A x N x 1.5] - B}

Where,

A= Maximum turnover in construction works executed in any one year during the last Seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum.

N= Number of years prescribed for completion of work for which bids has been invited.

B= Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

8. **Financial Information:**

Bidder should furnish the Annual financial statement for the last five years in **Form 'A'** and solvency certificate in **Form 'B'** or Net worth certificate in **Form 'B-I'**.

9. **Experience in Works highlighting experience in Similar Works:**

Bidder should furnish the List of eligible similar nature of works successfully completed during the last seven years in **Form 'C'** and ongoing works in **Form 'C-I'**.

10. **Organization Information:**

Bidder is required to submit the information in respect of his organization in **Form 'E'**

11. **Letter of Transmittal:**

The bidder should submit the letter of transmittal attached with the document.

12. **Opening of Price Bid:**

The bids are opened by the Engineer-in-charge or his authorized representative on the due date and time as mentioned in NIT. If it is not possible to open the bids on the specified date due to unavoidable circumstances, a corrigendum may be issued indicating the revised date and time for opening of bids. After evaluation of applications, a list of short listed agencies will be prepared. Thereafter, the financial bids of only the qualified and technically acceptable bidders shall be opened at the notified time, date and place in the presence of the qualified bidders or their authorized representatives.

13. **Award Criteria:**

13.1 The employer reserves the right, without being liable for any damages or obligation to inform the bidder, to:

(a) Amend the scope and value of contract to the bidder.
(b) Reject any or all the applications without assigning any reason.

13.2 Any effort on the part of the bidder or his agent to exercise influence or to pressurize the employer would result in rejection of his bid. Canvassing of any kind is prohibited.

14. **(i)** The site for the work is available subjected to clearance, cutting / shifting of trees. Delay on this account any claim of compensation, unearned profit, eastablishment adanvcepayment to any vendor by the the contractor shall not be entertained and paid by the NDMC.

(**ii) The architectural and structural drawings shall be made available in phased manner by EE (SPL. PROJ), as per requirement of the same and as per approved programme of completion submitted by the contractor after award of the work.**

15. The intending bidder must read the terms and conditions of NDMC-6 carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required.

16. **Information and Instructions for bidders posted on website shall form part of bid document**.

17. The contractor submitting the bid should read the Schedule of Quantities, Special

Conditions, Additional Conditions, Particular Specifications and other terms and conditions given in the NIT, drawings and the 'General Conditions of Contract for Construction Works'. The contractor should also visit the site of work and acquaint himself with the site conditions before tendering.

18. **GST on all materials as well as GST on Work Contract etc., or any other taxes applicable in respect of this contract shall be payable by the Contractor. Percentage- rate quoted by him shall be inclusive of such taxes, levies etc. and Government will not entertain any claim for reimbursement whatsoever in respect of the same. The percentage rates of the contract shall be inclusive of all taxes and levies and nothing extra shall be paid. Further the percentage rate quoted by the contractor shall be inclusive of labour welfare cess and the same shall be recovered from the contractor's bills and will be remitted by the department.**

19. Those contractors not registered on the website mentioned above, are required to get registered beforehand. If needed they can be imparted training on online bidding process as per details available on the website.

20. On opening date, the contractor can login and see the bid opening process. After opening of bids, he will receive the competitors bid sheets.

21. Contractor can upload documents in the form of JPG format and PDF format.

22. a) This being a percentage rate contract, so the bidder should quote overall percentage at one place in financial bid.

    b) Contractor must ensure to quote his tender percentage for the Estimated Cost. In case, the designated cell is left blank the Tender shall be treated as invalid.

    c) Contractor should quote the percentage above or below accurate to two places of decimal or zero percentage only. The column should not be kept blank; otherwise the tender shall be treated as INVALID.

23. **Certificate of Financial Turn Over:** At the time of submission of bid contractor may upload Affidavit/ Certificate from **CA** mentioning Financial Turnover of last **07 years for the period** either upto FY ending MARCH 2022 or March 2021 as specified in the bid document and further details if required may be asked from the contractor after opening of technical bids. There is no need to upload entire voluminous balance sheet.

24. The Technical Bid shall be opened first on due date and time as mentioned above. The time and date of opening of financial bid of bidders qualifying the technical bid shall be communicated to them at a later date.

25. Pre Bid conference shall be held in the chamber of Chief Engineer (Civil)-II NDMC to clear the doubts of intending bidders, if any.

26. Valid Electrical Contractors License issued, from Designated Authority/ Competent Authority Govt. of Delhi or any state or Union Territory of India, in name of bidder himself or associate agency for electrical works and valid on last date of Bid for eligibility is essential and for carrying out Electrical Works.

27. Performa of receipt of Earnest money is enclosed at **Annexure 'F'** of **NIT at page No. 43**.

28. The bidder should either himself meet the eligibility conditions for the **Specialized** 'Civil' , Fire Fighting works as above or otherwise he will have to associate an agency meeting the eligibility requirements for specialized Civil, Fire Fighting works after award of work and has to submit details of such agency(s) conforming eligibility conditions as defined in the bid document to the Executive Engineer of concerned component at least two months in advance from taking up specific component. Names of the agency(s) to be associated shall be approved by the Engineer-in-Charge of concerned component.

29. Applicants are advised to keep visiting the above mentioned web-sites from time to time (till the deadline for bid submission) for any updates in respect of the tender documents, if any. Failure to do so shall not absolve the applicant of his liabilities to submit the applications complete in all respects including updates thereof, if any. An incomplete application may be liable for rejection.

30. All necessary licenses such as Labour license, EPFO and ESI, BOCW welfare registration etc., shall be taken by contractor within the time limits as prescribed under Clause 1 of Schedule- 'F'.

31. Contractor shall not divert any advance payments or part thereof for any other purpose other than needed for completion of the contracted work. All advance payments received as per terms of the contract (i.e. mobilization, secured against materials brought at site, secured against plant & machinery and / or for work done during interim stages, etc., if any) are required to be re-invested in the contracted work to ensure advance availability of resources in terms of materials, labour, plant & machinery needed for required pace of progress for timely completion of work.

32. If any information furnished by the applicant is found to be incorrect at a later stage, he shall be liable to be debarred from tendering/ taking up of works in NDMC. The department reserves the right to verify the particulars furnished by the applicant independently.

33. The department reserves the right to accept or reject any prospective application without assigning any reason and to restrict the list of qualified contractors to any number deemed suitable by it, if too many bids are received satisfying the laid down criterion**.**

34. Any dispute arising out of this tender including dispute related to encashment of any Bank Guarantee/ FDR etc., shall be subject to the jurisdiction of courts of Delhi only.

Note:

(i) The bidder should ensure that ~~Integrity Pact &~~ all the undertakings/ affidavits to be filled up &uploaded with the bid should have **exactly the same content/ verbatim as given in the NIT**. Any deviation/ addition/ deletion in the content will make the undertaking/ Affidavit invalid and the technical bid in such case shall be rejected.

(ii) **Financial Arrangements for carrying out the proposed work** should be added in **Form 'A'**, and Form 'A' should contain signature, seal & U.D. Number of the Chartered Accountant; and signature of the bidder, otherwise the technical bid shall be rejected.

(iii) BANK Banker Certificate should be issued in the name of **E.E. (Special Project)** and it should

be issued by the bank **after the date of publishing of NIT**, in accordance to Form 'B' of the NIT, otherwise the technical bid shall be rejected.

(iv) In the 'Form of Banker's Certificate issued by a Commercial Bank' as per Performa 'B' names of all partners as recorded with the bank should be included, in case of partnership firm.

(v) All the information regarding details of running works and bidding capacity uploaded by the bidder, if found incorrect or incomplete, at any stage of tendering process or during execution of work, the entire amount of 'Earnest Money 'and 'Performance Guarantee' shall be forfeited and the bidder/ contractor shall be black listed & debarred from tendering process in NDMC for one year.

(vi) Financial Bid shall be opened only for those bidders, whose bid will qualify in 'Technical Evaluation' to be carried out by 'Technical Evaluation Sub-Committee'. The final outcome of Technical Evaluation will be intimated to the bidders only through e-procurement system, just before the opening of Financial Bids.

Executive Engineer (SPL. PROJ)

NDMC-6

NEW DELHI MUNICIPAL COUNCIL

NOTICE INVITING e-TENDER

Executive Engineer (Special Project), NDMC on behalf of NDMC invites online **Percentage Rate Two Envelope Bids** from appropriate Agencies / firms/contractors/ companies of repute who have experience in conservation/restoration/rehabilitation/retrofitting of any type of buildings , for "**Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway.**

1.1 The work is Estimated to Cost **Rs. 26,46,90,399/- (Civil Rs. 19,17,49,332/- + Electrical Rs.6,46,11,792/- + Fire Rs. 83,29,275/-).** This estimate, however, is given merely as a rough guide.

1.1.1 The authority competent to approve NIT for the combined cost and belonging to the major discipline will consolidate NITs for calling the bids. He will also nominate Division which will deal with all matters relating to the invitation of bids. Besides indicating the combined estimated cost put to bid, should clearly indicate the estimated cost of each component separately. The eligibility of bidder will correspond to the combined estimated cost of different components put to bid.

1.2 Intending bidder is eligible to submit the bid provided he has definite proof from the appropriate authority, which shall be to the satisfaction of the competent authority, of having satisfactorily completed similar works of magnitude specified below:

CRITERIA OF ELIGIBILITY FOR SUBMISSION OF BID DOCUMENTS

1.2.1 (I) Three similar works each of value not less than **Rs. 10.59 Crore** or two similar works each of value not less than **Rs. 15.89 Crore** or one similar work of value not less than **Rs. 21.18 Crore** in last **7 years** ending last day of month previous to the one in which tenders are invited. The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of **7%** per annum, calculated from the date of completion to the last day of month previous to the one in which tenders are invited.

(II)The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of **7%** per annum, calculated from the date of completion to the last day of month previous to the one in which tenders are invited.

(III)For the purpose of this clause, '**Similar work**' shall mean "Comprising of civil/ composite successfuly Completed work/works conservation/restoration / Rehabilitation/retrofitting of any type of buildings work by bidder himself or by having MOU with at least one agency of minor component o Electrical / Fire Fighting Works **either by major component bidder himself or by having MOU Assosiate Agency, of at least one minor component i.e. Electrical / Fire Fighting, who has completed at least one work electrical/ fire or by having group of separate works of same or different catagory fulfilling the**

eligibility criteria of minor component having minimum amount as per table mentioned in clause 1.2.1 (VI) . This should be certified by an officer not below the rank of Executive Engineer/Project Manager or equivalent.

(IV) (a)Associate Agencies of minor components can only MOU with Bidder of this tender. If Associate agency has multiple MOU with more then one prospective bidder of this tender ,bid of that bidder will be ineligible and rejected .

(IV) (b) If main bidder or Engineer in charge want to change, the agencies of minor components ,after award of work or during progress of wok for any reasons then main bidder may have separate new agencies as per eligibility criteria in 1.2.1 (VI) or at relaxed criteria with prior approval of competent authority.

(V) Only successfully completed works (Major/ Minor components) shall be considered for Technical Evaluation for performance and similar works experience.

(VI) The main bidder(Civil), if not eligible as per Eligibility criteria himself he has to associate agency for either of minor component fulfilling the eligibility criteria as mentioned in Para 1.2.1 (I) of Amount equivalent to but not less than to the Minor Component (As mentioned below)

Sr. No.	Minor Components	03 similar works each of value not less than 40% i.e.,	(OR) 02 Similar works each of value not less than 60% i.e.,	(OR) 02 Similar works each of value not less than 80% i.e.,
1.	Electrical	Rs. 2.58Cr	Rs 3.88Cr	Rs.5.17Cr
2.	Fire Fighting	Rs 33,31,710/-	Rs 49,97,565/-	Rs 66,63,420/-

(VII) (a) Electrical Works means all type of electrical works

(VII)(b) Fire works means all type of fire works including its Installation

(VIII) Valid Approved Electrical Contractors License, to be valid on Last Date of Bid, issued from designated authority, Govt. of Delhi or any state govt, is essential to determine bidder Technical Eligibility. The electric license shall either be issued in name of, Main Bidder or Associate Agency of Minor component of Electrical works. Associate Agency of Minor component of Electrical works should also have Valid Approved Electrical Contractors License.

IX) If the firm claiming Technical Eligibility Criteria for the works has completed any of the works in joint venture with any other company, then, along with the experience certificates, the firm shall submit the joint venture agreement for that particular work. Experience certificates not accompanied by joint venture agreement shall not be considered for technical evaluation. The credit for the firm which has completed a work in joint venture is allocated as follows:

X) If the firm has completed the work as a Lead member in the project, then the firm can claim credit for the entire amount of completed scope of work.

XI) If the firm has completed the work as a member in the project, then the firm can claim credit for the entire scope of the work in proportion to the stake (e.g. if the total amount of completed work executed is X and if the firm has executed the project as member with a 40% stake then the firm can claim credit for (40% of total amount of completed work executed = 0.4X). A statutory auditor certificate specifying the payments received for the project should be submitted. In the event of percentage participation in the project calculated through the statutory auditor certificate differs from the percentage in the JVA, the percentage participation calculated through payments received shall be considered for evaluation purposes.

1.2.2 **Criteria of eligibility for Bidders:**

To become eligible for issue of bid, the bidders shall have to furnish an affidavit as under:

Affidavit on Non-Judicial stamp paper of Rs. 100/- to be notarized after date of publication of Draft NIT (Scanned copy to be uploaded at the time of submission of bid from the Contractor/bidder).

I, _____(Name of Authorized Signatory) , S/0_____ R/O_____Proprietary/Authorised Signatory of _____ (Name of Company), undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in NDMC in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money and Performance Guarantee.

(Scanned copy to be uploaded at the time of submission of bid)

1.2.3 Deleted

1.2.4 The bidder should have had **average annual financial turn over 30% of ECPT or** (gross) **Rs. 7.95 Crore** on Civil/Electrical construction work during the **immediate last three** consecutive year's **balance sheets**, duly **audited** by Chartered Accountant. Year in which no turnover is shown would also be considered for working out the average.

1.2.5 The bidder should not have incurred any loss (i.e. **profit after tax should be positive**) in more than **two** years during available last **five** consecutive year's **balance sheets**, duly certified and **audited** by the Chartered Accountant, as per Performa 'A'.

1.2.6 The bidder should have a **solvency 40% of ECPT or Rs. 10.59 Crore** or certified by his Bankers as per Performa 'B'.

Or

Net worth certificates of minimum **10% or Rs. 2.65 Crore** of the estimated cost put to tender issued by certified Chartered Accountant as per Performa 'B-1'.

1.2.7 The bidder should have sufficient number of Technical and Administrative employees for proper execution of the contract. The bidder shall have to submit a list of these employees stating clearly how these would be involved in this work within 15 days of award of work.

1.2.8 **The bidding capacity of the contractor should be equal to or more than the estimated cost of the work put to tender. The bidding capacity shall be worked out by the following formula:**

Bidding Capacity = {[A x N x 1.5] - B}

Where,

A= Maximum turnover in construction works executed in any one year during the last Seven years taking into account the completed as well as works in progress.

The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum.

N= Number of years prescribed for completion of work for which bids has been invited.

B= Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

Note: The Bidder should submit bidding capacity as per Form C-3

Sl. NO	Name of work/ Project and Location	Owner or sponsoring organization	Contract value in Cros of rupess	Date of Commencement as per contract	Stipulated date of Completion	Upto date percentage progress of work	Remaining work in percentage(100-comumn 8/100	Exisiting Commitment Column 4 X Column 8/100	Name and address/ telephone number of officier to whom reference may be made	Remakrs
1	2	3	4	5	6	7	8	9	10	11
Total (B)=										

Maximum turnover in last seven years = Rs……..

Updated value of turnover (A) =Rs……..

No. of Years(N) =……

Bidding Capacity =(AxNx1.5) -B =……

Certificate:

I Certify that all the awarded and ongoing works have been included in the above list.

Signature of Bidder(s)

1.2.9 The Joint Venture is not allowed.

2. Agreement shall be drawn with the successful Tenderer on prescribed Form No. NDMC 7, which is available on website http://govtprocurement.delhi.gov.in. Tenderer shall quote his Percentage rate as per various terms and conditions of the

said form which will form part of the agreement.

3. The time allowed for carrying out the work will be **24 months** from the date of start as defined in schedule 'F' or from handing over of the site, whichever is later.

4. The tender document consisting of specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents except Standard General Conditions of Contract Form can be seen free of cost on website http://govtprocurement.delhi.gov.in.

The standard publications like General Conditions of Contract 2020(GCC-2020) for construction works, Delhi Schedule of Rates (for Civil & Electrical), Specifications for Civil and Electrical works and Delhi Analysis of Rates (for Civil and Electrical) with amendments/ correction slips up to the last date of submission of tender can be seen free of cost from website www.cpwd.gov.in.

5. After submission of the tender the contractor can re-submit revised bid any number of times but before last time and date of submission of bid as notified.

6. While submitting the revised bid, contractor can revise the percentage rate any number of times but before last time and date of submission of tender as notified.

~~7. Copy of Enlistment Order and other documents as specified in the press notice shall be scanned and uploaded to the e-Tendering website within the period of bid submission.~~

8. **The bid submitted shall become invalid if**:

(i) The bidder is found ineligible.

(ii) The bidder does not up load all the documents (**including GST registration or undertaking as applicable**) as stipulated in the bid document.

(iii) If a tenderer does not quote any percentage above/ below on the total amount of the tender, the tender shall be treated as invalid and will not be considered as lowest.

(iv) Bids on which any of the prescribed conditions is not fulfilled or any condition including that of conditional rebate is put forth by the bidders.

The contractor, whose bid is accepted, will be required to furnish performance guarantee of **3% (Three Percent)** of the tendered value within the period specified in Schedule 'F'. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs. 500/-) or Insurance Surety Bonds/Banker's cheque / Account Payee Demand Draft/FDR of any Commercial Bank (in case guarantee amount is less than Rs. 1, 00,000/-) or NDMC Securities or Fixed Deposit Receipts or Guarantee Bonds of any Commercial Bank or the State Bank of India in accordance with the prescribed form. In case the contractor fails to deposit the said Performance guarantee within

the period as indicated in Schedule 'F', including the extended period if any, The Earnest Money deposited by the contractor shall be forfeited automatically without any notice to the contractor.

The Earnest Money deposited along with tender shall be returned after receiving the aforesaid performance guarantee.

The contractor whose bid is accepted will also be required to furnish either copy of applicable licenses/ registrations or proof of applying for obtaining labour licenses, registration with EPFO, ESIC and BOCW Welfare Board including Provident Fund Code No., if applicable, and also ensure the compliance of aforesaid provisions by the sub-contractors, if any engaged by the contractor for the said work and Programme Chart (Time and Progress) within the period specified in Schedule 'F'.

9. Intending Bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. A bidder shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The bidders shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a bid by a bidder implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and local conditions and other factors having a bearing on the execution of the work.

10. The competent authority on behalf of NDMC does not bind itself to accept the lowest or any other bid and reserves to itself the authority to reject any or all the bids received without the assignment of any reason. All bids in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth bythe bidders shall be summarily rejected.

11. Canvassing whether directly or indirectly, in connection with bidders is strictly prohibited and the bids submitted by the contractors who resort to canvassing will be liable for rejection.

After opening of technical bids, Engineer-in-charge may demand hard copies of the uploaded documents from the bidder, if required for obtaining any clarity. In case of Non submission of Hard copies within specified time by the bidder and/ or any discrepancy is noticed between the documents as uploaded at the time of submission of the bid online and hard copies as submitted physically in the office of Executive Engineer, then the bid submitted shall become invalid and also the Earnest Money deposited by the contractor shall be forfeited automatically without any notice to the contractor.

12. Further the tenderer shall not be allowed to participate in the retendering process of

the work.

13. The competent authority on behalf of NDMC reserves to himself the right of accepting the whole or any part of the bid and the bidders shall be bound to perform the same at the rate quoted.

14. The contractor shall not be permitted to bid for works in NDMC, if his near relative is posted as Divisional Accountant or as an officer in any capacity between the grades of Superintending Engineer and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any officer in NDMC. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department.

15. No Engineer of Gazetted Rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India/ NDMC is allowed to work as a contractor for a period of one year after his retirement from Government service, without the prior permission of the Government of India/ NDMC in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be such a person who had not obtained the permission of the Government of India/ NDMC as aforesaid before submission of the bid or engagement in the contractor's service.

16. The bid for the works shall remain open for acceptance for a period of **75 (Seventy Five)** days from the date of opening of Technical bid in case tenders are invited on two bid system. Further if any bidder withdraws his bid before the said period or issued of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the bid which are not acceptable to the department, then the NDMC shall without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the bidder shall not be allowed to participate in the re-bidding process of the work.

17. This notice inviting Bid shall form a part of the contract document. The successful bidder/contractor, on acceptance of his bid by the Accepting Authority shall within **15 days** from the stipulated date of start of the work, sign the contract consisting of:

    a) The Notice Inviting Bid, all the documents including additional conditions, specifications and drawings, if any, forming part of the bid as uploaded at the time of invitation of bid and the percentage quoted online at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.

    b) Standard NDMC Form 7 or other Standard NDMC Form as applicable.

18. The person/persons whose tender(s) may be accepted (herein after called the contractor) shall permit NDMC at the time of making any payment to him for work done under the contract to deduct a sum at the rate of **2.5%** of the gross amount of each running and final bill till the sum deducted will amount to **security deposit** of

2.5% of the tendered value of the work. Such deductions will be made and held by NDMC by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in cash or in the form of Government Securities of fixed deposit receipts. In case a fixed deposit receipt of any Bank is furnished by the contractor to the NDMC as part of the security deposit and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising there from, or from any sums which may be due to or may become due to the contractor by NDMC on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the State Bank of India or by Commercial Bank or Government Securities (if deposited for more than 12 months), any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills of the contractor at the rates mentioned above.

19. In case of reduction in scope of work no claim on account of reduction in value of work, loss of expected profit, consequential overheads etc. shall be entertained.

20. The bidder has not been black listed by any State/Central Department or PSU or Autonomous bodies.

21. **For Composite Bids:**

22.1 The Executive Engineer-in-charge of the major component will call bids for the composite work. The cost of bid document will be fixed with respect to the combined estimated cost put to tender for the composite bid.

22.2 The bid document will include following three components:

Part A: NDMC-6, NDMC-7 including schedule 'A' to 'F' for the major component of the work, Standard General Conditions of Contract for Construction works as amended/modified up to date.

Part B: General/ Specific conditions, Specifications and Schedule of Quantities applicable to major component of the work.

Part C: Schedule 'A' to 'F' for minor component of the work. (SE/EE-in-charge of major component shall also be competent authority under clause 2 and clause 5 as mentioned in schedule 'A' to 'F' for major components), General/ Specific Conditions, Specifications and Schedule of Quantities applicable to minor component(s) of the work.

Note: In case of any contradiction or duplicacy of the general information given in schedule 'A' to 'F' of Part A Part C and Part D, information given in Part A shall be applicable.

22.3 The bidder must with himself, Associate agency at least one of the appropriate category eligible to bid for each of the minor component individually.

22.4 After acceptance of the tender by competent authority, the EE-in-charge of major component of the work shall issue letter of award on behalf of the NDMC. After the work is awarded, the main contractor will have to enter into one agreement with EE-in-charge of major competent and has also to sign two or more copies of agreement depending upon number of EE's/ DDH-in-charge of minor components. One such signed set of agreement shall be handed over to EE/DDH-in-charge of minor component(s). EE of major component will operate Part-A and Part-B of the agreement. EE/DDH-in-charge of minor component(s) shall operate Part-C along with Part-A of the agreement.

~~22.5 Entire work under the scope of composite bid including major and all minor components shall be executed under one agreement.~~

22.6 Security Deposit will be worked out separately for each component corresponding to the tendered cost of the respective component of works.

22.7 The main contractor has to associate agency(s) for minor component(s) conforming to eligibility criteria as defined in the bid document and has to submit detail of such agency(s) to Engineer-in-charge of minor component(s) within prescribed time. Name of the agency(s) to be associated shall be approved by Engineer-in-charge of minor component(s).

22.8 In case the main contractor intends to change any of the above agency/agencies during the operation of the contract, he shall obtain prior approval of Engineer-in-charge of minor component. The new agency/agencies shall also have to satisfy the laid down eligibility criteria. In case Engineer-in-charge is not satisfied with the performance of any agency, he can direct the contractor to change the agency executing such items of work and this shall be binding on the contractor.

22.9 The main contractor has to enter into agreement with contractor(s) associated by him for execution of minor component(s). Copy of such agreement shall be submitted to EE/Fire Officer of each minor component as well as to EE-in-charge of major component. In case of change of associate contractor, the main contractor has to enter into agreement with the new contractor associated by him.

22.10 Running payment for the major component shall be made by EE of Major discipline to the main contractor. Running payment for minor components shall be made by the Engineer-in-charge of the discipline of minor component directly to the main contractor.

22.11 The composite work shall be treated as completed when all the components of the or one work of minor coponent are completed. The completion certificate of the composite work shall be recorded by Engineer- in-charge of major component after record of completion certificate of all other components.

22.12 Final bill of whole work shall be finalized and paid by the EE of major component. Engineer(s)-in-charge of minor components will prepare and pass the final bill for

their component of work and pass on the same to the EE of major component for including in the final bill for composite contract.

23. Engineer–in-Charge shall deduct **TDS**, **GST** and **Cess** as per prevailing NDMC instructions/ orders from the total payments made to contractor in pursuance of this contract. The TDS shall be deducted on advance payment to be adjusted in future bills and on the amount of cost escalation. The TDS certificate shall be issued by the engineer-in-charge to the contractor in form (In TDS form) within 28 days from the end of the month in which tax has been deducted.

24. **In order to achieve a high standard of quality, it may be required to go for third party quality control. For this purpose, a separate agency shall be appointed by the owner who will carry out independent testing of material checking and ensuring overall quality procedures. The contractor shall be required to fully cooperate with agency and facilitate them in taking samples, transportation and examination of various activities including documentation at no extra time and cost to the owner, in case of any adverse finding by the agency, the contractor shall do the needful rectification at no extra time and cost to the owner. The Engineers-in-charge shall be at liberty for getting quality assurance work done through any agency as approved by the Chief Engineer at his own cost.**

25. Valid Electrical Contractors License issued, from Designated Authority/ Competent Authority Govt. of Delhi or any state or Union Territory of India, in name of bidder himself or associate agency for electrical works and valid on last date of Bid for eligibility is essential and for carrying out Electrical Works.

26. The contactor shall submit list of works which are in hand (progress) in form 'C-I' attached.

27. All Government Institutes, Indian Institutes of Technology, National Institutes of Technology, Central and State Research Centres, Centrally and State funded laboratories stands approved.

28. Intending Bidders may inspect the Conceptual Drawings in the office of EE(Special Project) before submission of bid.

Note:

(i) The bidder should ensure that ~~Integrity Pact &~~ all the undertakings/ affidavits to be filled up &uploaded with the bid should have **exactly the same content/ verbatim as given in the NIT**. Any deviation/ addition/ deletion in the content will make the undertaking/ Affidavit invalid and the technical bid in such case shall be rejected.

(ii) **Financial Arrangements for carrying out the proposed work** should be added in **Form 'A'**, and Form 'A' should contain signature, seal & U.D. Number of the Chartered Accountant; and signature of the bidder, otherwise the technical bid shall be rejected.

(iii) BANK Banker Certificate should be issued in the name of **E.E. (Special Project)** and it should be issued by the bank **after the date of publishing of NIT**, in accordance to Form 'B' of the NIT, otherwise the technical bid shall be rejected.

(iv) In the 'Form of Banker's Certificate issued by a Commercial Bank' as per Performa 'B' names of all partners as recorded with the bank should be included, in case of partnership firm.

(v) All the information regarding details of running works and bidding capacity uploaded by the bidder, if found incorrect or incomplete, at any stage of tendering process or during execution of work, the entire amount of 'Earnest Money 'and 'Performance Guarantee' shall be forfeited and the bidder/ contractor shall be black listed & debarred from tendering process in NDMC for one year.

(vi) Financial Bid shall be opened only for those bidders, whose bid will qualify in 'Technical Evaluation' to be carried out by 'Technical Evaluation Sub-Committee'. The final outcome of Technical Evaluation will be intimated to the bidders only through e-procurement system, just before the opening of Financial Bids.

(Signature of Contractor) **Executive Engineer (SPL. PROJ)**

Dated: …… **New Delhi Municipal Council**

New Delhi

LIST OF DOCUMENTS TO BE SCANNED AND UPLOADED WITHIN THE PERIOD OF BID SUBMISSION TO DETERMINE THE ELIGIBILITY OF BID:

I Insurance Surety Bonds / Account Payee Demand Draft/Fixed Deposit receipt/Banker's Cheque/Bank Guarantee (For Balance Amount as prescribed) from any of the Commercial Banks (Drawn in favour of Secretary, NDMC) against EMD and copy of receipt for deposition of original EMD issued from any Executive Engineer, NDMC **in the prescribed format as specified at Annexure 'F' at Page No. 46.** The Bank Guarantee submitted as a part of Earnest Money is valid for a period of 180 days for 2 Bid system or more from the date of submission of the Tender.

II Details of eligible similar nature of works completed as per **Form 'C'**.

III Detail of Projects under execution as per **Form 'C-1'.**

IV Certificates of Work Experience as per **Form 'D'**.

V Certificate of Financial Turnover from C.A. as per **Form 'A'**.

VI Banker Certificate from scheduled/ nationalized bank as per **Form 'B'**.

Or

Net worth certificate of minimum 10% of the estimated cost put to tender issued by certified Chartered Accountant as per **Form 'B-1'**

VII Details of Structure and Organization as per **Form 'E'**.

VIII Letter of Transmittal as per Performa **Annexure 'A'**.

IX Affidavit on Non-Judicial stamp paper of Rs. 100/- to be notarized after date of publication of Draft NIT in accordance to clause 1.2.2 of NDMC-6 to be submitted by main bidder as well as by the agency of minor component.

X GST registration Certificate, if already obtained by the bidder.

If the bidder has not obtained GST as applicable, then in such a case the bidder shall **scan and** upload following undertaking along with **other** bid documents:

"If work is awarded to me, I/ we shall obtain GST registration Certificate **as applicable** within one month from **the** date of receipt of award letter or before **release of any payment by NDMC, whichever is earlier, failing which I/ We shall be responsible for any delay in payments which will be due towards me/us on account of the work executed and/ or for any action taken by NDMC or GST department in this regard.**"

XI Separate MOU and Wiliingness letter with Associate agency/agencies of minor component ,as per performa……..,……, and list of successfully completed work by agency/ agencies of minor component Electrical/ Fire .

XII Certificate of tenderer that "I, M/s. …… hereby certify that I/my firm have/has not been black listed/ debarred in any government, public undertaking/ private undertaking etc. on account of supply of sub-standard material and/ or poor execution/ poor performance for last three years from date of opening of Tender."

XIII Last five consecutive balance sheets, duly certified and audited by the Chartered Account to determine profit/losses as per para 7.3 of Page-11 either upto fy ending March 2022 or March 2021

XIV The bidder should submit bidding capacity as per **Form'C-3.**

XV) (i) Copy resolutation/authorizes letter upload, in case of company registered under Indian Company Act, 1956/ 2013 (Amended), - Copy of Resolution of Board of Directors authorizing a specific person to upload all Documents and Rate for this work mentioning all necessary details in the resolution like signature of Directors, Date of Meeting, its Place, Verifying Specimen Signature of authorized signatory etc. or In case of partnership firm, letter of authorization, in favour of (specific individual) for submission of document and Rate, issuyed by all the partners

(ii) All Affidavits, Undertaking and Declarations must be submitted by Authorised Signatory, For Example -

I, _____(Name of Authorized Signatory) , S/0_____ R/O_____Proprietary/Authorised Signatory of _____ (Name of Company), undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in NDMC in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money and Performance Guarantee. …….. .

(iii) If a company has previously executed work in J.V. then it is required to submit the Work Sharing Component having verification of the Executive Engineer.

(iv) In case of Partnership Firm, Letter of Authorization, in favour of (specific individual) for Submission of Document and Rate, issued by all the partners.

(v) Authorized Signatory of Partnership firm may submit all Affidavits and Declarations as narrated in Sr. No. (ii)

(vi) Performance Certificates submitted by bidders shall be verified by NDMC from respective issuing competent authorities. So the bidders must submit Address, Email-ID, Phone No., of issuing competent authorities

XVI)(a) LIST of successfully completed similar works of Associate agency /agencies of Minor Component of Electrical / FIRE as per mimimum eligibility 1.2.1(VI) and Similar work 1.2.1 (VII) (a) and 1.2.1 (V II) (b) for Electrical works and Fire works respectively.

XVI)(b) Form 26 AS Form of Income tax Deptt (so far issued) with regard to similar works completed by main bidder and/ OR Associate agency for work of Private sector company .

XVI(c) Main Bidder shall submit MOU alongwith Willingness Certificate of Associate Agency as per **Performa B and B-1 respectively.**

XVII) Valid Electrical Lisence as per **Para-25** of NDMC form-6.

Executive Engineer (SPL. PROJ)

NDMC Form-7

NEW DELHI MUNICIPAL COUNCIL

PERCENTAGE RATE TENDER & CONTRACT FOR WORKS

(A) Tender for the work of "Conservation & Restoration of Main Gole Market Building as a Museum and Redevelopment of surrounding area including Construction of Service Block & Subway .

(i) To be submitted online by **4.00 PM on 11.11.2022** through website **http://govtprocurement.delhi.gov.in** to the Executive Engineer (Special Project), Civil Engineering Department, NDMC, New Delhi.

(ii) To be opened in presence of tenderers/ their authorized representatives, who may be present at **4:30 PM on 11.11.2022** in the office of Executive Engineer, (Special Project), Civil Engineering Department, NDMC, New Delhi.

TENDER

I/ We have read and examined the Notice Inviting Tender, Schedule A, B, C, D, E & F, Specifications applicable, Drawings & Designs, General Rules and Directions, Conditions of Contract, Clauses of Contract, Special Conditions, Schedule of Rate & other documents and Rules referred to in the Conditions of Contract and all other contents in the tender document for the work.
I/We have read and examined the notice inviting tender, schedule A, D, E & F Specifications, Drawings & Designs, General Rules and Directions, Conditions of Contract, clauses of contract, Special conditions, Schedule of Rates, other documents , regulations, Acts and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/ We hereby tender for the execution of the work specified for the NDMC within the time specified in Schedule 'F' viz., Schedule of Quantities and in accordance in all respect with the Specifications, Designs, Drawing and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of Contract and with such materials as are provided for, by, and in respect of accordance with, such conditions so far as applicable.

I / We agree to keep the tender open for 75 (Seventy Five) days from the due date of its opening of technical bid, in case of tenders invited in two bid system and not to make any modification in its terms and conditions.

I/We have deposited EMD for the prescribed amount in the office of concerned Executive Engineer as per the bid document

A copy of earnest money deposit **receipt of prescribed amount deposited in the form of Insurance Surety Bonds, Account Payee Demand Draft, Fixed Deposit Receipt, Banker's Cheque or Bank Guarantee(as prescribed) issued by a Commercial** Bank, is scanned and uploaded (strike out as the case may be). If I/ We, fail to furnish the prescribed performance guarantee within prescribed period, I/ We agree that the Chairman, NDMC or his successors, in office shall without prejudice to any other right or remedy, be at liberty I/ We shall be suspended for 1 year as per declaration. Further, if I/ We fail to commence work as specified, I/ We agree that the Chairman, NDMC or his successors, in office shall without prejudice to any other right or remedy, available in law, be at liberty to forfeit the said Performance Guarantee absolutely. The Performance Guarantee shall be a guarantee to execute all the work referred to in the tender documents upon the terms and conditions contained or referred to those in excess of that limit at the rates to be determined in accordance with the provision continued in Clause 12.2 and 12.3 of the tender form.

Further, I/ We agree that in case of forfeiture of Performance Guarantee as aforesaid. I/ We shall be debarred for participation in the re-tendering process of the work.

I, _____(Name of Authorized Signatory) , S/0_____ R/O_____Proprietary/Authorised Signatory of _____ (Name of Company), undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in NDMC in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money and Performance Guarantee

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

Dated:

Witness: **Signature of Contractor**

Address:

Occupation: **Postal Address**

ACCEPTANCE

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the NDMC for a sum of Rs. ……. (Rupees…… ……).

The letters referred to below shall form part of this contract agreement:

(a)

(b)

(c)

For & on behalf of NDMC

Dated …… **Signature …….**

Designation …….

Annexure- 'A'

INFORMATION REGARDING ELIGIBILITY
LETTER OF TRANSMITTAL

From: _____

To
The Executive Engineer (Special Project)
Civil Engineering Department,
New Delhi Municipal Council.

Name of work: "Conservation & Restoration of Main Gole Market Building as a Museum and Redevelopment of surrounding area including Construction of Service Block & Subway.

Sir,

Having examined the details given in press notice and bid document for the above work, I/we hereby submit the relevant information.

1. I/we hereby certify that all the statement made and information supplied in the enclosed forms A to E and accompanying statement are true and correct.

2. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.

3. I/we submit the requisite certified Banker certificate and authorize the **Executive Engineer (Special Project)** to approach the Bank issuing the Banker certificate to confirm the correctness thereof. I/we also authorize **Executive Engineer (Special Project)** to approach individuals, employers, firms and corporation to verify our competence and general reputation.

or

It is to certify that as per the audited balance sheet and profit & loss account during the financial year_____ the net worth of M/s …… (Name & Registered address of Individual/Firm/Company) as on ……. (the relevant date) is Rs. ……. After considering all liabilities. It is further certified that net worth of the company has not eroded by more than 30% in the last 3 years ending on (31.3.2021).

4. I/we submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following eligible similar works:

Name of work	Certificate from

Certificate:

It is certified that the information given in the enclosed eligibility bid are correct. It is also certified that I/ we shall be liable to be debarred, disqualified / cancellation of enlistment/ forefeiting EMD/ P.G. in case any information furnished by me/ us found to be incorrect.

Enclosures:
Seal of bidder
Date of submission

Signature(s) of Bidder(s)

FORM 'A'

FINANCIAL INFORMATION

Financial Analysis – Details to be furnished duly supported by figures in balance sheet/profit & loss account for the last five years duly certified by the Chartered Accountant, as submitted by the applicant to the income Tax Department (Copies to be attached)

	Years				
	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
(i) Gross Annual turnover on Construction works					
(ii) Profit/Loss (after taxes)					

II. Financial arrangements for carrying out the proposed work

Signature of Bidder(s)

Signature of Chartered Accountant with seal

Form 'B'

FORM OF BANKERS' CERTIFICATE FROM A COMMERCIAL BANK

This is to certify that to the best of our knowledge and information that M/s. Sh…….. having marginally noted address, a customer of our bank are/is respectable and can be treated as good for any engagement up to a limit of Rs. ……. (Rupees……)

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature)
For the Bank

NOTE:

(1) Bank Solvency issued in name **of E.E. (Special Project)** i.e. tendering authority and issued by the bank after the date of publishing of NIT.

(2) In case of partnership firm, certificate should include names of all partners as recorded with the Bank.

Form 'B-1'

FORM FOR CERTIFICATE OF NETWORTH FROM CHARTERED ACCOUNTANT

It is to certify that as per the audited balance sheet and profit & loss account during the financial year_____ the net worth of M/s …… (Name & Registered address of Individual/Firm/Company) as on ……. (the relevant date) is Rs. ……. After considering all liabilities. It is further certified that net worth of the company has not eroded by more than 30% in the last 3 years ending on (31.3.2021).

Signature of Chartered Accountant……..

Name of Chartered Accountant……..

Membership No of ICAI……..

Date & Seal……..

FORM 'C'

DETAILS OF ELIGIBLE SIMILAR NATURE OF WORKS COMPLETED DURING THE LAST SEVEN YEARS ENDING PREVIOUS DAY OF LAST DATE OF SUBMISSION OF TENDERS

S. No.	Name of work/Project and exact location	Owner or sponsoring Organization	Cost of Work in Crores of Rs.	Date of commencement as per contract	Stipulated date of Completion	Actual date of completion	Litigation/ Arbitration Cases Pending/in Progress in details *	Name and address / Telephone No. of officer to whom reference may be made	Whether the work was done on back to back basis Yes/ No
1	2	3	4	5	6	7	8	9	10

*Indicate gross amount claimed and amount awarded by the Arbitrator.

Signature of Bidder(s)

FORM 'C-1'

PROJECTS UNDER EXECUTION

Sl. No.	Name of work/ Project and location	Owner or sponsoring Organization	Cost of Work in Crores of Rs.	Date of commencement as per contract	Stipulated date of Completion	Up to date percentage progress of work	Slow progress if any and reasons thereof	Name and address / Telephone No. of officer to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

Signature of Bidder(s)

FORM 'D'

PERFORMANCE REPORT OF WORKS REFERRED TO IN FORM 'C'

Name of the Firm / Contractor: ……

1. **Name of work / Project & Location**

2. **Agreement No.**

3. **Estimated Cost Rs.**

4. **Tendered Cost Rs.**

5. **Date of start**

6. **Date of completion**

   (i) **Stipulated date of completion**

   (ii) **Actual date of completion**

7. **Amount of compensation levied for delayed completion, if any.**

   (a) **Whether case of levy of compensation for delay has been decided or not Yes / No**

8. **Amount of reduced rate items, if any**

9. **Performance Report**

1) Quality of work	**Outstanding / Very Good / Good / Poor**
2) Financial soundness	**Outstanding / Very Good / Good / Poor**
3) Technical Proficiency	**Outstanding / Very Good / Good / Poor**
4) Resourcefulness	**Outstanding / Very Good / Good / Poor**
5) General behavior	**Outstanding / Very Good / Good / Poor**

Dated:

Executive Engineer or Equivalent with seal address
STD code & Phone no.
***Mobile No.**
***Email ID:**

FORM 'E'

STRUCTURE OF ORGANISATION

1. Name & address of the bidder

2. Telephone no./Telex no./Fax no.

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

    a) An Individual

    b) A proprietary firm

    c) A firm in partnership

    d) A limited company or Corporation

4. Particulars of registration with various NDMC Bodies (attach attested photocopy)

	Organization / Place of registration	Registration No.
1.		
2.		
3.		

5. Names and titles of Directors & Officers with designation to be concerned with this work.

6. Designation of individuals authorized to act for the organization.

7. Has the bidder, or any constituent partner in case of partnership firm Limited Company/ joint venture, ever been convicted by the court of law? If so, give details.

8. In which field of Civil Engineering construction the bidder has specialization and interest?

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

Signature of Bidder(s)

(Separate MOU for Electrical /Fire Fighting Works)

On Stamp Paper of Rs.100 duly signed by both the parties duly notorised after Date of Publication of Tender.

Performa- B

Separate MEMORANDUM OF UNDERSTANDING [M.O.U.] BETWEEN

1) M/S [Name of the firm with full address]
   Through authorized person
   [Henceforth called the main bidder/ contractor]

And

2) M/S [Name of the firm with full address]
   Through authorized person
   [Henceforth called associate Electrical Agency or associate Fire Agency]

For the execution of electrical work or Fire Works for **Conservation & Restoration of Main Gole Market Building as a Museum and Redevelopment of surrounding area including Construction of Service Block & Subway** for Electrical Component or Fire Component only] as per schedule, specifications, terms and conditions of the tender.

We state that MOU between us will be treated as an agreement and has legality as per Indian Contract act [amended upto date] and the department [NDMC] can enforce all the terms and conditions of the agreement for execution of the above work. Both of us shall be responsible for the execution of work as per agreement to the extent this MOU allows main contractor shall be paid consequent to the execution as per agreement to the extent this MOU permit. In case of any dispute, either of us will go for mediation/arbitration by the Chief Engineer (C-II), Superintending Engineer(Elct.), Fire Officer(F) . His decision shall be final and binding on both of us. We have agreed as under:-

1. The electrical or Fire Agency will execute all electrical or Fire works in the wholesome manner as per terms and conditions of the agreement. Payment shall be made to the associate electrical/ Fire contractor via main contractor.
2. All the machinery and equipments, tools and tackles required for execution of the electrical/ Fire works as per agreement shall be the responsibility of the Electrical/ Fire Agency as well as of Main Contractor.
3. The site staff required for the electrical or Fire work shall be arranged by the electrical agency/ Fire agency and main contractor as per the terms and conditions of the agreement.
4. Site Order Book maintained for the said work shall be signed by the authorized representative main contractor or main contractor himself.
5. All the correspondence regarding execution of the electrical or Fire work shall be done by the Department with Main Contractor with a copy to the Associate Agency, in case of non-compliance of the provisions of agreement the main

contractor as well as the Associated Agency shall be responsible. The action under clause 2 & 3 shall be initiated and taken against the main contractor.

SIGNATURE OF MAIN CONTRACTOR

Place:

Date :

SIGNATURE OF ASSOCIATE AGENCY OF ELECTRICAL WORKS/ FIRE FIGHTING WORKS.

Place:

Date :

Witness 1. Name, Address, Signature

2. Name, Address, Signature

COUNTERSIGNED

EXECUTIVE ENGINEER (Spcl. Proj.) /

Place:

Date:

Performa – B-I

WILLINGNESS CERTIFICATE

Name of work : **Conservation & Restoration of Main Gole Market Building as a Museum and Redevelopment of surrounding area including Construction of Service Block & Subway** I,……s/o……..R/o……. authorized signatory of the Agency hereby, give my willingness to work as electrical Agency or Fire Agency for the above mentioned work.

I will execute the work as per specification and conditions for the agreement and as per direction of the Engineer-in-Charge. Also I will employ full time technically qualified supervisor for the works. I will attend inspection of officers of the Department as and when required.

Place:

Dated :

Signature of the Electrical Agency/

Fire Fighting Agency

INTEGRITY PACT

(Integrity Pact is applicable for all works of estimated cost put to tender equal to or more than the threshold value given in Schedule F)

This Integrity Pact is made at..... on this..... day of .....20.....

BETWEEN

Chairman, NDMC represented by the Engineer-in-Charge (hereinafter referred to as the Principal, which expression shall unless repugnant to tie meaning or context hereof include its successors and permitted assignees)

AND

.....

(Name and address of the bidder

(Hereinafter referred to as the Bidder/Contractor and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assignees)

Preamble

WHEREAS the Principal has floated the tender **(NIT No. 02/EE (Special Project)/AB/2022-23)** (hereinafter referred to as the Tender) and intends to award, under laid down organizational procedure, contract for **"Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway"** hereinafter referred to as the Contract.

AND WHEREAS the Principal values full compliance with all relevant laws of the land, rules regulations, economic use of recourses and of fairness/transparency in its relation with its Bidder(s) and Contractor(s).

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as Integrity Pact), the terms and conditions of which shall also be read as integral part and parcel of the Tender/Bid documents and Contract between the parties.

In order to achieve these goals, the Principal will appoint Independent External Monitors (IEMs) who will monitor the tender process and the execution of the contract for compliance with the principles mentioned hereunder.

NOW. THEREFORE, in consideration of mutual covenants contained in this Pact, the parties hereby agree as follows and this Integrity Pact witnesses as under

Articles

Article 1: Commitment of the Principal

(1) The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles.

(a) No employee of the Principal, personally or through any of his/her family members, will in connection with the Tender, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

(b) The Principal will, during the Tender process, treat all Bidder(s) with equity and reason.

The Principal will, in particular before and during the Tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/

additional information through which the Bidder(s) could obtain an advantage in relation to the Tender process or the Contract execution.

(c) The Principal shall endeavour to exclude from the Tender process any person, whose conduct in the past has been of biased nature.

2) If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there be a substantive suspicion in this regard the Principal will inform the Chief Vigilance Officer and in addition can also initiate disciplinary actions as per its internal laid down policies and procedures.

Article 2: Commitment of the Bidder(s)/Contractor(s)

1. It is required that each Bidder/Contractor (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the Government / Department all suspected acts of fraud or corruption or Coercion or Collusion of which it has knowledge or becomes aware, during the tendering process and throughout the negotiation or award of a contract.

2 The Bidder(s)/Contractor(s) commits himself to take all measures necessary to prevent corruption He commits himself to observe the following principles during his participation in the Tender process and during the Contract execution:

(a) The Bidder(s)/Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal employees involved in the Tender process or execution of the Contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the Contract.

(b) The Bidder(s)/Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non submission of bids or any other actions to restrict competitiveness or to cartelize in the bidding process.

(c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act.

Further the Bidder(s)/ Contract(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information, or documents provided by the Principal/Owner as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder(s)/Contractor(s) of foreign origin shall disclose the names and addresses of agents/Chairman, NDMC, if any. Similarly Bidder(s)/Contractor(s) of Indian nationality shall disclose names and addresses of foreign agents/representatives, if any Either the Indian agent on behalf of the foreign principal or the foreign principal directly could bid in a tender but not both Further, in cases where an agent participates in a tender on behalf of one manufacturer, he shall not be allowed to quote on behalf of another manufacturer along with the first manufacturer in a subsequent/parallel tender for the same item.

(e) The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.

(0) Bidder(s)/Contractor(s) who have signed the Integrity Pact shall not approach the courts while representing the matter to IEMs and shall wait for their decision in the matter.

3. The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

4. The Bidder(s)/Contractor(s) will not, directly or through any other person or firm indulge in fraudulent practice, willful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and/or to influence the procurement process to the detriment of the Government interests.

5. The Bidder(s)/Contractor(s) will not, directly or through any other person or firm use coercive practices (which shall include the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/ her reputation or property) to influence their participation in the tendering process.

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Principal under law or the contract or its established policies and laid down procedures, the Principal shall have the following rights in case of breach of this Integrity Pact by the Bidder(s)/Contractor(s) and the Bidder/ Contractor accepts and undertakes to respect and uphold the Principal absolute right:

1. If the Bidder(s)/Contractor(s) either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Principal after giving 14 days notice to the contractor shall have powers to disqualify the Bidder(s)/Contractor(s) from the Tender process or terminate/determine the Contract, if already executed or exclude the Bidder/Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Principal. Such exclusion may be forever or for a limited period as decided by the Principal.

2 Forfeiture of Earnest Money Deposit/Performance Guarantee/Security Deposit: If the Principal has disqualified the Bidder(s) from the Tender process prior to the award of the Contract or terminated/determined the Contract or has accrued the right to

terminate/determine the Contract according to Article 3(1), the Principal apart from exercising any legal rights that may have accrued to the Principal, may in its considered opinion forfeit the entire amount of Earnest Money Deposit/Performance Guarantee and Security Deposit of the Bidder/Contractor.

3. Criminal Liability: If the Principal obtains knowledge of conduct of a Bidder or Contractor, or of an employee or a representative or an associate of a Bidder or Contractor which constitutes corruption within the meaning of PC Act, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to law enforcing agencies for further investigation.

Article 4: Previous Transgression

1. The Bidder declares that no previous transgressions occurred in the last 3 years with any other Company in any country confirming to the anticorruption approach or with Central Government or State Government or any other Central/State Public Sector Enterprises in India that could justify his exclusion from the tender process.

2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken for banning of business dealings/holiday listing of the Bidder/Contractor as deemed fit by the Principal.

3. If the Bidder/Contractor can prove that he has resorted/recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal may, at its own discretion, revoke the exclusion prematurely.

Article 5: Equal Treatment of all Bidders/Contractors/Subcontractors

1. The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact. The Bidder/Contractor shall be responsible for any violation(s) of the principles laid down in this agreement by any of its Subcontractors/sub-vendors.

2. The Principal will enter into pacts on identical terms as this one with all Bidders and Contractors.

3. The Principal will disqualify Bidders who do not submit the duly signed Integrity Pact between the Principal and the Bidder along with the Tender or violate its provisions at any stage of the Tender process.

Article 6- Duration of the Pact

This Integrity Pact begins when both the parties have legally signed it expires for the Contractor 12 months after the completion of work under the contract or expiry of defect liability period or last payment made under the contract, whichever is later and for all other bidders, 6 months after the Contract has been awarded.

If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this Integrity Pact as specified above, unless it is discharged/determined by the Chairman, NDMC.

Article 7. Other Provisions

1. This Integrity Pact is subject to Indian Law, place of performance and jurisdiction is the Head quarters of the Division of the Principal, who has floated the tender.

2 Changes and supplements as well as termination notice need to be made in writing.

3. If the Contractor is a partnership or a consortium, this Integrity Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a Company, the Integrity Pact must be signed by a representative duly authorized by board resolution.

Should one or several provisions of this Integrity Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intensions.

5 Issues like Warranty/Guarantee etc, shall be outside the purview of IEMs.

6. It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Pact, any action taken by the Principal in accordance with this Integrity Pact or interpretation thereof shall not be subject to arbitration.

7. In view of the nature of integrity pact, the integrity Pact is irrevocable and shall remain valid even if the main tender/contract is terminated till the currency of the integrity pact.

8 If any complaint regarding violation of IP is received directly by the Principal in respect of the contract, the same shall be referred to the IEM for comments/recommendations.

Article 8-Independent External Monitor (IEM)

(1) The Principal appoints competent and credible Independent External Monitor for this Pact after approval by Central Vigilance Commission **(Names and address of IEMs are as under:- 1. Sh. R. K. Srivastava IEM e-mail ID Srivastava.rsk@gmail.com, 2. Sh. Upendra Malik IEM e-mail ID upendra.malik@gmail.com)**. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

2) The Monitor is not subject to instructions by the representatives of the parties and performs his/her functions neutrally and independently. The Monitor would have access to all contract documents, whenever required. It will be obligatory for him/her to treat the information and documents of the Bidders/Contractors as confidential.

(3) The Bidder(s)/Contractor(s) accepts that the IEM has the right to access without restriction to all project documentation of the Principal including that provided by the Contractor, The Contractor will also grant the IEM, upon his/her request and demonstration of a valid interest, unrestricted and unconditional access to their project documentation. The same is applicable to sub-contractors.

(4) The IEM is under contractual obligation to treat the information and documents of the Bidder(s)/Contractor(s)/Sub-contractor(s) with confidentiality. The IEM has also signed "Non-Disclosure of Confidential Information' and 'Absence of Conflict of Interest'. In case if any conflict of interest arising at a later date, the IEM shall inform the Engineer in Charge and recuse himself / herself from that case.

(5) As soon as the IEM notices, or believes to notice, a violation of this agreement, he/she will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action. The IEM can in this regard submit non binding

recommendations Beyond this, the IEM has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(6) The IEM will submit a written report to the Chairman, NDMC concerned within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

(7) If the IEM has reported to the Chairman, NDMC concerned, a substantiated suspicion of an offence under relevant IPC/PC Act, and the Chairman, NDMC concerned has, within a reasonable time, not taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer the IEM may also transmit this information directly to the Central Vigilance Commissioner.

(8) The Principal will provide to the IEM sufficient information about all meetings among the parties related to the project provided such meetings could have impact on contractual relations between the Principal and the contractor. The parties will offer to the IEM the option to participate in such meetings.

(9) The word IEM or monitor would include both singular and plural.

Article 9- Legal and Prior Rights

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and/or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both the Parties agree that this Integrity Pact will have precedence over the Tender/Contact documents with regard to any of the provisions covered under this Integrity Pact.

IN WITNESSWHEREOF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses.

.....

(For and on behalf of Principal)

.....

(For and on behalf of Bidder/Contractor)

WITNESSES:

1. .....

(Signature, name and address)

2. .....

(Signature, name and address)

Place: New Delhi.

Dated:.....

Note: To be signed by the Bidder and the Engineer-in-Charge.

Annexure 'F'

Information and instruction for Executive Engineer for e-tendering.

1. **The Executive Engineer of all divisions of NDMC should receive the original EMD for tender of other division.**

2. **The NIT approving authority/ EE at the time of issue of NIT shall also fill and upload following prescribed format of receipt of deposition of original EMD along-with NIT:-**

Receipt of deposition of Original EMD **(Receipt No ……../date……)**
Name of Work: - Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway. **NIT No: - 02/EE (Spl. Project)/AB/2022-23** 1. **Estimated Cost: - Rs. 26,46,90,399.00** 2. **Amount of Earnest Money Deposit: - Rs.36,46,904/-** 3. **Last date of Submission of bid: - *** *(*To be filled by NIT approving authority/EE at the time of issue of NIT and uploaded along with NIT)*
1 **Name of contractor …… *** **2 Form of EMD. …… *** **3 Amount of Earnest Money Deposit. …… *** **4 Date of Submission of EMD …… *** Signature, Name and Designation of EMD Receiving officer(AAO) along with Office stamp (# To be filled by EMD receiving EE)

3. **The Executive Engineer receiving EMD in original form shall examine the EMD deposited by the bidder and shall issue a receipt of deposition of earnest money to the agency in a given format uploaded by tender inviting EE. The receipt may be issued by the AE(P)/AE/AAO.**

4. **The Executive Engineer receiving original EMD shall also intimate tender inviting EE about deposition of EMD by the agency by email/tax/telephonically.**

5. **The original EMD receiving EE shall release the EMD within 30 days of declaration of result of Technical Bid Evaluatiion.**

6. **The tender inviting EE will call for original EMD of the L-1 tenderer from EMD receiving EE immediately.**

Executive Engineer (Spl. Project)

INFORMATION AND INSTRUCTIONS FOR BIDDERS FOR e-TENDERING FORMING PART OF BID DOCUMENT AND TO BE POSTED ON WEBSITE

(Applicable for inviting open bids)

1 **Executive Engineer (Special Project), NDMC** on behalf of NDMC invites online **Percentage Rate Composite Two Envelope Bids** from appropriate Agencies / firms/contractors/ companies of repute who have experience in conservation /restoration/rebabilitation/retofitting work of any type of Buildings for the work "**Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway(Composite Work)** at the Estimated Cost of **Rs.26,46,90,399/ - (Civil Rs. 19,17,49,332/- + Electrical Rs.6,46,11,792/- + Fire work Rs.83,29,275/-)** with EMD **Rs. 36,46,904/- &** a time period of completion of **24 (Twenty Four) Months. A sum of Rs.36,46,904/- as** earnest money shall have to be deposited in the office of the any Executive Engineer, NDMC through **Insurance Surety Bonds / Account Payee Demand Draft/Fixed Deposit receipt/Bankers Cheque/e-Bank Guarantee** (For Balance Amount as prescribed) from any of the Commercial Banks (Drawn in favour of Secretary, NDMC). The e-Bank Guarantee submitted as a part of Earnest Money is valid for a period of 90 days for Single Bid works and 180 days for 2 Bid system or more from the date of submission of the Tender. It should be ensured that FDR is pledged **in favour of the Secretary, NDMC**.

2 .

S. No.	NIT No.	Name of work and Location	Estimated Cost put to bid (Rs.)	Earnest Money (Rs.)	Period Of Completion	Last date & Time of submission of bid	Period during which EMD and other Documents shall be submitted	Time & Date of opening of bid
01.	02/EE (Spl. Project) /AB/2022-23	Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway.	Rs.26,46,90,399/-	Rs.36,46,904/-	24 (Twenty Four) Months	Up to 4:00 PM on 11.11.2022	After last date & time of submission of tender and up to 4:00PM on 11.11.2022	At 4:30 pm on 11.11.2022

In case the last date of submission of tender is extended, the enlistment of contractor should be valid on the original date of submission of tenders.

2. The intending bidder must read the terms and conditions of NDMC-6 carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required

3. Information and Instructions for bidders posted on website shall form part of bid document.

4. The bid document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents can be seen and downloaded from website http://govtprocurement.delhi.gov.in free of cost.

5. But the bid can only be submitted after **deposition of original EMD either in the office of EE (Spl. Project) inviting bids or division office of any Executive Engineer, NDMC within the period of bid submission. (The EMD document shall only be issued from the place in which the office of receiving division office is situated)** and uploading the mandatory scanned documents such as Insurance Surety Bonds / Account Payee Demand Draft/Fixed Deposit receipt/Bankers Cheque/Bank Guarantee (For Balance Amount as prescribed) from any of the Commercial Banks (Drawn in favour of Secretary, NDMC) **as mentioned in NIT, receipt for deposition of original EMD to the division office of any Executive Engineer,NDMC or EE inviting Bid** and other documents as specified. The Bank Guarantee submitted as a part of Earnest Money is valid for a period of 180 days for 2 Bids system or more from the date of submission of the Tender.

6. Those contractors not registered on the website mentioned above, are required to get registered beforehand. If needed they can be imparted training on online bidding process as per details available on the website.

7 The intending bidder must have valid digital signature to submit the bid.

8. On opening date, the contractor can login and see the bid opening process. After opening of bids he will receive the competitor bid sheets.

9. Contractor can upload documents in the form of JPG format and PDF format.

10. This being a percentage contract so agencies should quotated their over all percentage at one place in financial bid.

11. ~~SC/ST contractors enlisted under Class IV category are exempted from processing fee payable to…….~~ **~~- N/A - .~~**

12. The Bank Banker Certificate of the tenderer should be minimum equivalent to 40% of ECPT or **10.59 Crore.**

PROFORMA OF SCHEDULES

SCHEDULE 'A'

Schedule of Quantities (Civil, Electric, Fire Work):	Enclosed at **Page No. 546-759**

SCHEDULE 'D'

Extra Schedule for specific requirements / document for the work, if any:	**N/A**

SCHEDULE 'E'

Reference to General Conditions of contract:	**GCC 2020 with up to date amendments**
Name of Work:	**Name of work: - Conservation & restoration of main Gole Market building as a museum and redevelopment of surrounding area including construction of Service Block & Subway.**
Estimated Cost of the work:	**Rs. 26,46,90,399/-** (Civil: Rs. 19,17,49,332/- + Electrical: Rs.6,46,11,792/- + Fire: Rs.83,29,275/-)
Earnest money:	**Rs.36,46,904/-**
Performance Guarantee:	**3%** of the tendered value.
Security Deposit:	**2.5%** of the accepted tendered value.

SCHEDULE 'F'

General Rules & Directions:		
Officer inviting tender:		**Executive Engineer (SPL. PROJ)**
Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2 & 12.3:		**100%**
Definitions:		
2(v)	Engineer-in-Charge	**Executive Engineer (SPL. PROJ)**
2(vii)	Accepting Authority	**As per delegation of power**
2(x)	Percentage on cost of materials and labour to cover all overheads and profits:	**Provided that no extra overheads an profits shall be payable on the part(s) o work assigned to other agency(s) by th contractor as per terms of contract.** **15%**
2(xi)	Standard Schedule of Rates	**DSR-2021 with up to date correction slips/ market rates for Civil works**

		DSR-2021 current Market rates and Quotations for Fire Fighting works; and DSR & AOR (E&M) rates/ market rates for Electrical Works.	
2(xii)	Department	**Civil Engineering Department, NDMC**	
9(ii)	Standard NDMC Contract Form	**GCC 2020 for Construction Works, CPWD Form 7 as amended up to last date of submission of bid.**	
Clause 1			
(i)	Time allowed for submission of Performance Guarantee, Programme Chart (Time and Progress) and applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board of proof of applying thereof from the date of issue of letter of acceptance.	**7 Days**	
(ii)	Maximum allowable extension with late fee @ 0.1% per day of Performance Guarantee amount beyond the period provided in (i) above	**7 Days**	
Clause 2			
Authority for fixing compensation under clause 2		**As per delegation of power**	
Clause 2A			
Whether Clause 2A shall be applicable		**-N/A-**	
Clause 5			
Number of days from the date of issue of letter of acceptance for reckoning date of start		**10 Days or date of handing overof site whichever is later**	
Mile stone(s) as per table given below			
Sr. No.	**Description of mile stone (physical)**	**Time allowed in days (From date of start)**	**Amount to be withheld in case of non-achievement of milestones**
1.	All demolishing work of Main Gole Market	**90 days**	In the event of not achieving the necessary progress as assured from running payment. 1% of the tendered value of work will be withheld for failure of each milestone.
2.	Casting of Ground Floor Roof Slab	**120 days**	
3.	All conservation and resoration work of Main Gole Market Block	**300 days**	
4.	First Floor roof including glass dome Structure	**400 days**	
5	Demolishing and re-structure of Royal Block	**500 days**	
6.	Construction of Service Block, Service tunnel and Subway	**700 days**	
7.	Full work as per contract and handing over	**730 days (24 Months)**	
Note1: The amount so withheld may be released, if specifically requested by the contractor, on submission of Bank Guarantee in prescribed proforma.			
Time allowed for execution of work		**24 Months (Twenty Four Months)**	

Authority to decide:			
(i)	Extension of Time:	**As per delegation of powers of Major Component**	
(ii)	Rescheduling of Mile Stones:	**Superintending Engineer of Major Component**	
(iii)	Shifting of date of start in case of delay in handing over of site	**Superintending Engineer of Major Component**	
Clause 5.1			
Schedule of Handing over site			
Part	**Portion of site**	**Description**	**Time Period for handing over reckoned from date of issue of letter of intent.**
Part A	Portion without any hindrance	Site available Main Gole Market Block	10 Days
Part B	Portion with encumbrances	Royal Block and Service Block	After shifting/vacation of Royal Block shops by the Shopkeepers
Part C	Portions dependent on work of other agencies	Subway	After approval from all statutory bodies
Clause 7			
Gross work to be done together with net payment/ adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment.		**Rs. 1.O Crore**	
Clause 7A & 7B			
Whether Clause 7A & 7B shall be applicable		**Yes**	
Clause 8A			
Authority to decide compensation on account if contractor fails to submit completion plans		**Superintending Engineer of Major Component**	
Clause 10A			
List of testing equipment to be provided by the contractor at site lab		**Applicable as per Annexure-VI Note: No reimbursement will be paid for tests either tests happened once or repeated.**	
Clause 10 B (i)			
Whether clause 10 B (i) shall be applicable (Secure Advance)		**No**	
Clause 10CA			
Sl. No.	**Material covered under this clause**	**Nearest Materials (other than cement, reinforcement bars, the structural**	**Base Price and corresponding period of all the Materials covered under clause 10 CA**

		steel and POL) for which All India Wholesale Price Index is to be followed	
1.	Cement (OPC-43 Grade)	NIL	**Base Price as circulated by CPWD for the month of last day of submission of bids**
2.	Steel (TMT Bars) reinforcement	NIL	**Base Price as circulated by CPWD for the month of last day of submission of bids**
3.	Structural Steel	NIL	**Base Price as circulated by CPWD for the month of last day of submission of bids**
Note:			
(i)	**EE (SPL. PROJ) Civil will recheck up to date rates of material under clause 10CA issued by CPWD and make suitable correction accordingly in clause 10CA in Schedule 'A' to 'F' and then upload the NIT.**		
(ii)	**includes Cement component used in RMC brought at site from outside approved RMC plants, if any**		
(iii)	**Base price and its corresponding period of all the materials covered under clause 10 CA is to be mentioned at the time of approval of NIT. In case of recall of tender, the base price may be modified by adopting latest base price and its corresponding period**		
(iv)	**OPC Cement shall be used for all items, in case of use of PPC cement necessary cost adjustment shall be made.**		
Clause 10CC			
Whether Clause 10CC shall be applicable		**Yes WITH LABOUR COMPONENT 25% OF WORK DONE**	
Clause 11			
Specifications to be followed for execution of work		**Civil Works:** CPWD specification Vol I & II of 2019 with up to date correction slips + Technical Specificaiton for Non schedule spealized Item. **Electric Works:** CPWD's general specifications for Electrical Works Part-I (Internal)-2022, IE Rules, Heating, Ventilation & Air-Conditioning (HVAC) – 2019 **Firefighting Works:** CPWD General Specificaitons for Electric work - 2020 & NBC Part-IV 2016 with upto date correction slips	
Clause 12			
Type of Work		**Original Work**	

Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for building work		**30% (Hundred Percentage)**
Clause 12.5		
(i)	Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for foundation work	**100% (Hundred Percentage)**
(ii)	Deviation Limit for items in earth work subhead of DSR and related items	**100% (Hundred Percentage)**
Clause 16		
Competent Authority for deciding reduced rates.		**Chief Engineer (Civil)-II**
Clause 18		
List of mandatory machine. Tool & plant to be deployed by the contractor at site		**As per Annexure -VII**
Clause 19 C		
Authority to decide penalty for each default		**Engineer-in-charge**
Clause 19 D		
Authority to decide penalty for each default		**Engineer-in-charge**
Clause 19 G		
Authority to decide penalty for each default		**Engineer-in-charge**
Clause 19 K		
Authority to decide penalty for each default		**Engineer-in-charge**
Clause 25		
i) Conciliator		Competent Authority to appoint Conciliator/Arbitrator
ii) Arbitrator Appointing Authority		**Chairman/ Chairperson, NDMC**
iii) Place of Arbitration		**New Delhi**

Clause 32

Requirement of Technical Representative(s) and recovery Rate

Sl No.	**Minimum Qualification of Technical Representative**	**Discipline**	**Designation (Principal Technical /Technical representative)**	**Minimum Experience In years**	**Number**	**Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 36(i)**
						Figures (per Month)
1.	Graduate Engineer (Major Component)	1	Project Manager with Degree in the major discipline of Engineering	20 years (and having experience of one similar nature of work)	1	Rs. 60,000/- per month
2.	Graduate Engineer	1	Deputy Project Mangar	12 yaers(and	1	Rs. 40,000/- per month per person

				having experience of one similar nature of work)		
3.	Graduate Engineer or Diploma Engineer	1 + 1	Project/ Site Engineer	5 or 10 Years respectively	2	Rs. 25,000/- per month per person
4	Graduate Engineer	1	Quality Engineer	2 Years	1	Rs. 25,000/- per month per person
5.	Diploma Engineer	1	Project Planning / billing Engineer	5 Years	1	Rs. 15,000/- per month per person
6.	M.Arch	1	Architect	25 Years	1	Rs. 60,000/- per month per person

Assistant Engineers retired from NDMC services that are holding Diploma will be treated at par with Graduate Engineers.

Diploma holders with minimum 10 years' relevant experience with a reputed construction company can be treated at par with Graduate Engineers for the purpose of such deployment subject to the condition that such diploma holders should not exceed 50% of requirement of degree engineers.

Clause 38		
(i)	(a) Schedule / statement for determining theoretical quantity of cement & bitumen on the basis of Delhi Schedule of Rates, 2021 printed by CPWD.	**D.S.R. 2021 plus market rates with up to date correction slips** + Technical Specificaiton for Non schedule spealized Item.
(ii)	Variations permissible on theoretical quantities	
	(a) Cement	
	For works with estimated cost put to tender not more than Rs.25 Lakhs.	**3% plus/minus**
	For works with estimated cost put to tender more than Rs.25 Lakhs.	**2% plus/minus**
	(b) Bitumen All works.	**2.5% plus & only & nil on minus side.**
	(c) Steel Reinforcement and structural steel sections for each diameter, section and category.	**2% plus/minus**
	(d) All other material	**NIL**

RECOVERY RATES FOR QUANTITIES BEYOND PERMISSIBLE VARIATION

Sl. No.	Description of Item	Rates in figures and words at which recovery shall be made from the contractor	
		Excess beyond permissible variation	Less use beyond the permissible variation
1.	Cement	Not applicable	Rs. 5,000/- per M.T.
2.	Steel reinforcement (a) Primary Manufacturer	Not applicable	Rs. 50,000/- per M.T.

Executive Engineer (SPL. PROJ)
For & on behalf of NDMC

Annexure-I

On non-judicial stamp paper of minimum Rs.100/-

(Guarantee offered by Bank to NDMC in connection with the execution of Contracts)

FORM OF BANK GUARANTEE FOR EARNEST MONEY DEPOSIT/ PERFORMANCE GUARANTEE/ SECURITY DEPOSIT/ ~~MOBILIZATION ADVANCE~~

1. Whereas the Executive Engineer (Special Project), NDMC on behalf of the Chairman, NDMC (hereinafter called "The Government") has invited bids under ……. (NIT number) ……dated……for…… (name of work)…… The Government has further agreed to accept irrevocable Bank Guarantee for Rs …… (Rupees……..only) in **favour of Secretary, NDMC payable at New Delhi** valid up to **Six month from last date of submission of bid** (date)* ..... as Earnest Money Deposit from ……. (name and address of contractor) ..... hereinafter called "the contractor") for compliance of his obligations in accordance with the terms and conditions of the said NIT.

OR**

Whereas the Executive Engineer (Special Project), NDMC on behalf of the Chairman, NDMC (hereinafter called "The Government") has entered into an agreement bearing number…….with…….(name and address of the contractor)……..(hereinafter called " the Contractor") for execution of work……..(name of work) ..... The Government has further agreed to accept an irrevocable Bank Guarantee for Rs…….(Rupees……..only) **in favour of Secretary, NDMC payable at New Delhi** valid up to…..(Date)……as Performance Guarantee/Security Deposit/Mobilization Advance from the said Contractor for compliance of his obligations in accordance with the terms and conditions of the agreement.

2. We, ……. (indicate the name of bank) ……. (hereinafter referred to as "the Bank"), hereby undertake to pay to the Government an amount not exceeding Rs. …… (Rupees…only) in demand by the Government within 10 days of the demand.

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

4. We…... (indicate the name of the Bank) ……..., further undertake to pay the Government any money so demanded not withstanding any dispute or dispute raised by the contractor in any suit or proceeding pending before any Court or Tribunal, our liability under this Bank Guarantee being absolute and unequivocal. The payment so made by us under this Bank Guarantee shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such

payment.

5. We,…….(indicate the name of the Bank)……., further agree that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligation here under to vary any of the terms & conditions of the said agreement or to extended time of performance by the said contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said contractor and to forbear or enforce any of the terms & conditions relating to the said agreement and we shall not be relived from our liability by reasons of any such variation or extension being granted to the said Contractor or for any forbearance , act of omission on the part of the Government or any indulgence by the Government to the said Contractor or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

6. We, ……. (indicate the name of the Bank), further agree that the Government at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor at the first instance without proceeding against the Contractor and not withstanding any security or other guarantee the Government may have in relation to the Contractor's liabilities.

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

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

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

Date:

Witnesses:

1. Signature:
   Name and Address:

Authorized Signatory
Name:
Designation:
Staff Code No.:
Bank Seal:

2. Signature:
   Name and Address:

- Date to be worked out on the basis of validity period from the date of submission of tender.

** In Paragraph 1, strike out the portion not applicable. Bank Guarantee will be made either for earnest money or for Performance Guarantee/ Security Deposit/ Mobilization Advance, as the case may be.

Annexure-II

Sample letter for Acceptance of tender

By REGISTERED POST

No. Dated:

To

(Name and Address of the contractor)

Subject: (Name of work as appearing in the tender for the work).

Dear Sir(s)

Your tender for the work mentioned above has been accepted on behalf of the New Delhi Municipal Council at your tendered / negotiated tender value of Rs..... (Rupees.....) which is .....% below / above the estimated cost of Rs.....(Rupees)

1. You are requested to submit the performance guarantee of Rs. ..... (Rupees.....) within 7 days of issue of this letter. The Performance Guarantee shall be in any of the prescribed form as provided in Clause – I of the General Condition of Contracts for NDMC Works and shall be valid up to ..... On receipt of prescribed performance guarantee necessary letter to commence the work shall be issued and site of work shall be handed over to you thereafter.

2. Please note that the time allowed for carrying out the work as entered in the tender ..... days, will be reckoned from ..... days subject to maximum allowable extension under Clause 1(ii), from the date of issue of this letter.

Yours faithfully,

Executive Engineer (Special Project)
For & on behalf of NDMC

Annexure-III

Sample letter for Commencement of works

By Registered Post

No. Dated:

To

(Name and Address of the contractor)

Subject: (Name of work as appearing in the tender for

the work).

Ref: 1. Performance guarantee submitted by you vide your letter No ..... Datedfor

above work.

2. This office letter of intent/ acceptance of tender No.....dt.....

Dear Sir(s)

1. In continuation to the letters referred above, you are requested to attend this office to complete formal agreement within 15 days from stipulated date of start.

2. You are requested to contact the Assistant Engineer, ... (complete address) for taking possession of site and starting the work on or before ..... days from the date of letter ofacceptance of tender. Please note, that the time allowed for carrying out the work as entered in the tender ( ) days, will be reckoned from ..... to days subject to maximum allowable extension under Clause 1(ii), from the date of issue of acceptance letter.

Yours faithfully,

Executive Engineer (Special Project)
For & on behalf of NDMC

ANNEXURE- IV

GUARANTEE FOR REMOVAL OF

DEFECTS AFTER COMPLETION IN RESPECT OF WATER PROOFING WORKS.

The agreement made this_____day of_____two thousand and

_____

Between_____ son of

_____of_____(hereinafter called the Guarantor of the one part) and the Executive Engineer (Special Project), NDMC on behalf of the Chairman, NDMC (hereinafter called the Government of the other part).

WHEREAS this agreement is supplementary to a contract (here in after called the contract), dated_____and made between the GUARANTOR of the ONE part and the GOVERNMENT of the other part, whereby the contractor, interalia, undertook to render the buildings and structures in the said contract recited completely water and leak- proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structures will remain water and leak-proof **FOR TEN** years to be reckoned from the date after the maintenance period prescribed in the contract.

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

Provided that the Guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse of roof or alteration and for such purpose:

(i) Misuse of roof shall mean any operation which will damage proofing treatment like chopping of firewood and the things of same nature which might cause damage to the roof

(ii) Alteration shall mean construction of an additional storey or a part of the roof or construction adjoining to existing roof whereby proofing treatment is removed in parts.

(iii) The decision of the Engineer-in-charge with regard to cause of leakage shall be final.

During this period of guarantee the Guarantor shall make good all the defects and in case of any defect being found render the building water proof to the satisfaction of the Engineer-in- charge at his cost and shall commence the work for such rectification within seven days from the date of issue of the notice from the Engineer-in-charge calling upon him to rectify the defects failing which the work shall be got done by the department by some other

contractor at the GUARANTOR"S cost and risk. The decision of the Engineer-in-charge as to the cost payable by the Guarantor shall be final and binding.

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

IN WITNESS WHERE-OF these presents have been executed by the obligor …….. and by Executive Engineer (Special Project), NDMC on behalf of the Chairman, NDMC on the month and year first above written.

SIGNED, sealed and delivered by (OBLIGOR) in the presence of.

1.

2.

Signed for and on behalf of the Chairman, NDMC by _____in the presence of:

1.

2.

Annexure-V

Guarantee to be Executed By Contractors for Removal of Defects after Completion in Respect of Aluminium Doors, Windows, Ventilators Work and Curtain / Structural Glazing work.

The agreement made this _____day of_____two thousand _____

between_____son of_____(hereinafter called the Guarantor of the one part) and the Executive Engineer (Special Project), NDMC on behalf of the Chairman, NDMC (hereinafter called the Government of the other part).

WHEREAS THIS agreement is supplementary to a contract (hereinafter called the Contract) dated _____ and made between the GUARANTOR OF THE ONE part and the Government on the other part. Where by the contractor inter alia, undertook to render the work in the said contract recited structurally stable leak proof and sound material, workmanship, anodizing, coloring, sealing. AND WHEREAS THE GUARANTER agreed to give a guarantee to the effect that the said work will remain structurally stable, leak proof and guaranteed against the faulty material and workmanship defective anodizing coloring and finishing for **two years** to be reckoned from the date after the maintenance period prescribed in the contract.

NOW THE GUARANTOR hereby guarantees that the work executed by him will remain structurally stable leak proof and guaranteed against faulty material and workmanship defective anodizing and coloring for the minimum life of **two years** to be reckoned from the date after the maintenance period prescribed in the contract.

The decision of the Engineer-in-charge with regard to case of defect shall be final.

During the period of guarantee the guarantor shall make good all defects and in case of any defect to the satisfaction of Engineer-in-charge at his cost and shall commence the work for such rectification within seven days from the date of issue of the notice from the Engineer-in-charge calling upon him to rectify the defects failing which the work shall be got done by department or by some other contractor at guarantors cost and risk. The decision of the Engineer-in-charge as to the cost, payable by the Guarantor shall be final and binding.

That if Guarantor fails to make good all the defects, commits breach there under then the guarantor will indemnify the Principal and his successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement.

As to the amount of loss and / or damage and / or cost incurred by the Government the decision of the Engineer-in-charge will be final and binding on the parties.

IN WITNESS WHEREOF these present have been executed by the Obligator_____and by Executive Engineer (Special Project), NDMC on behalf of the Chairman, NDMC on the day, month and year first above written.

SIGNED SEALED AND delivered by OBLIGATOR in the
presence of:

1.

2.

SIGNED FOR AND ON BEHALF OF THE NEW DELHI MUNICIPAL COUNCIL by in presence of:

1.

2.

Annexure-VI

FIELD TESTING EQUIPMENT AND INSTRUMENTS TO BE PROVIDED BY THE CONTRACTOR AT HIS OWN COST

A. Testing Equipment at Field Laboratories (Minimum numbers specified against each of them)

1. Balances
   a) 7Kg to 10 kg capacity, semi-self-indicating type- Accuracy 10 gm – 2 no.
   b) 500 gm capacities, semi-self-indicating type- Accuracy 1 gm – 2 no.
   c) Pan balance- 5kg capacity - Accuracy 10 gms – 2 no.
2. Ovens- electronically operated, thermostatically controlled up to 110°C to 10°C – 2 no.
3. Sieves as per IS 460-1962.
   i) IS sieves - 450mm internal dia, of sizes 100mm, 80mm, 63mm, 50mm, 40mm, 25mm, 20mm, 12.5mm, 10mm, 6.3mm and 4.75mm complete with lid and pan. – 2 Set
   ii) IS sieves - 200mm internal dia (brass frame), consisting of 2.36mm, 1.18mm, 600 microns, 425 microns, 300 microns, 212 microns, 150 microns, 90 microns, 75 microns with lid and pan. – 2 Set
4. Sieve shaker capable of 200mm and 450 mm dia sieves, manually operated with timing switch assembly – 1 no.
5. Equipment for slump test-slump cone, steel plate, tamping rod, steel scale, scoop – 2 Set
6. Dial gauges, 25mm travel- 0.01mm/division least count– 2 no.
7. 100 tonnes compression testing machine, hydraulically operated – 2 no.
8. Graduated measuring cylinders 200 ml capacity– 5 no.
9. Enamel trays (for efflorescence test for bricks)
   (i) 300 mm x 250 mm x 40 mm - 2 Nos.
   (ii) Circular plates of 250mm dia - 4 Nos.
10. Concrete cube moulds 15 x 15 x 15cm - 50 Nos.
11. Vicats Apparatus for testing consistency of cement – 1 no.
12. Cement Mortar cube Moulds – > 50 sq.cm area – 6 Nos.

(B) FIELD TESTING INSTRUMENTS

1. Steel tapes - 3m – 10Nos.
2. Metallic Tape – 30m – 2No.
3. Vernier calipers – 2 no.
4. Micrometer screw 25mm gauge – 2 no.
5. Good quality plumb bob – 2Nos.
6. Spirit level, minimum 30cms long with 3 bubbles for horizontal vertical – 2 nos.
7. Wire gauge (circular type) disc. – 2 no.
8. Foot rule – 2 no.
9. Long Nylon thread
10. Plastic bags for taking samples.

Annexure-VII

Minimum required T&P to be owned/ taken on lease by the Contractor

(This list is only indicative and not exhaustive)

S. No.	Activity	Detail of T&P	Qty.
1	Earth work	a) Hydraulic Excavator (3D)	2 Nos.
		b) Front end Loader capacity 1 cubic meter.	5
		c) Trucks	5
		d) Earth rammers	5
		e) Drill Machine	2
		f) Crane	2
		g) Hydraulic Excavator of 1 cubic meter bucket	5
		h) Tripper 5 cubic meter.	5
		(i) Sand Blasting Equipment	Nil
2	Concrete work	a) Concrete Mixer with hopper	2 Nos.
		b) Concrete Pump	2
		c) Plate vibrator	4
		d) Pin Vibrator	5
		e) Concrete Joint Cutting Machine	2
		f) Air Compressor	2
3	Building work	a) Bar cutting machine	5 Nos.
		b) Hydraulic Bar bending machine	5 No.
		c) Steel shuttering plates i/c Steel scaffolding, adjustable telescopic props, Adjustable spans	5000 Sqm
		d) Cutting Saw Machine	5
		e) Machine for rubbish of floors	5
		f) Hand Grinder for mirror polish	5
4	Survey	Auto level with leveling staff	2 No.
5	Road Work	a) Vibratory roller 8 to 10 tonne	1
		b) Smooth Wheeled Roller 8 to 10 tonne	1
		c) Tandem Road Roller	1
		d) Water Tanker 5 to 6 KL Capacity	5
		e) Concrete paver finisher with 40 HP Motor and sensor	1
		f) Suction Jetting Machine 1500 PSI	1
6	Miscellaneous	a) Pump Set of Capacity 4000 Thousand per litre.	2
		b) Generator 250 KVA	2
		c) Compressor, gun, rubber pipes & other accessories	2
7	Others	Any other Machinery required for completion of work as per direction of Engineer-in-charge.	

NOTE:

1. The contractor has to establish within 21 days from the award of work a field laboratory at site including all necessary equipment's and skilled manpower for the **Field Tests as indicated in the tender document** at his own cost to have proper quality control. **Rs. 1,000/-** per day shall be recovered from the contractor for any delay beyond the specified period. If contractor fails to establish lab within additional period of 15 days, the Engineer in Charge shall initiate action as deemed fit under relevant clauses of the agreement.

2. A site laboratory with temporary structure of minimum 25 sqm area may be

fabricated at site by the contractor for accommodating above instruments and for conducting of various tests for which no extra payment shall be made to the contractor.

3. One sample keeping room of minimum area of 20 sqm should also be fabricated at site for keeping various material brought by the contractor at site and approved by the Engineer in charge. No extra payment on account of this shall be made to the contractor.

4. All the above structures should be decent looking and shall be fabricated as per direction of Engineer in charge. All the above structure shall be demolished after completion of work and the dismantled material shall be the property of the contractor.

NEW DELHI MUNICIPAL COUNCIL

GENERAL RULES & DIRECTIONS

1. All work proposed for execution by contract will be notified in a form of invitation to tender pasted in public places and signed by the officer inviting tender or by publication in Newspapers as the case may be.

   This form will state the work to be carried out, as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tender, and the security deposit and Performance guarantees to be deposited by the successful tenderer and the percentage, if any, to be deducted from bills. Copies of the specifications, designs and drawings and any other documents required in connection with the work signed for the purpose of Identification by the officer inviting tender shall also be open for inspection by the Contractor at the office of officer inviting tender during office hours.

2. In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power-of attorney authorizing him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952.

3. Receipts for payment made on account of work, when executed by a firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.

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

Applicable for Percentage Rate Tender only (NDMC- 7)

4A. In case of Percentage Rate Tenders, Contractor shall fill up the usual printed form, stating at what percentage below/above (in figures as well as in words) the total estimated cost given in Schedule of Quantities at Schedule-A, he will be willing to execute the work. The tender submitted shall be treated as invalid if:

(i) The contractor does not quote percentage above/ below on the total amount of tender or any section/sub head of the tender.

(ii) The percentage above/below is not quoted in figures & words both on the total amount of tender or any section/sub head of the tender.

(iii) The percentage quoted above/below is different in figures & words on the total amount of tender or any section/sub head of the tender:

Tenders, which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort including conditional rebates, will be summarily rejected.

4B. In case the lowest tendered value (estimated cost +/- amount worked out on the basis of percentage above/below) of two or more contractors is same, such lowest contractors will be asked to submit sealed revised offer in the form of letter

mentioning percentage above/below on estimated cost of tender including all sub sections/sub heads as the case may be, but the revised percentage quoted above/below on tendered cost or on each sub section/sub head should not be higher than the percentage quoted at the time of submission of tender. The lowest tender shall be decided on the basis of revised offers.

In case any of such contractor refuses to submit revised offer, then it shall be treated as withdrawal of his tender before acceptance and 50% of earnest money shall be forfeited. Further the bidder shall not be allowed to participate in the re-bidding process of the work.

5. The officer inviting tender or his duly authorized assistant will open tenders in the presence of any intending contractors who may be present at the time.
6. The officer inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest or any other tender.

7. The receipt of an accountant or clerk for any money paid by the contractor will not be considered as any acknowledgment or payment to the officer inviting tender and the contractor shall be responsible for seeing that he procures a receipt signed by the officer inviting tender or a duly authorized Cashier.

8. Deleted

9. In case of Percentage Rate Tenders only percentage quoted shall be considered. Any tender containing item rates is liable to be rejected. Percentage quoted by the contractor in percentage rate tender shall be accurately filled in figures and words, so that three is no discrepancy.

10. In Percentage Rate Tenders the tenderer shall quote percentage below/above (in figure as well as in words) at which he is willing to execute the work. He shall also work out the total amount of his offer and the same should be written in figure as well as in words. In case of figure, the word 'Rs.' should be written before the figure of Rs. and word 'P' after the decimal figure, e.g. 'Rs. 2.15 P and in case of words, the word 'Rupees' should precede and the word 'Paisa' should be written at the end.

11. (i) The contractor whose tender is accepted, will be required to furnish performance guarantee of **3%** (**Three Percent**) of the tendered value within the period specified in Scheduled F. This guarantee shall be in the form of cash (if cash guarantee amount is less than Rs. 10,000/-) or Deposit at call receipt of any Commercial Bank /banker's cheque of any Commercial Bank /demand draft of any Commercial Bank /pay order of any Commercial Bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities of Fixed Deposit Receipt or Guarantee Bonds of any Commercial Bank or Commercial Bank or the State Bank of India in accordance with the prescribed form. **In case the contractor fails to deposit the said performance guarantee within the period as indicated in schedule F including the extended period if any, action will be taken as per the conditions stipulated in the proforma of undertaking as specified at Annexure 'F' of this NIT.**

(ii) The contractor whose tender is accepted will also be required to furnish by way of Security Deposit for the fulfillment of his contract, an amount equal to 2.5% of the tender **value** of the work. The Security Deposit will be collected by deductions from the Running bills as well as final bill of the contractor at the rates mentioned above. The Security amount will also be accepted in the shape of **Insurance Surety Bonds, Account Payee Demand Draft, Fixed Deposit Receipt or Bank Guarantee from any of the Commerical Banks**.

12. On acceptance of the tender, the name of the accredited representative(s) of the contractor who would be responsible for taking instructions from the Engineer-in-charge shall be communicated in writing to Engineer–in–Charge.

13. **GST** or any other tax applicable in respect of inputs procured by the contractor for this contract shall be payable by the Contractor and NDMC will not entertain any claim whatsoever in respect of the same. However, **component of GST at the time of supply of service (as provided in CGST act 2017) provided by the contractor shall be varied to check that if it is different from that applicable on the last date of receipt of tender including extension if any. The applicable and eligible service tax shall be reimbursed preferably with in the seven days but not later than 30 days of submission of documentary proof of payment, provided the same is in order.**

14. The contractor shall give a list of both gazetted and non-gazetted NDMC officers & employees related to him.

15. The tender for the work includes, in addition to building work, all other works such as sanitary and water supply installations, drainage installation, electrical work, Fire work, roads and paths etc.

16. The contractor shall submit list of works which are in hand (progress) in the following form:

Name of Work	**Name and particulars of Division, where work is being**	**Value of work**	**Position of works in**	**Remarks**

Contractor **Executive Engineer (Special Project)**

CONDITIONS OF CONTRACT FOR WORKS

Definitions:

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

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

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

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

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

   iv) The N.D.M.C or NDMC means The New Delhi Municipal Council.

   v) The **Engineer-in-charge** means the Executive Engineer who shall supervise and be in charge of the work and who shall sign the contract on behalf of the NDMC as mentioned in Schedule 'F' hereunder.

   vi) Govt. means Central/ NDMC/Delhi Government.

   vii) The terms Chief Engineer includes Additional Chief Engineer also.

   viii) **Accepting Authority** shall mean the authority mentioned in Schedule 'F'.

   ix) **Excepted Risk** are risks due to riots (other than those on account of contractor's employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of Government, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by NDMC of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to NDMC faulty design of works.

   x) **Market Rate** shall be the rate as decided by the Engineer-in-charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Schedule 'F' to cover, all overheads and profits. Provided that no extra overhead and profits shall be payable on the part (s) of work assigned to other agency (s) by the contractor as per terms of contract. Schedule (s) referred to in these conditions shall mean the relevant schedule (s) annexed to the tendered documents or the standard Schedule of Rates of the Govt. mentioned in Schedule 'F' hereunder, with the amendments thereto issued up to the date of receipt of the tender.

   xi) **Department** means NDMC or any department of NDMC which invites tenders on behalf of Chairman NDMC as specified in schedule 'F'.

   xii) **District Specifications** means the specifications followed by the State NDMC in

the area where the work is to be executed.

xiii) **Tendered value** means the value of the entire work as stipulated in the letter of award.

xiv) **Date of commencement of work:** The date of commencement of work shall be the date of start as specified in schedule 'F' or the first date of handing over of the site, whichever is later, in accordance with the phasing if any, as indicated in the tender document.

xv) GST shall be mean Goods and Service Tax-Central, State and Inter State.

Scope and Performance

3. Where the context so requires, words imparting the singular only also include the plural and vice versa. Any reference to masculine gender shall whenever required include feminine gender and vice versa.

4. Headings and Marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.

5. The contractor shall be furnished, free of cost one certified copy of the contract documents except standard specifications, Schedule of Rates and such other printed and published documents, together with all drawings as may be forming part of the tender papers. None of these documents shall be used for any purpose other than that of this contract.

Works to be carried out

6. The work to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labour, materials, tools, plants, equipment and transport which may be required in preparation of and for and in the full and entire execution and completion of the works. The descriptions given in the Schedule of Quantities (Schedule 'A') shall, unless otherwise stated, be held to include wastage on materials, carriage and cartage, carrying and return of empties, hoisting, setting, fitting and fixing in position and all other labours necessary in and for the full and entire execution and completion of the work as aforesaid in accordance with good practice and recognized principles.

Sufficiency of Tender

7. The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices quoted in the Schedule of Quantities, which rates and prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

Discrepancies and Adjustment of Errors

8. The several documents forming the Contact are to be taken as mutually explanatory of one another, detailed drawings being followed in preference to small scale drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.

8.1 In the case of discrepancy between the schedule of Quantities, the Specifications and/ or the Drawings, the following order of preference shall be observed:

i) Description of Schedule of Quantities.
ii) Particular Specification and Special Condition, if any.
iii) Drawings.
iv) CPWD Specifications.
v) Indian Standard Specifications of B.I.S.

8.2 If there are varying or conflicting provisions made in any one document forming part of the contract, the Accepting Authority shall be the deciding authority with regard to the intention of the document and his decision shall be final and binding on the contractor.

8.3 Any error in description, quantity or rate in Schedule of Quantities or any omission there from shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the works comprised therein according to drawings and specifications or from any of his obligations under the contract.

Signing of Contract

9. The successful tenderer/contractor, on acceptance of his tender by the Accepting Authority shall, within 15 days from the stipulated date of start of the work, sign the contract agreement consisting of:

i) The notice inviting tender, all the documents including drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

ii) Standard N.D.M.C Form as mentioned in Schedule 'F' consisting of:
(a) Various standard clauses with corrections up to the date stipulated in Schedule 'F' along with annexure thereto.
(b) NDMC Safety Code
(c) Model Rules for the protection of health, sanitary arrangements for workers employed by NDMC or its contractors.
(d) Contractor's Labour Regulations.
(e) List of Acts and omissions for which fines can be imposed.

iii) No payment for the work done will be made unless contract is signed by the contractor.

10. Stipulated materials and T&P shall be issued only after necessary contract documents are signed by the contractor.

Contractor

Engineer-in-Charge
Executive Engineer (Spl. Project)
For & on behalf of NDMC

CLAUSES OF CONTRACT

CLAUSE 1

Performance Guarantee

(i) The contractor shall submit an irrevocable Performance Guarantee **at specified percentage** of the tendered **value as mentioned in Schedule 'E',** in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in Schedule 'F' from the date of issue of letter of acceptance. This period can be further extended by the Engineer-in-Charge up to a maximum period as specified in schedule 'F' on written request of the contractor stating the reason for delays in procuring the Performance Guarantee. To the satisfaction of the Engineer-in-Charge. This Guarantee shall be in the form of Insurance Surety Bonds, Account Payee Demand Draft, Fixed Deposit Receipt or Bank Guarantee from any of the Commercial Banks. In case a fixed deposit receipt of any Bank is furnished by the contractor to the Government as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit.

(ii) The Performance Guarantee shall be submitted by the contractor on format as per GCC and shall be initially valid up to the stipulated date of completion plus minimum 6 months beyond that. In case the time for completion of work gets enlarged, the Contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest. However, in case of contracts involving maintenance of building and services/ any other work after construction of same building and services/other works, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.

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

(a) Failure by the Contractor to extend the validity of the Performance Guarantee as described here in above, in which event the Engineer-in-Charge may claim the full amount of thePerformance Guarantee.

(**b**)Failure by the Contractor to pay NDMC any amount due, either as agreed by the Contractoror determined under any of the Clauses/Conditions of the agreement,within 30 days of theserviceof noticeto this effect byEngineer-in-Charge.

(iv)In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeitedin full and shall be absolutely at the disposal of the NDMC.

(v) On substantial completion of any work which has been completed to such an extent that the intended purpose of the work is met and ready to use, then a provisional completion certificate shall be recorder by the Engineer-in-Charge. The provisional certificate shall have appended with a list of outstanding balance item of work that need to be completed in accordance with the provisions in the contract.

This provisional completion certificate shall be recorded by the concerned Engineer-in-charge with the approval of superintending Engineer/project manager / Chief Engineer/ Chief Project Manager, if required. After recording of the provisional completion certificate for the work by the competent authority, the 80% of performance guarantee shall be returned to the Contractor,

without any interest.

However in case of contracts involving maintenance of building and services / any other work after construction of same building and services / other works, then 40% of performance guarantee shall be returned to the Contractor, without any interest after recording the provisional completion certificate.

CLAUSE 1 A

Recovery of Security Deposit

The person**(s)** whose tender may be accepted (hereinafter called the contractor) shall permit NDMC at the time of making any payment to him for work done under the contract to deduct a sum at the rate of **2.5%** of the gross amount of each running and final bill till the sum deducted will amount to security deposit of **2.5%** of the tendered **value** of the work. Such deductions will be made and held by NDMC by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in the form of NDMC Securities or fixed deposit receipts. In case a fixed deposit receipt of any Bank is furnished by the contractor to the NDMC as part of the security deposit and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the NDMC to make good the deficit.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising there from, or from any sums which may be due to or may become due to the contractor by NDMC on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within **10 days** make good in cash or fixed deposit receipt tendered by the State Bank of India or by Commercial Bank s or NDMC Securities (if deposited for more than **12 months**) endorsed in favour of the **Secretary NDMC**, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills and the final bill of the contractor at the rates mentioned above.

The security deposit as deducted above can be released against bank guarantee issued by a Commercial Bank , on its accumulations to a minimum of **Rs. 5 lac** subject to the condition that amount of such bank guarantee, except last one, shall not be less than **Rs. 5 lac**. Provided further that the validity of bank guarantee including the one given against the earnest money shall be in conformity with provisions contained in clause 17 which shall be extended from time to time depending upon extension of contract granted under provisions of clause 2 and clause 5.

In case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then **50%** of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.

Note-1: NDMC papers tendered as security will be taken at 5% (Five per cent) below its market price or at its face value, whichever is less. The market price of NDMC paper would be ascertained by the Divisional Officer at the time of collection of interest and the amount of interest to the extent of deficiency in value of the NDMC paper will be withheld if necessary.

Note-2: NDMC Securities will include all forms of Securities mentioned in Rule No. 274 of the G.F. Rules except fidelity bond. This will be subject to the observance of the condition mentioned under the rule against each form of security.

Note-3: Note 1 & 2 above shall be applicable for both clause 1 and 1A

CLAUSE 2

Compensation for Delay

If the contractor fails to maintain the required progress in terms of clause 5 or to complete the work and clear the site on or before the contract or justified extended date of completion, as per clause 5 (excluding any extension under Clause 5.5) as well as any extension granted under clauses 12 and 15, he shall, without prejudice to any other right or remedy available under the law to the NDMC on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the authority specified in schedule 'F' may decide on the amount of Tendered Value of the work for every completed day/month (as determined) that the progress remains below that specified in Clause 5 or that the work remains incomplete. This will also apply to items or group of items for which a separate period of completion has been specified.

(i) Compensation for delay of work with maximum rate @ **1 %** (**one percent**) per month of delay to be computed on per day basis based on quantum of damage suffered due to stated delay on the part of Contractor. Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed **10 %** (**ten percent**) of the accepted Tendered Value of work or of the accepted Tendered Value of the Sectional part of work as mentioned in Schedule 'F' for which a separate period of completion is originally given.

In case no compensation has been decided by the authority in Schedule 'F' during the progress of work, this shall be no waiver of right to levy compensation by the said authority if the work remains incomplete on final justified extended date of completion. If the Engineer in Charge decides to give further extension of time allowing performance of work beyond the justified extended date, the contractor shall be liable to pay compensation for such extended period. If any variation in amount of contract takes place during such extended period beyond justified extended date and the contractor becomes entitled to additional time under clause 12, the net period for such variation shall be accounted for while deciding the period for levy of compensation. However, during such further extended period beyond the justified extended period, if any delay occurs by events under sub clause 5.2, the contractor shall be liable to pay compensation for such delay.

Provided that compensation during the progress of work before the justified extended date of completion for delay under this clause shall be for non-achievement of sectional completion or part handing over of work on stipulated/justified extended date for such part work or if delay affects any other works/services. This is without prejudice to right of action by the Engineer in Charge under clause 3 for delay in performance and claim of compensation under that clause.

In case action under clause 2 has not been finalized and the work has been determined under clause 3, the right of action under this clause shall remain post determination of contract but levy of compensation shall be for days the progress is behind the schedule on date of determination, as assessed by the authority in Schedule F, after due consideration of justified extension. The compensation for delay, if not decided before the determination of contract, shall be decided after of determination of contract.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the NDMC. In case, the contractor does not achieve a particular milestone mentioned in schedule F, or the re-scheduled milestone(s) in terms of Clause 5.4, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied as above. With-holding of this amount on failure to achieve a milestone, shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in

subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

CLAUSE 3

When Contract Can be Determined

Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

(i) If the contractor having been given by the Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or un-workman like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter.

(ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence and continues to do so after a notice in writing of seven days from the Engineer-in-Charge.

(iii) If the contractor fails to complete the work or section of work with individual date of completion on or before the stipulated or justified extended date, on or before such date of completion; and the Engineer in Charge without any prejudice to any other right or remedy under any other provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence of such mutual agreement by his own assessment making such time essence of contract and in the opinion of Engineer-in-Charge the contractor will be unable to complete the same or does not complete the same within the period specified.

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

(v) If the contractor shall offer or give or agree to give to any person in NDMC service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for Government.

(vi) If the contractor shall enter into a contract with NDMC in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in-Charge.

(vii) If the contractor had secured the contract with NDMC as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.

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

(ix) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a

creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

(x) If the contractor shall suffer an execution being levied on his goods and allow it to be continued for a period of **21 days**.

(xi) If the contractor assigns, (excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer -in-Charge. When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the NDMC shall have powers:

(a) To determine the contract as aforesaid so far as performance of work by the Contractor is concerned (of which determination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, the Earnest Money Deposit Security Deposit already recovered, Security deposit payable and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the Government.

(b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un-executed out of his hands and to give it to another contractor to complete the work. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work including any new items needed to complete the work. In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

CLAUSE 3A

In case, the work cannot be started due to reasons not within the control of the contractor within **1/8th of the stipulated time for completion** of work or **one month** whichever is more, either party may close the contract by giving notice to the other party stating reasons. In such eventuality, the Performance Guarantee of the contractor shall be refunded within following time limits:

(i) If the tendered value of the work is up to Rs. 1 Crore: 15 days.

(ii) If the tendered value of the work is more than to Rs. 1 Crore and up to Rs. 10 Crore: 21 days.

(iii) If the tendered value of the work exceeds Rs. 10 Crore: 30 days.

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

CLAUSE 4

Contractor Liable to pay compensation even if action not taken under Clause 3

In any case in which any of the powers conferred upon the Engineer-in-Charge by Clause-3 thereof, shall have become exercisable and the same are not exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Engineer-in-Charge putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Engineer-in-Charge which shall be final and binding on the contractor) use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-Charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work/or any part thereof, paying or allowing for the same in account at the contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Engineer-in-Charge, whose certificate thereof shall be final, and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) and in the event of the contractor failing to comply with any such requisition, the Engineer-in-Charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Engineer-in-Charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

CLAUSE 5

Time and Extension for Delay

The time allowed for execution of the Works as specified in the Schedule 'F' or the extended time in accordance with these conditions shall be the essence of the Contract. The execution of the works shall commence from such time period as mentioned in schedule 'F' or from the date of handing over of the site notified by the Engineer-in-Charge, whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, the performance guarantee shall be forfeited by the Engineer in Charge and shall be absolutely at the disposal of the NDMC without prejudice to any other right or remedy available in law.

5.1 As soon as possible but within 7 (seven) working days of award of work and in consideration of

a) Schedule of handing over of site as specified in the Schedule 'F'
b) Schedule of issue of designs as specified in the Schedule 'F',

(i) The Contractor shall submit a Time and Progress Chart for each mile stone. The Engineer- in-Charge may within **7** (**seven**) working days thereafter, if required modify, and communicate the program approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved by the Engineer-in-Charge. The work programme shall include all details of balance drawings and decisions required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents.

(ii) In case of non-submission of construction programme by the contractor the program approved by the Engineer-in-Charge shall be deemed to be final.

(iii) The approval by the Engineer-in-Charge of such programme shall not relieve the contractor of any of the obligations under the contract.

(iv) The contractor shall submit the Time and Progress Chart and progress report using the mutually agreed software or in other format decided by Engineer-in-Charge for the work done during previous month to the Engineer-in-charge on or before 5th day of each month failing which a recovery as per Schedule F to be decided by the NIT approving authority shall be made on per week or part basis in case of delay in submission of the monthly progress report.

5.2 If the work(s) be delayed by:

(i) force majeure, or
(ii) abnormally bad weather, or
(iii) serious loss or damage by fire, or
(iv) civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or
(v) delay on the part of other contractors or tradesmen engaged by Engineer-in-Charge in executing work not forming part of the Contract, or
(vi) any other cause like above which, in the reasoned opinion of the Engineer-in-Charge is beyond the Contractor's control.

then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer-in-Charge for entry in the hindrance register (physical or web-based as prescribed in Schedule 'F' but shall nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

The contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in sub clause 5.2.

5.3 In case the work is hindered by the Department or for any reasons/event, for which the Department is responsible, the authority as indicated in Schedule 'F' shall, if justified, give a fair and reasonable extension of time and reschedule the mile stones for completion of work such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law, provided further that for concurrent delays under this sub clause and sub clause 5.2 to the extent the delay is covered under sub clause 5.2 the contractor shall be entitled to only extension of time and no damages.

5.1 Request for rescheduling of Mile stones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed forms i.e. Form of application by the contractor for seeking rescheduling of milestones or Form of application by the contractor for seeking extension of time (Appendix –XVI) respectively to the authority as indicated in Schedule 'F'. The Contractor shall indicate in such a request the period by which rescheduling of milestone/s or extension of time is desired with every request for rescheduling of milestones, or if at any time the actual progress of work falls behind the approved programme by more than **10%** of the stipulated period of completion of contract, the contractor shall produce a revised programme which shall include all details of pending drawings and decisions required to complete the contract and also the target dates by which these details should be available without causing any delay in execution of the work. A recovery as specified in Schedule 'F' shall be made on per day basis in case of delay in submission of the revised programme.

5.4.1 In any such case the authority as indicated in Schedule 'F' may give a fair and reasonable extension of time for completion of work or reschedule the mile stones. Engineer-In-Charge shall finalized/ reschedule a particular mile stone before taking an action against subsequent mile stone. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority as indicated in Schedule 'F' in writing, within 21 days of the date of receipt of such request from the Contractor in prescribed form. In event of non-application by the contractor for extension of time E-in-C after affording opportunity to the contractor, may give, supported with a programme (as specified under 5.4 above), a fair and reasonable extension within a reasonable period of occurrence of the event.

5.2 In case the work is delayed by any reasons, in the opinion of the Engineer-in-Charge, by the contractor for reasons beyond the events mentioned in clause 5.2 or clause 5.3 or clause 5.4 and beyond the justified extended date; without prejudice to right to take action under Clause 3, the Engineer-in-Charge may grant extension of time required for completion of work without rescheduling of milestones. The contractor shall be liable for levy of compensation for delay for such extension of time.

5.3 **The Engineer-in-charge may release withheld amount of non achievement of Milestone(s) against Bank Guarnatee/FDR of an equivalent amount valid upto stipulated date of completion (to be extended further, if required) issued by a Commerlcial Bank.**

CLAUSE 6

Computerized Measurement Book

Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Computerized Measurement Book having pages of A-4 size as per the format of the department so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the contractor from the Engineer-in-Charge or his authorized representative as per interval or program fixed in consultation with Engineer-in-Charge or his authorized representative. After the necessary corrections made by the Engineer-in-Charge, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the Engineer-in- Charge for the dated signatures by the Engineer-in-Charge and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the Engineer-in-Charge and/or his authorized representative. The contractor will, thereafter, incorporate such changes as may be done during these checks/test checks in his draft computerized measurements, and submit to the department a computerized measurement book, duly bound, and with its pages' machine numbered. The Engineer-in-Charge and/or his authorized representative would thereafter check this MB, and record the necessary certificates for their checks/test checks.

The final, fair, computerized measurement book given by the contractor, duly bound, with its pages' machine numbered, should be 100% correct, and no cutting or over-writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor

shall have to submit a fresh computerized MB with its pages duly machine numbered and bound, after getting the earlier MB cancelled by the department. Thereafter, the MB shall be taken in the Divisional Office records, and allotted a number as per the Register of Computerized MBs. This should be done before the corresponding bill is submitted to the Division Office for payment. The contractor shall submit two spare copies of such computerized MB's for the purpose of reference and record by the various officers of the department.

The contractor shall also submit to the department separately his computerized Abstract of Cost and the bill based on these measurements, duly bound, and its pages' machine numbered along with two spare copies of the "bill. Thereafter, this bill will be processed by the Division Office and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.

The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements/levels by the Engineer-in-Charge or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

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

Engineer-in-Charge or his authorized representative may cause either themselves or through another officer of the department to check the measurements recorded by contractor and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and/or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 7

Payment on Intermediate Certificate to be regarded as Advances

No payment shall be made for work, estimated to cost **Rs. Twenty Lakh** or less till after the whole of the work shall have been completed and certificate of completion given. For works estimated to cost over **Rs. Twenty Lakh,** the interim or running account bills shall

be submitted by the contractor for the work executed on the basis of such recorded measurements on the format of the Department in triplicate on or before the date of every month fixed for the same by the Engineer-in-Charge. The contractor shall not be entitled to be paid any such interim payment if the gross work done together with net payment/ adjustment of advances for material collected, if any, since the last such payment is less than the amount specified in Schedule 'F', in which case the interim bill shall be prepared on the appointed date of the month after the requisite progress is achieved. Engineer-in-Charge shall arrange to have the bill verified by taking or causing to be taken, where necessary, the requisite measurements of the work. In the event of the failure of the contractor to submit the bills, no claims whatsoever due to delays on payment including that of interest shall be payable to the contractor. Payment on account of amount admissible shall be made by the Engineer-in-Charge certifying the sum to which the contractor is considered entitled by way of interim payment at such rates as decided by the Engineer-in-Charge. **An amount of ad-hoc payment not less than 75% of the net amount of the bill under check, shall be made within 10 working days of submission of the bill by the Contractor to the Engineer-in-Charge or his Authorized Engineers together with the account of the material issued by the department, or dismantled materials, if any. The remaining payment is also to be made after final checking of the bill within 28 working days of submission of bill by the contractor.** In case of delay in payment of intermediate bills after 45 days of submission of bill by the contractor, provided the bill submitted by the contractor found to be in order, a simple intereset @5% (five percent) per annum shall be paid to the contractor from the date of expiry of prescribed time limit.

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Engineer-in-Charge relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Engineer-in-Charge under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion, interim payments shall continue to be made as herein provided without prejudice to the right of the department to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

The Engineer-in-Charge in his sole discretion on the basis of a certificate from the Assistant Engineer to the effect that the work has been completed up to the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) up to lintel level (including sunshade etc.) and slab level, for each floor working out at 75% of the assessed value. The advance payments so allowed shall be adjusted in the subsequent interim bill to be submitted by the contractor within 10 days of the interim payment. In case of delay in submission of bill by the contractor a simple interest @ 10% per annum **on the advance payment made** shall be paid to the NDMC from the date of expiry of prescribed time limit.

~~**Payment in Composite Contracts**~~

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

~~In case main contractor fails to make the payment to the contractor associated by him~~

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

CLAUSE 7A

No Running Account Bill shall be paid for the work till the applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable are submitted by the contractor to the Engineer-in-Charge.

CLAUSE 7B

Payment to third party

If the exigencies of the work so demand, the engineer-in-charge may allow payment to a third party, who is creditor to the contractor, after fulfilling the following conditions.

a) The contractor gives an authority letter addressed to the engineer-in-charge on a non-judicial stamp paper of Rs. 100 in the format given below.
I/We authorize the Executive Engineer, (Spl. Project) Civil, NDMC to pay directly on my/our behalf to …….. (name of the third party) an amount of Rs. …….. (Rupees ……. In words) for the work done or supplies made by ……. (name of the third party). I/we shall be responsible for the quality and quantity of the same under the provisions of agreement number ……..

b) The total payment to third party (or parties) shall not exceed 10% of the agreement cost of the work.

Signature of the contractor

CLAUSE 8

Completion Certificate and Completion Plan

Within ten days of the completion of the work, the contractor shall give notice of such completion to the Engineer-in-Charge and within thirty days of the receipt of such notice, the Engineer-in-Charge shall inspect the work and if there is no defect in the work, shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about

which the work is to be executed or of which he may have had possession for the purpose of the execution; thereof, and not until the work shall have been measured by the Engineer-in-Charge. If the contractor shall fail to comply with the requirements of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Engineer-in-Charge may at the expense of the contractor remove such scaffolding, surplus materials and rubbish etc., and dispose off the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8A

Completion Plan to be submitted by the Contractor

The contractor shall submit completion plans for internal and external Civil, Electrical and Mechanical Services within thirty days of the completion of the work, provided that the service plan having been issued for execution by the Engineer-In-Charge, unless the contractor, by virtue of any other provision in the contract, is required to prepare such plans.

In case, the contractor fails to submit the completion plan as aforesaid, he shall be liable to pay a sum of 0.1 % (Zero Point One Percent) of accepted Tendered Value or limit prescribed in Schedule F whichever is more as may be fixed by the authority as mentioned schedule F and in this respect the decision of the that authority shall be final and binding on the contractor.

CLAUSE 9

Payment of Final Bill

The final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute on account of quantity and/or rates shall be paid at approved quantity and/or rates by the Engineer-in-Charge within **three months period** reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized Assistant Engineer, complete with account of materials issued by the Department and dismantled materials.

If the final bill is submitted by the contractor within the period specified above and payment of final bills is made by the deptt. After prescribed time limit, a simple interest @ 5% per annum shall be paid to the contractor from the date of expiry of prescribed time limit, provided the final bill submitted by the contractor is found to be in order.

CLAUSE 9A

Payment of Contractor's Bills to Banks

Payments due to the contractor may, if so desired by him, be made to his bank, registered financial, co-operative or thrift societies or recognized financial institutions instead of direct to him provided that the contractor furnishes to the Engineer-in-Charge (1) an authorization in the form of a legally valid document such as a power of attorney conferring

authority on the bank; registered financial, co-operative or thrift societies or recognized financial institutions to receive payments and (2) his own acceptance of the correctness of the amount made out as being due to him by NDMC or his signature on the bill or other claim preferred against NDMC before settlement by the Engineer-in-Charge of the account or claim by payment to the bank, registered financial, co-operative or thrift societies or recognized financial institutions. While the receipt given by such banks; registered financial, co-operative or thrift societies or recognized financial institutions shall constitute a full and sufficient discharge for the payment, the contractor shall whenever possible present his bills duly receipted and discharged through his bank, registered financial, co-operative or thrift societies or recognized financial institutions.

Nothing herein contained shall operate to create in favour of the bank; registered financial, co-operative or thrift societies or recognized financial institutions any rights or equities visa-vis the NDMC.

CLAUSE 10A

Materials to be provided by the Contractor

The contractor shall, at his own expense, provide all materials, required for the works other than those which are stipulated to be supplied by the Government.

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

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

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

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

shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

The contractor shall at his own expense, provide a material testing lab at the site for conducting routine field test including test (either test required repeated). The lab shall be equipped at least with the testing equipment as specified in schedule F and NO reimbursement will be paid for either it happens once or repeated.

CLAUSE 10 CA

Payment due to variation in prices of materials after receipt of tender

If after submission of the tender, the price of materials specified in Schedule F increases/ decreases beyond the base price(s) as indicated in Schedule F for the work, then the amount of the contract shall accordingly be varied and provided further that any such variations shall be effected for stipulated period of Contract including the justified period extended under the provisions of Clause 5 of the Contract without any action under Clause 2. However, for work done/during the justified period extended as above, it will be limited to indices prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-rata basis only as cost of extra work x stipulated period/tendered cost). If updated stipulated date of completion as calculated on pro- rata basis does not cover full calendar month then indices will be considered or restricted to previous month.

The increase/decrease in prices of cement, steel reinforcement, structural steel and POL shall be determined by the Price indices issued by the Director General, CPWD. For other items provided in the Schedule 'F', this shall be determined by the All India Wholesale Price Indices of materials as published by Economic Advisor to NDMC Government of India, Ministry of Commerce and Industry. Base price for cement, steel reinforcement, structural steel and POL shall be as issued under the authority of Director General CPWD applicable for Delhi including Noida, Gurgaon, Faridabad & Ghaziabad and for other places as issued under the authority of Zonal Chief Engineer, CPWD and base price of other materials issued by concerned Zonal Chief Engineer and as indicated in Schedule 'F'. In case, price index of a particular material is not issued by Ministry of Commerce and Industry, then the price index of nearest similar material as indicated in Schedule 'F' shall be followed.

The amount of the contract shall accordingly be varied for all such materials and will be worked out as per the formula given below for individual material:
Adjustment for component of individual material

$$V = P \times Q \times \frac{CI - CIo}{CIo}$$

where,

V = Variation in material cost i.e. increase or decrease in the amount of rupees to be paid or recovered.

P = Base Price of material as issued under authority of DG, CPWD or concerned Zonal Chief Engineer and as indicated in Schedule "F". For project and original Works.

Q = Quantity of material brought at site for bonafide use in the works since previous bill excluding any such quantity consumed in the deviated quantity of items beyond deviation limit and extra /substituted item, paid/to be paid at rates derived on the basis of market rate under clause 12.2.

CIo = Price index for cement, steel reinforcement bars structural steel and POL as issued by the DG, CPWD and corresponding to the time of base price of respective material indicated in Schedule 'F'. For other items, if any, provided in Schedule 'F', All India Wholesale Price Index for the material as published by the Economic Advisor to Government of India, Ministry of Industry and Commerce and corresponding to the time of base price of respective material indicated in Schedule 'F'.

CI = Price index for cement, steel reinforcement bars, structural steel and POL as issued under the authority of DG, CPWD for period under consideration. For other items, if any, provided in Schedule 'F', All India Wholesale Price Index for the material for period under consideration as published by Economic Advisor to Government of India, Ministry of Industry and Commerce.

Note:

(i) In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the index prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-rata basis only as cost of extra work x stipulated period/ tendered cost) shall be considered.

Provided always that provisions of the preceding Clause 10 C shall not be applicable in respect of Materials covered in this Clause. If updated stipulated date of completion as calculated on pro- rata basis does not cover full calendar month then indices will be considered or restricted to previous month.

(ii) If during progress of work or at the time of completion of work, it is noticed that any material brought at site is in excess of requirement, then amount of escalation if paid earlier on such excess quantity of material shall be recovered on the basis of cost indices as applied at the time of payment of escalation or as prevailing at the time of effecting recovery, whichever is higher.

(iii) Cement mentioned wherever in this clause also includes Cement component used in RMC brought at site from outside approved RMC plants, if any.

(iv) The date wise record of ready mix concrete shall be kept in a register and the cement consumption for the same shall be calculated accordingly.

(v) If built-up steel items are brought at site from workshop, then the variation shall be paid for the structural steel up to the period when the built up item/finished product is brought at site.

CLAUSE 10 CC

Payment due to increase / decrease in Prices / Wages (excluding materials covered under clause 10 (CA) after Receipt of Tender for Works

If the prices of materials (not being materials supplied or services rendered at fixed prices by the department in accordance with clause 10 & 34 thereof) and/or wages of labour required for execution of the work increase, the contractor shall be compensated for such increase as per provisions detailed below and the amount of the contract shall accordingly be varied, subject to the condition that that such compensation for escalation in prices and wages shall be available only for the work done during the stipulated period of the contract including the justified period extended under the provisions of clause 5 of the contract without any action under clause 2. No such compensation shall be payable for a work for which the stipulated period of completion is equal to or less than the time as specified in Schedule F. Such compensation for escalation in the prices of materials and labour, when due, shall be worked out based on the following provisions: -

(i) The base date for working out such escalation shall be the last stipulated date of receipt of tenders including extension, if any.

(ii) The cost of work on which escalation will be payable shall be reckoned as below:

(a) Gross value of work done up to this quarter:

(A)

(b) Gross value of work done up to the last quarter:

(B)

(c) Gross value of work done since previous quarter (A-B) (C)

(d) Full assessed value of Secured Advance (excluding materials Covered under Clause 10 CA) fresh paid in this quarter: (D)

(e) Full assessed value of Secured Advance (excluding materials Covered under Clause 10 CA) recovered in this quarter: (E)

(f) Full assessed value of Secured Advance for which escalation payable in this quarter (D-E): (F)

(g) Advance payment made during this quarter: (G)

(h) Advance payment recovered during this quarter: (H)

(i) Advance payment for which escalation is payable in this Quarter :(G-H) (I)

(j) Extra items/deviated quantities of items paid as per Clause 12 Based on prevailing market rates during this quarter: (J)

Then, M = C+F+I-J

N = 0.85 M

(k) Less cost of material supplied by the department as per Clause 10 and recovered during the quarter (K)

(l) Less cost of services rendered at fixed charges as per Clause 34 and recovered during the quarter (L)

Cost of work for which escalation is applicable: W = N - (K + L)

(iii) Components for materials (except cement, reinforcement bars, structural steel or other materials covered under clause 10 CA) labour, P.O.L., etc. shall be pre-determined for every work and incorporated in the conditions of contract attached to the tender papers included in Schedule 'F'. The decision of the Engineer-in-Charge in working out such percentage shall be binding on the contractors.

(iv) The compensation for escalation for other materials (excluding cement, reinforcement bars, structural steel or other materials covered under clause 10 CA) and P.O.L. shall be worked as per the formula given below: -

(a) Adjustment for civil component (except cement, structural steel, reinforcement bars and other materials covered under clause 10CA) / electrical component of construction 'Materials'

$$Vm = W \times \frac{Xm}{100} \times \frac{MI-MIo}{MIo}$$

Vm = Variation in material cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of Work done worked out as indicated in sub-para (ii) of Clause 10CC.

Xm = Component of 'materials' (except cement, structural steel, reinforcement bars and other materials covered under clause10CA) expressed as percent of the total value of work.

Ml = All India Wholesale Price Index for civil component/electrical component* of construction material as worked out on the basis of All India Wholesale Price Index for Individual Commodities/ Group Items for the period under consideration as published by Economic Advisor to Govt. of India, Ministry of Industry & Commerce and applying weight ages to the Individual Commodities/Group Items. (In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be considered.)

Mlo = All India Wholesale Price Index for civil component/electrical component* of construction material as worked out on the basis of All India Wholesale Price Index for Individual Commodities/Group Items valid on the last stipulated date of receipt of tender including extension, if any, as published by the Economic Advisor to Govt. of India, Ministry of Industry & Commerce and applying weightages to the Individual Commodities/Group items.
*Note: relevant component only will be applicable.

(b) Adjustment for component of '**POL**'

$$Vf = W \times \frac{Z}{100} \times \frac{FI - FI0}{FI0}$$

Vf = Variation in cost of Fuel, Oil & Lubricant i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of Work done worked out as indicated in sub-para (ii) of Clause 10CC.

Z = Component of Fuel, Oil & Lubricant expressed as percent of the total value of work

FI = All India Wholesale Price Index for Fuel, Oil & Lubricant for the period under consideration as published by Economic Advisor to Govt. of India, Ministry of Industry & Commerce, New Delhi. (In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the index prevailing at the time of stipulated date of completion or the prevailing index of the period under consideration, whichever is less, shall be considered.)

FI0 = All India Wholesale Price Index for Fuel, Oil & Lubricant valid on the last stipulated date of receipt of tender including extension, if any.

(v) The following principles shall be followed while working out the indices mentioned in para (iv) above.

(a) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The first such payment shall be made at the end of three months after the month (excluding the month in which tender was accepted) and thereafter at three months interval. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.

(b) The index (MI/FI etc.) relevant to any quarter/period for which such compensation

is paid shall be the arithmetical average of the indices relevant to the three calendar months. If the period up to date of completion after the quarter covered by the last such installment of payment, is less than three months, the index Ml and Fl shall be the average of the indices for the months falling within that period.

(vi) The compensation for escalation for labour shall be worked out as per the formula given below:-

$$VL = W \times \frac{Y}{100} \times \frac{LI - LIo}{LI0}$$

VL : Variation in labour cost i.e. amount of increase or decrease in rupees to be paid or recovered.

W : Value of work done, worked out as indicated in sub-para (ii) above.

Y : Component of labour expressed as a percentage of the total value of the work.

Ll : Minimum wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as applicable on the last date of the quarter previous to the one under consideration. (In respect of the justified period extended under the provisions of clause 5 of the contract without any action under clause 2, the minimum wage prevailing on the last date of quarter previous to the quarter pertaining to stipulated date of Completion or the minimum wage prevailing on the last date of the quarter previous to the one under consideration, whichever is less, shall be considered.)

Llo : Minimum daily wage in rupees of an unskilled adult male mazdoor, fixed under any law, statutory rule or order as on the last stipulated date of receipt of tender including extension, if any.

(vii) The following principles will be followed while working out the compensation as per sub-para (vi) above.

(a) The minimum wage of an unskilled male mazdoor mentioned in sub-para (vi) above shall be ~~the higher of the wage notified by Government of India, Ministry of Labour and~~ that notified by the local administration ~~both relevant to the place of work and the period of reckoning~~.

b) The escalation for labour also shall be paid at the same quarterly intervals when escalation due to increase in cost of materials and/or P.O.L. is paid under this clause. If such revision of minimum wages takes place during any such quarterly intervals, the escalation compensation shall be payable at revised rates only for work done in subsequent quarters;

(c) Irrespective of variations in minimum wages of any category of labour, for the purpose of this clause, the variation in the rate for an unskilled mazdoor alone shall form the basis for working out the escalation compensation payable on the labour component.

(viii) In the event the price of materials and/or wages of labour required for execution of the work decrease/s, there shall be a downward adjustment of the cost of work so that such price of materials and/or wages of l abour shall be deductible from the cost of work under this contract and in this regard the formula herein before stated under this Clause 10CC shall mutatis mutandis apply, provided that:

(a) no such adjustment for the decrease in the price of materials and/or wages of labour aforementioned would be made in case of contracts in which the stipulated period of completion of the work is equal to or less than the time as specified in Schedule 'F'.

(b) The Engineer-in-Charge shall otherwise be entitled to lay down the procedure by which the provision of this sub-clause shall be implemented from time to time

and the decision of the Engineer-in-Charge in this behalf shall be final and binding on the contractor.

(ix) Provided always that:-

(a) Where provisions of clause 10CC are applicable, provisions of clause 10C will not be applicable but provisions of clause 10CA will be applicable.

(b) Where provisions of clause 10CC are not applicable, provisions of clause 10C and 10CA will become applicable.

Note:

Updated stipulated date of completion (period of completion plus extra time for extra work for compensation under clause 10C, 10CA and 10CC after works.

The factor of 1.25 taken into account for calculating the extra time under clause 12.1 for extra time shall not be considered while calculating the updated stipulated date of completion for this purpose in clause 10C, clause 10CA and clause 10CC.

CLAUSE 10 D

Dismantled Material - NDMC Property

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as NDMC property and such materials shall be disposed off to the best advantage of NDMC according to the instructions in writing issued by the Engineer-in-Charge.

CLAUSE 11

Works to be executed in Accordance with Specifications, Drawings, Orders etc.

The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Engineer-in-Charge and the contractor shall be furnished free of charge one copy of the contract documents together with specifications, designs, drawings and instructions as are not included in the standard specifications of Central Public Works Department specified in Schedule 'F' or in any Bureau of Indian Standard or any other, published standard or code or, Schedule of Rates or any other printed publication referred to elsewhere in the contract.

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

CLAUSE 12

Deviations / Variations Extent and Pricing

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

12.1 The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be extended, if requested by the contractor, as follows:

(i) In the proportion which the additional cost of the altered, additional or substituted work, bears to the original tendered value plus
(ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Engineer-in-Charge.

12.2 **Deviation, Extra Items and Pricing**

In the case of extra item(s) (**items which are not available in the contract**), the contractor may within **fifteen days** of receipt of order or occurrence of the item(s), submit claim for market rate(s), supported with proper analysis of rate and manufacturer's specification for the work, invoices, vouchers, etc. (as applicable), failing which the rate(s) approved later by the Engineer-In-Charge shall be final and binding. Where the Contractor submits claim for market rate(s) in the manner prescribed above, the Engineer-in-charge shall, within **45 days** of the receipt of the claims, after giving consideration to the analysis of rates and other documents submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

The rate(s) of extra items so determined by the Engineer-in-Charge shall be final and binding on the contractor, and shall not be arbitrable.

Deviation, Deviated Quantities, Pricing

In the case of contract items, which exceed the limits laid down in schedule F, the contractor may within **fifteen days** of receipt of order or occurrence of the excess, claim revision of the rates, supported with proper analysis of rate and invoices, vouchers, etc. (as applicable), for the quantity in excess of the above mentioned limit. The Engineer-in-Charge shall within **45 days** of receipt of the claims, after giving consideration to the analysis of the rates and other documents submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

The rate(s) so determined by the Engineer-in-Charge shall be final and binding on the contractor, and shall not be arbitrable.

12.3 In the case of contract items which exceed the limits laid down in Schedule F, and the Engineer-in-Charge shall after giving notice to the contractor within **30 days** of submission of that bill by the contractor which contains such item(s), and after taking in to consideration any reply received from the contractor within **15 days** of the issue

of such notice, reduce the rate of quantity in excess of the above mentioned limit on the basis of market rates, within **30 days** of the expiry of the said period of **15 days**, and the contractor shall be paid in accordance with the rates so determined.

The rate(s) so determined by the Engineer-in-Charge shall be final and binding on the contractor, and shall not be arbitrable.

12.4 Deleted

12.5 The cost of any operation necessarily in contemplation of tenderer while quoting tender, or necessary or incidental to proper execution of an item of work included in the Schedule of rates mentioned Schedule 'F', whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations.

CLAUSE 13

Foreclosure of Contract due to Abandonment or Reduction in Scope of Work

If at any time after acceptance of the tender or during the progress of work, the purpose or object for which the work is being done changes due to any supervening cause and as a result of which the work has to be abandoned or reduced in scope the Engineer-in-Charge shall give notice in writing to that effect to the contractor stating the decision as well as the cause for such decision and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

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

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

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

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

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

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

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

In the event of action being taken under Clause 13 to reduce the scope of work, the contractor may furnish fresh Performance Guarantee on the same conditions, in the same manner and at the same rate for the balance tendered value and initially valid up to the extended date of completion or stipulated date of completion if no extension has been granted plus 60 days beyond that. Wherever such a fresh Performance Guarantee is furnished by the contractor the Engineer-in-Charge may return the previous Performance Guarantee.

CLAUSE 14

Carrying out Part work at risk & Cost of Contractor

If contractor:

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

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

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

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

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

The Engineer-in-Charge shall determine the amount, if any, is recoverable from the contractor for completion of the part work/ part incomplete work of any item(s) taken out of his hands and execute at the risk and cost of the contractor, the liability of contractor on account of loss or damage suffered by NDMC because of action under this clause shall not exceed 10% of the tendered value of the work.

In determining the amount, credit shall be given to the contractor with the value of work done in all respect in the same manner and at the same rate as if it had been carried out

by the original contractor under the terms of his contract, the value of contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the contractor. The certificate of the Engineer-in-Charge as to the value of work done shall be final and conclusive against the contractor provided always that action under this clause shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the department are less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

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

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

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

CLAUSE 15

Suspension of Work

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

(a) on account of any default on the part of the contractor or;

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

(c) for safety of the works or part thereof.

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

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

(a) the contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work

for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

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

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

CLAUSE 16

Action in case Work not done as per Specifications.

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

If it shall appear to the Engineer-in-Charge or his authorized subordinates in-charge of the work or to the Chief Engineer in charge of Quality Assurance or his subordinate officers or the officers of the organization engaged by the Department for Quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing

which shall be made within twelve months (six months in the case of work costing Rs. 10 Lac and below except road work) of the completion of the work from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause 2 of the contract (for non-completion of the work in time) for this default.

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

CLAUSE 17

Contractor Liable for Damages, defects during defect liability period

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

In case of Maintenance and Operation works of E&M services, the security deposit deducted from contractors shall be refunded within one month from the date of final payment or within one month from the date of completion of the maintenance contract whichever is earlier.

CLAUSE 18

Contractor to Supply Tools & Plants etc.

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Engineer-in-Charge's stores), machinery, tools & plants as specified in schedule F. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffolding and temporary works

required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Engineer-in-Charge at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under this contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

CLAUSE 18 A

Recovery of Compensation paid to Workmen

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

CLAUSE 18 B

Ensuring Payment and Amenities to Workers if Contractor fails

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

CLAUSE 19

Labour Laws to be complied by the Contractor

The contractor shall comply with the provisions of the contract labour (Regulation and Abolition) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971. The contractor shall also obtain a valid license under the said Act before the

commencement for the work, and continue to have a valid license until its completion.

The contractor shall also comply with provisions of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.

The contractor shall also abide by the provisions of the **Child and Adolescent** Labour (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfill these requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work.

CLAUSE 19A

No labour below the age of **Eighteen** years shall be employed on the work.

CLAUSE 19 B

Payment of wages:

(i) The contractor shall pay to labour employed by him either directly or through subcontractors, wages not less than fair wages as defined in the C.P.W.D. Contractor's Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

(ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-contractors in connection with the said work, as if the labour had been immediately employed by him.

(iii) In respect of all labour directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the Central Public Works Department contractor's Labour Regulations made by Government from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions unauthorizedly made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

(iv) **(a)** The Engineer-in-Charge concerned 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-fulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.

(b) Under the provision of Minimum Wages (Central) Rules, 1950, the contractor is bound to allow to the labours directly or indirectly employed in the works one-day rest for 6 days' continuous work and pay wages at the same rate as for duty. In the event of default, the Engineer-in-Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labours and pay the same to the persons entitled thereto from any money due to the contractor by the Engineer-in-Charge concerned.

In the case of Union Territory of Delhi, however, as the all-inclusive minimum daily wages fixed under Notification of the Delhi Administration No.F.12(162)MWO/DAB/ 43884-91, dated 31-12-1979 as amended from time to time are inclusive of wages for the weekly day of rest, the question of extra payment for weekly holiday would not arise.

(v) The contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, and the Contractor's Labour (Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rules made thereunder from time to time.

(vi) The contractor shall indemnify and keep indemnified NDMC against payments to be made under and for the observance of the laws aforesaid and the C.P.W.D. Contractor's Labour Regulations without prejudice to his right to claim indemnity from his sub-contractors.

(vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

(viii) Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

(ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen.

CLAUSE 19C

In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per C.P.W.D. Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid, he shall be liable to pay a penalty of Rs.500/- for each default and in addition, the Engineer-in-Charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19 D

The contractor shall submit by the 4th and 19th of every month, to the Engineer-in-Charge, a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively:

(1) the number of labourers employed by him on the work,
(2) their working hours,
(3) the wages paid to them,
(4) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and the number of female workers who have been allowed maternity benefit according to Clause 19F and the amount paid to them.

Failing which the contractor shall be liable to pay to N.D.M.C., a sum not exceeding Rs.500/- for each default or materially incorrect statement. The decision of the Divisional Officer shall be final in deducting from any bill due to the contractor, the

amount levied as fine and be binding on the contractor.

CLAUSE 19 E

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

CLAUSE 19 F

Leave and pay during leave shall be regulated as follows:

1. Leave:

(i) in the case of delivery - maternity leave not exceeding 8 weeks, 4 weeks up to and including the day of delivery and 4 weeks following that day,
(ii) in the case of miscarriage – up to 3 weeks from the date of miscarriage.

2. Pay:

(i) in the case of delivery - leave pay during maternity leave will be at the rate of the women's average daily earnings, calculated on total wages earned on the days when full time work was done during a period of three months immediately preceding the date on which she gives notice that she expects to be confined or at the rate of Rupee one only a day whichever is greater.
(ii) in the case of miscarriage - leave pay at the rate of average daily earning calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date of such miscarriage.

3. Conditions for the grant of Maternity Leave:
No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than six months immediately preceding the date on which she proceeds on leave.

4. The contractor shall maintain a register of Maternity (Benefit) in the Prescribed Form as shown in appendix -I and II, and the same shall be kept at the place of work.

CLAUSE 19 G

In the event of the contractor(s) committing a default or breach of any of the provisions of the NDMC, Contractor's Labour Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing any statement under the provisions of the above Regulations and' Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the NDMC a sum not exceeding Rs. 500/- for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to Rs. 500/- per day for each day of default subject to a maximum of 5 per cent of the estimated cost of the work put to tender. The decision of the Engineer-in-Charge shall be final and binding on the parties.

Should it appear to the Engineer-in-Charge that the contractor(s) is/are not properly observing and complying with the provisions of the NDMC Contractor's Labour Regulations and Model Rules and the provisions of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (R& A) Central Rules 1971, for the protection of health and sanitary arrangements for work-people employed by the contractor(s) (hereinafter referred as "the said Rules") the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said Rules be complied with and the amenities prescribed

therein be provided to the work-people within a reasonable time to be specified in the notice. If the contractor(s) shall fail within the period specified in the notice to comply with and/observe the said Rules and to provide the amenities to the work-people as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities hereinbefore mentioned at the cost of the contractor(s). The contractor(s) shall erect, make and maintain at his/their own expense and as per approved standards all necessary huts and sanitary arrangements required for his/their work-people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have power to give notice in writing to the contractor(s) requiring that the said huts and sanitary arrangements be re-modelled and/or reconstructed according to approved standards, and if the contractor(s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor(s).

CLAUSE 19 H

The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Engineer-in-Charge.

(i) (a) The minimum height of each hut at the eaves level shall be 2.10m (7 ft.) and the floor area to be provided will be at the rate of 2.7 sq.m. (30 sq.ft.) for each member of the worker's family staying with the labourer.

(b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6'x5') adjacent to the hut for each family.

(c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.
(d) The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

(ii) (a) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in-Charge. In case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Engineer-in-Charge and the contractor shall ensure that throughout the period of their occupation, the roofs remain water-tight.

(b) The contractor(s) shall provide each hut with proper ventilation.

(c) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.

(d) There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Engineer-in-Charge. Back to back construction will be allowed.

(iii) **Water Supply -** The contractor(s) shall provide adequate supply of water for the use of labourers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The contractor(s) shall

also at his/ their own cost make arrangements for laying pipe lines for water supply to his/ their labour camp from the existing mains wherever available, and shall pay all fees and charges therefore.

(iv) The site selected for the camp shall be high ground, removed from jungle.

(v) **Disposal of Excreta** - The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

(vi) **Drainage** - The contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

(vii) The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

(viii) **Sanitation -** The contractor(s) shall make arrangements for conservancy and sanitation in the labour camps according to the rules of the Local Public Health and Medical Authorities.

CLAUSE 19 I

The Engineer-in-Charge may require the contractor to dismiss or remove from the site of the work any person or persons in the contractors' employ upon the work who may be incompetent or misconduct himself and the contractor shall forthwith comply with such requirements. In respect of maintenance/repair or renovation works etc. where the labour have an easy access to the individual houses, the contractor shall issue identity cards to the labourers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labour.

CLAUSE 19 J

It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorizedly during construction, and is handed over to the Engineer-in-Charge with vacant possession of complete building. If such building though completed is occupied illegally, then the Engineer-in-Charge shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay, a levy upto 5% of tendered value of work may be imposed by the Superintending Engineer whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However, the Superintending Engineer/Chief Engineer, through a notice, may require the contractor to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 19 K

Employment of skilled / semi-skilled workers

The contractor shall at all stages of work deploy skilled / semi skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training institute / Industrial Training institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized institute managed / certified by State / Central Government. The number of such qualified

tradesmen shall not be less than 40% (Revised upwards from 20% originally) of total skilled / semi skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognised institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs.100 per day. Decision of Engineer in Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

Provided always, that the provisions of this clause, shall not be applicable for works with estimated cost put to tender being less than Rs.5 crores.

CLAUSE 19 L

Contribution of EPF and ESI

The ESI and EPF contributions **on the part of employer** in respect of this contract shall be paid by the contractor. **These contributions on the part of the employer paid by the contractor shall be reimbursed by the Engineer-in-charge to the contractor on actual basis. The verification of deployment of labour will be done through biometric attendance system or any other suitable method by the Engineer in Charge. The applicable and eligible amount of EPF & ESI shall be reimbursed preferably within 7 days but not later than 30 days of submission of documentary proof of payment provided same are in order.**

CLAUSE 20

Minimum Wages Act to be complied with

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

CLAUSE 21

Work not to be sublet. Action in case of insolvency

The contract shall not be assigned or sublet without the written approval of the Engineer-in - Charge. And if the contractor shall assign or sublet his contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public officer or person in the employ of NDMC in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer- in-Charge on behalf of the NDMC shall have power to adopt the course specified in Clause 3 hereof in the interest of NDMC and in the event of such course being adopted, the consequences specified in the said Clause 3 shall ensue.

CLAUSE 22

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of NDMC without reference to the

actual loss or damage sustained and whether or not any damage shall have been sustained.

CLAUSE 23

Changes in firm's Constitution to be intimated

Where the contractor is a partnership firm, the previous approval in writing of the Engineer- in-Charge shall be obtained before any change is made in the constitution of the firm. Where the contractor is an individual or a Hindu undivided family business concern, such approval as aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the contractor. If previous approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 hereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

CLAUSE 24

Life Cycle Cost

The contractor shall be responsible for safety, quality and soundness of the buildings including structural elements beyond maintenance period. The contractor shall have obligation to rectify such defects minimum up to 5 (five) years from the date of completion of work. The defects have to be rectified within a reasonable time not exceeding Forty-Five days after issue of notice by Engineer- in- Charge.

If contractor does not take corrective action within 45 days, then action for debarring of the agencies shall be taken by the appropriate authority.

CLAUSE 25

Settlement of Disputes by Conciliation and Arbitration

Except where otherwise provided in the contract, all questions and disputes 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, orders 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 cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter.

25.1 Conciliation: lf the contractor considers any work demanded of him to be outside the requirements of the contract, or disputes any drawing, record or decision given in writing by the Engineer-in-Charge; or if the Engineer-in- Charge considers any act or decision of the contractor on any matter in connection with or arising out of the contract or carrying out of the work to be unacceptable and disputed; such party may promptly refer such disputes and amount claimed for each dispute to the Conciliator (Special Director General or the Additional Director General concerned with the work, as applicable) in the proforma prescribed in Appendix XVll mentioned in Schedule F, under intimation to the other party. The Conciliator may then request each party to submit to him a brief written statement describing the disputes and the points at issue. Each party shall send a copy of such statement to the other party. At any stage of the conciliation proceedings, the Conciliator may request a party to submit to him such additional information as he deems appropriate. When it appears to the Conciliator that there exist elements of a settlement which may be acceptable to the parties, he shall formulate the terms of a possible settlement and submit them to the parties for their observations. After receiving the observations of the parties, he may reformulate the terms of a possible settlement in the light of such observations. lf the parties reach agreement on a settlement of the disputes, they may draw up and sign a written settlement agreement on non-judicial stamp paper as per Stamp Act. The Conciliator shall authenticate the settlement agreement and furnish a copy thereof to each

party. The termination of conciliation proceedings shall be in accordance with Section 76 of The Arbitration and Conciliation Act, 'l996. No party shall be represented before the said Conciliator by an advocate or legal counsel. The conciliation proceedings shall be completed within 45 days from the receipt of reference. This time may be enlarged by 15 days by the Conciliator. The conciliation proceedings shall be deemed to have been terminated at the end of 60 days from the receipt of reference.

25.2 Arbitration: lf the aforesaid conciliation proceedings fail or the Conciliator fails to give proposal for settlement within the aforesaid period, either party may promptly give notice in the proforma prescribed in Appendix XVIII, under intimation to the other party, to the Chief Engineer or the Superintending Engineer concerned with the work (aa applicable), hereinafter referred to as the Arbitrator Appointing Authority as indicated in Schedule F, for appointment of Arbitrator. Arbitrator without taking recourse to the process of conciliation mentioned in sub clause 25.1 above. ln the event of either party giving a notice to the Arbitrator Appointing Authority for appointment of Arbitrator, the said Authority shall appoint Arbitrator as per the procedure given below and refer such disputes to arbitration.

(a) Number of Arbitrators: lf the contract amount is less than Rs.100 crore, the disputes may be referred for adjudication by a sole Arbitrator. lf the contract amount is Rs.100 crore or more, the disputes may be referred to an Arbitral Tribunal of three Arbitrators.

(b) Qualification of Arbitrators: lt is a term of this contract that each member of the Arbitral Tribunal shall be Graduate Engineer with experience in execution of public works engineering contracts, and he should have worked earlier at a level not lower than the Chief Engineer (equivalent to level of Joint Secretary to the Government of lndia).

The aforesaid educational qualification and work experience shall be mandatory for appointment as Arbitrator.

The age of Arbitrator at the time of appointment shall not exceed 75 years. An Arbitrator may be appointed notwithstanding the total number of active arbitration cases with him.

(c) Parties to select Arbitrator: Based on the criteria specified above, a list of empaneled Arbitrators has been prepared in NDMC, and the parties shall have option to select an Arbitrator from the list sent to them.

25.3 Appointment of Sole Arbitrator: The parties may opt for appointment of the Arbitrator of the Ministry of Housing and Urban Affairs. ln such cases, the party seeking arbitration has to submit an express agreement in writing as per Appendix XIX towards waiver of Section 12(5) of the Arbitration and Conciliation Act, 1996 along with the notice for appointment of Arbitrator in the proforma prescribed in Appendix XVIII, under intimation to the other party. The Arbitrator Appointing Authority shall, within 30 days of receipt of the said notice, appoint Arbitrator of the Ministry of Housing and Urban Affairs as Arbitrator in the matter, provided the other party also submits waiver of Section 12(5), ibid in Appendix XIX within 7 days of the receipt of the said notice.

Where any one of the parties does not opt for the Arbitrator of the Ministry of Housing and Urban Affairs, or does not submit the waiver agreement, the Arbitrator Appointing Authority shall propose five Arbitrators from the list of NDMC Empanelled Arbitrators to the party seeking arbitration under intimation to the other party within 15 days of receiving the notice. The party seeking arbitration shall give his choice for one of them within 15 days of receiving the list, and the Arbitrator Appointing Authority shall appoint the chosen personas the Sole Arbitrator within 15 days of the receipt of choice.

It is a term of this arbitration agreement that if the parties fail to select, within the period prescribed above, an Arbitrator of their choice from the list of NDMC Empanelled Arbitrators forwarded to them, the Arbitrator Appointing Authority shall himself select and appoint Arbitrator from the said list.

25.4 Appointment of Arbitral Tribunal of three Arbitrators: The Arbitrator Appointing Authority shall prepare two separate lists of five Arbitrators each from the list of NDMC Empanelled Arbitrators, and send one to the party seeking arbitration and other to the responding party, within 15 days of the receipt of notice. The parties will then choose any one Arbitrator from the list provided to them within 15 days of receipt of the list, The Arbitrator Appointing Authority shall then appoint those chosen by the respective parties as Arbitrators and also a third Arbitrator from the list of NDMC Empanelled Arbitrators to act as presiding Arbitrator, within 15 days of receipt of choice from both the parties.

It is a term of this arbitration agreement that if the parties fail to select, within the period prescribed above, an Arbitrator of their choice from the list of NDMC Empanelled Arbitrators forwarded to them, the Arbitrator Appointing Authority shall himself select and appoint Arbitrator from the said list.

25.5 Applicable Law: The provisions of the Arbitration and Conciliation Act, 1996 (Act 26 of '1996) and any further statutory modification or re-enactment thereof shall be applicable. Further, the fast-track procedure for arbitration contained in Section 298 of the said Act shall apply.

25.6 Fee payable to Arbitrator(s): The fee payable to the arbitral tribunal shall be ~~as per CPWD OM No. 2/2006/SE[TLC/CSO/137 dated 19.1 1 .2019 (or latest amendment),~~ decided by the competent authority and shall be shared equally by both the parties.

25.7 Place of Arbitration: The place of arbitration shall preferably be as mentioned in Schedule F. However, the Arbitral Tribunal may decide the place in consultation with both the parties.

25.8 Terms of reference: The Arbitral Tribunal shall adjudicate on only such disputes as are referred to it by the Arbitrator Appointing Authority and give separate award against each dispute referred to him and shall give reasons for the award in all cases where the total amount of the claim by any party exceeds Rs. 1,00,000.

25.9 Interest on Arbitration award: It is also a term of this arbitration agreement that where the Arbitral award against any dispute is for the payment of money, no pre-suit and pendent-elite interest shall be payable on any part of the Arbitral award.

CLAUSE 26

Contractor to indemnify Govt. against Patent Rights

The contractor shall fully indemnify and keep indemnified the NDMC against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under or action brought against NDMC in respect of any such matters as aforesaid, the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the NDMC if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer-in-Charge in this behalf.

CLAUSE 27

Lump sum Provisions in Tender

When the estimate on which a tender is made includes lump sum in respect of parts of the work, the contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract for

such items, or if the part of the work in question is not, in the opinion of the Engineer-in-Charge payable of measurement, the Engineer-in-Charge may at his discretion pay the lump-sum amount entered in the estimate, and the certificate in writing of the Engineer-in-Charge shall be final and conclusive against the contractor with regard to any sum or sums payable to him under the provisions of the clause.

CLAUSE 28

Action where no Specifications are Specified

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case, there are no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturers' specifications, if not available then as per District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-Charge.

CLAUSE 29

Withholding and lien in respect of sum due from contractor

(i) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Engineer-in-Charge or the NDMC shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Engineer-in-Charge or the NDMC shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Engineer-in-Charge or the NDMC shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter become payable to the contractor under the same contract or any other contract with the Engineer-in-Charge of the NDMC or any contracting person through the Engineer-in-Charge pending finalization of adjudication of any such claim.
It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer-in-Charge or NDMC will be kept withheld or retained as such by the Engineer-in-Charge or NDMC till the claim arising out of or under the contract is determined by the arbitrator (if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Engineer-in-Charge or the NDMC shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.

(ii) NDMC shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract, etc., to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the contractor shall be liable

to refund the amount of over-payment and it shall be lawful for NDMC to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by NDMC to the contractor, without any interest thereon whatsoever. Provided that the NDMC shall not be entitled to recover any sum overpaid, nor the contractor shall be entitled to payment of any sum paid short where such payment has been agreed upon between the Superintending Engineer or Executive Engineer on the one hand and the contractor on the other under any term of the contract permitting payment for work after assessment by the Superintending Engineer or the Executive Engineer.

CLAUSE 29A

Lien in respect of claims in other Contracts

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or the NDMC or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or NDMC or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Engineer- in-Charge or the NDMC or with such other person or persons. It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer-in-Charge or the NDMC will be kept withheld or retained as such by the Engineer-in-Charge or the NDMC or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 30:

Water for Works

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

(i) That the water used by the contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer-in-Charge.

(ii) The Engineer-in-Charge shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Engineer-in- Charge, unsatisfactory.

(iii) Contractor has to get tested water in every 3 months.

CLAUSE 31

Hire of Plant & Machinery

The contractor shall arrange at his own expense all tools, plant, machinery and equipment (hereinafter referred to as T&P) required for execution of the work.

CLAUSE 31 A

Departmental water supply, if available

Water if available may be supplied to the contractor by the department subject to

the following conditions:-

(i) The water charges @ 1 % shall be recovered on gross amount of the work done.
(ii) The contractor(s) shall make his/their own arrangement of water connection and laying of pipelines from existing main of source of supply.
(iii) The Department do not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor(s) to make alternative arrangements for water at his/ their own cost in the event of any temporary break down in the NDMC water main so that the progress of his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.

CLAUSE 32

Employment of Technical Staff and employees

Contractors Superintendence, Supervision, Technical Staff & Employees

(i) The contractor shall provide all necessary superintendence during execution of the work and all along thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The contractor shall immediately after receiving letter of acceptance of the tender and before commencement of the work, intimate in writing to the Engineer-in-Charge, the name(s), qualifications, experience, age, address(s) and other particulars along with certificates, of the principal technical representative to be in charge of the work and other technical representative(s) who will be supervising the work. Minimum requirement of such technical representative(s) and their qualifications and experience shall not be lower than specified in Schedule 'F'. Even of the contractor (or partner(s) in case of firm/ company) is himself / herself an Engineers, it is necessary on the part of the contractor to Employ principal technical representative / technical representative (s) as per stipulation in Schedule 'F'

The Engineer-in-Charge shall within 3 days of receipt of such communication intimate in writing his approval or otherwise of such a representative(s) to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the contractor shall appoint another such representative(s) according to the provisions of this clause. Decision of the tender accepting authority shall be final and binding on the contractor in this respect. Such a principal technical representative and other technical representative(s) shall be appointed by the contractor soon after receipt of the approval from Engineer-in-charge and shall be available at site before start of work.

All the provisions applicable to the principal technical representative under the Clause will also be applicable to other technical representative(s) The principal technical representative and other technical representative(s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself/themselves, as required, to the Engineer-in-Charge and/or his designated representative to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the contractor. The principal technical representative and other technical representative(s) shall be actually available at site fully during all stages of execution of work, during recording/checking/test checking of measurements of works and whenever so required by the Engineer-in-Charge and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative(s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements/checked measurements/ test checked measurements. The representative(s) shall not look after any other work. Substitutes, duly approved by Engineer-in-Charge of the work in similar manner as aforesaid shall be provided in

event of absence of any of the representative(s) by more than two days.

If the Engineer-in-Charge, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative(s) is/are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non-refundable) shall be effected from the contractor as specified in Schedule 'F' and the decision of the Engineer-In-Charge as recorded in the site order book and measurement recorded checked/test checked in Measurement Books shall be final and binding on the contractor. Further if the contractor fails to appoint suitable technical Principal technical representative and/or other technical representative(s) and if such appointed persons are not effectively present or are absent by more than two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in-Charge shall have full powers to suspend the execution of the work until such date as suitable other technical representative(s) is/are appointed and the contractor shall be held responsible for the delay so caused to the work. The contractor shall submit a certificate of employment of the technical representative(s) (in the form of copy of Form-16 or CPF deduction issued to the Engineers employed by him) along with every on account bill/final bill and shall produce evidence if at any time so required by the Engineer-in-Charge.

(ii) The contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.

The contractor shall provide and employ skilled, semiskilled and unskilled labour as is necessary for proper and timely execution of the work.

The Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in-Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 33

Levy/Taxes payable by Contractor

(i) GST, Building and other Construction Workers Welfare Cess or any other tax, levy or Cess in respect of input for or output by this contract shall be payable by the contractor and NDMC shall not entertain any claim whatsoever in this respect except as provided under Clause 34.
(ii) The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar, etc. from local authorities.

If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the NDMC and does not any time become payable by the contractor to the State Government, Local authorities in respect of any material used by the contractor in the works, then in such a case, it shall be lawful to the NDMC and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

CLAUSE 34

Conditions for reimbursement of levy/taxes if levied after receipt of Tenders

(i) All tendered rates shall be inclusive of any tax, levy or cess applicable on last stipulated date of receipt of tender including extension if any. No adjustment i.e.

increase or decrease shall be made for any variation in the rate of GST, Building and Other Construction Workers Welfare Cess or any tax, levy or cess applicable on inputs.

However, effect of variation in rates of GST or Building and Other Construction Workers Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease.

Provided further that for Building and Other Construction Workers Welfare Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/cess.

Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time under Clause 5 in Schedule F.

(ii) The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the NDMC and/or the Engineer-in-Charge and shall also furnish such other information/document as the Engineer-in-Charge may require from time to time.

(iii) The contractor shall, within a period of 30 days of the imposition of any such further tax or levy or cess, or variation or repeal of such tax or levy or cess give a written notice thereof to the Engineer-in-charge that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 35

Termination of Contract on death of contractor

Without prejudice to any of the rights or remedies under this contract, if the contractor dies, the Divisional Officer on behalf of the NDMC shall have the option of terminating the contract without compensation to the contractor.

CLAUSE 36

If relative working in NDMC then the contractor not allowed to tender

The contractor shall not be permitted to tender for works in the NDMC circle (Division in case of contractors of Fire/Electric categories) responsible for award and execution of contracts in which his near relative is posted as Divisional Accountant or as an officer in any capacity between the grades of the Superintending Engineer and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any employee in the NDMC. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department. If however, the contractor is registered in any other department, he shall be debarred from tendering in NDMC for any breach of this condition.

NOTE: By the term "near relatives" is meant wife, husband, parents and grandparents, children and grandchildren, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

CLAUSE 37

No Gazetted Engineer to work as Contractor within one year of retirement

No engineer of gazetted rank or other gazetted officer employed in engineering or administrative duties in an engineering department of the NDMC shall work as a contractor or employee of a contractor for a period of one year after his retirement from NDMC service without the previous permission of NDMC in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be such a person who had not obtained the permission of NDMC as aforesaid, before submission of the tender or engagement in the contractor's service, as the case may be.

CLAUSE 38

Theoretical Consumption of Material

(i) After completion of the work and also at any intermediate stage in the event of Non reconciliation of materials issued theoretical quantity of materials used in the work shall be calculated on the basis and method given hereunder:

(a) Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in Schedule 'F'. In case any item is executed for which standard constants for the consumption of cement or bitumen are not available in the above mentioned schedule/statement or cannot be derived from the same shall be calculated on the basis of standard formula to be laid down by the Engineer-in-Charge.

(b) Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Engineer-in-Charge, including authorized lappages, chairs etc. plus **3%** wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual issues each diameter wise, section wise and category wise separately.

(c) Theoretical quantity of G.I. & C.I. or other pipes, conduits, wires and cables, pig lead and G.I./M.S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G.I./M.S. sheets it shall be 10%), such determination & comparison being made diameter wise & category wise.

(d) For any other material as per actual requirements.
Over the theoretical quantities of materials so computed a variation shall be allowed as specified in Schedule 'F' For non-scheduled items, the decision of the Engineer-in-Charge regarding theoretical quantities of materials which should have been actually used, shall be final and binding on the contractor.

(ii) The said action under this clause is without prejudice to the right of the NDMC to take action against the contractor under any other conditions of contract for not doing the work according to the prescribed specifications.

CLAUSE 39

Compensation during war like situations

The work (whether fully constructed or not) and all materials, machines, tools and plants, scaffolding, temporary buildings and other things connected therewith shall be at the risk of the contractor until the work has been delivered to the Engineer-in-Charge and a certificate from him to that effect obtained. In the event of the work or any materials properly brought to the site for incorporation in the work being damaged or destroyed in consequence of hostilities or warlike operation, the contractor shall when ordered (in writing) by the Engineer-in-Charge to remove any debris from the site, collect and properly stack or remove in store all serviceable materials salvaged from the damaged work and shall be paid at the contract rates in accordance with the provision of this agreement for the work of clearing the site of debris, stacking or removal of serviceable material and for reconstruction of all works ordered by the Engineer-in-Charge, such payments being in addition to compensation up to the value of the work originally executed before being damaged or destroyed and not paid for. In case of works damaged or destroyed but not already measured and paid for, the compensation shall be assessed by the Divisional Officer up to Rs.2,00,000/-- and by the next higher officer concerned for a higher amount. The contractor shall be paid for the damages/destruction suffered and for restoring the material at the rate based on analysis of rates tendered for in accordance with the provision of the contract. The certificate of the Engineer-in-Charge regarding the quality and quantity of materials and the purpose for which they were collected shall be final and binding on all parties to this contract.

Provided always that no compensation shall be payable for any loss in consequence of hostilities or warlike operations (a) unless the contractor had taken all such precautions against air raid as are deemed necessary by the A.R.P. (Air Raid Precaution) Officers or the Engineer-in-Charge (b) for any material etc. not on the site of the work or for any tools, plant, machinery, scaffolding, temporary building and other things not intended for the work. In the event of the contractor having to carry out reconstruction as aforesaid, he shall be allowed such extension of time for its completion as is considered reasonable by the Divisional Officer.

CLAUSE 40

Apprentices Act provisions to be complied with

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

CLAUSE 41

Release of Security deposit after labour clearance

The Security Deposit of the work shall be refunded if no labour complaint has been received from the labour officer till the due date of its payment. If a labour complaint is received during this period, the Engineer-in-charge shall, after issue of notice in this regard to the contractor, deduct the amount required to settle the complaint from his security deposit and refund the balance amount.

EXECUTIVE ENGINEER
(SPECIAL PROJECT)

N.D.M.C. SAFETY CODE

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1 (¼ horizontal and 1 vertical.)

2. Scaffolding of staging more than 3.6 m (12ft.) above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.

4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm. (3ft.).

5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11½") for ladder up to and including 3 m. (10 ft.) in length. For longer ladders, this width should be increased at least ¼" for each additional 30 cm. (1 foot) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit; action or proceedings to any such person or which may, with the consent of the contractor, be paid to compensate any claim by any such person.

6 (a) Excavation and Trenching – All trenches 1.2 m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100 ft.) in length or fraction thereof, Ladder shall extend from bottom of the trench to at least 90 cm. (3ft.) above the surface of the ground. The side of the trenches which are 1.5 m. (5ft.) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m. (5ft.) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or undercutting shall be done.

(b) Safety measures for digging bore holes:

(i). If the bore well is successful, it should be safely capped to avoid caving and collapse of the bore well. The failed and the abandoned ones should be completely refilled to avoid caving and collapse;
(ii). During drilling, sign boards should be erected near the site with the address of the drilling contractor and the Engineer-in-charge of the work;
(iii). Suitable fencing should be erected around the well during the drilling and after the installation of the rig on the point of drilling, flags shall be put 50m all-round the point of drilling to avoid entry of people;
(iv). After drilling the bore well, a cement platform (0.50m x 0.50m x 1.20m) 0.60m above ground level and 0.60m below ground level should be constructed around the well casing;
(v). After the completion of the bore well, the contractor should cap the bore well properly by welding steel plate, cover the bore well with the drilled wet soil and fix thorny shrubs over the soil. This should be done even while repairing the pump;
(vi).After the bore well is drilled the entire site should be brought to the ground level.

7. Demolition – Before any demolition work is commenced and also during the progress of the work,

(i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

(ii) No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by the operator shall remain electrically charged.

(iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

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

The following safety equipment shall invariably be provided:

i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.
iii) Those engaged in welding works shall be provided with welder's protective eye- shields.
iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
v**)** When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measures are adhered to:

a) Entry for workers into the line shall not be allowed except under supervision of the JE or any other higher officer.
b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
c) Before entry, presence of Toxic gases should be tested by inserting wet

lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.

d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.

e) Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.

f) The area should be barricaded or cordoned of by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.

g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.

h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.

i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-charge may decide the time up to which a worker may be allowed to work continuously inside the manhole.

j) Gas masks with Oxygen Cylinder should be kept at site for use in emergency.

k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 metres away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.

l) The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the manhole.

m) The workers shall be provided with Gumboots or non- sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.

n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.

o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.

p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-charge regarding the steps to be taken in this regard in an individual case will be final.

vi**)** The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:

a) No paint containing lead or lead products shall be used except in the form of paste or ready-made paint.

b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scrapped.

c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.

vii) Workmen executing work on scaffolds or other structures above specified height shall be provided with full body harness and fall arresters.

9. An additional clause (viii)(i) of New Delhi Municipal Council Safety Code (iv) the Contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form, wherever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use:

i) White lead, sulphate of lead or product containing these pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.
ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.
iii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.
iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
v) Overall shall be worn by working painters during the whole of working period.
vi) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.
vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of NDMC.
viii) NDMC may require, when necessary medical examination of workers.
ix) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

10. When the work is done near any place where there is risk of drowning, all necessary equipment's should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.

11. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:

i) (a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

(b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

ii) Every crane driver or hoisting appliance operator, shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

iv) In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractor's machines the

contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.

12. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

13. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

14. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

15. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Engineer-in-charge of the department or their representatives.

16. Notwithstanding the above clauses from (1) to (15), there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the NDMC.

Contractor

Engineer-in-Charge
Executive Engineer (SPECIAL PROJECT)
For & on behalf of NDMC

Models Rules for the Protection of Health and Sanitary Arrangements for Workers Employed by N.D.M.C. or its Contractors

1. APPLICATION

These rules shall apply to all buildings and construction works in charge of New Delhi Municipal Council in which twenty or more workers are ordinarily employed or are proposed to be employed in any day during the period during which the contract work is in progress.

2. DEFINITION

Work place means a place where twenty or more workers are ordinarily employed in connection with construction work on any day during the period during which the contract work is in progress.

3. FIRST-AID FACILITIES

(i) At every work place, there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.

(ii) The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment:

a) For work places in which the number of contract labour employed does not exceed 50. Each first-aid box shall contain the following equipment:

1. 6 small sterilized dressings.
2. 3 medium size sterilized dressings.
3. 3 large size sterilized dressings.
4. 3 large sterilized burn dressings.
5. 1 (30 ml.) bottle containing a two per cent alcoholic solution of iodine.
6. 1 (30 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
7. 1 snakebite lancet.
8. 1 (30 gms.) bottle of potassium permanganate crystals.
9. 1 pair scissors.
10. 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, NDMC of India.
11. 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.
12. Ointment for burns.
13. A bottle of suitable surgical antiseptic solution.

b) For work places in which the number of contract labour exceed 50. Each first-aid box shall contain the following equipment:

1. 12 small sterilized dressings.
2. 6 medium size sterilized dressings.
3. 6 large size sterilized dressings.
4. 6 large size sterilized burn dressings.
5. 6 (15 gms.) packets sterilized cotton wool.
6. 1 (60 ml.) bottle containing two per cent alcoholic solution iodine.
7. 1 (60 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
8. 1 roll of adhesive plaster.
9. 1 snake bite lancet.
10. 1 (30 gms.) bottle of potassium permanganate crystals.
11. 1 pair scissors.

12. 1 copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour Institutes /NDMC.
13. A bottle containing 100 tablets (each of 5 gms.) of aspirin.
14. Ointment for burns.
15. A bottle of suitable surgical antiseptic solution.

(iii) Adequate arrangements shall be made for immediate recoupment of the equipment when necessary.

(iv) Nothing except the prescribed contents shall be kept in the First-aid box.

(iv) The first-aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.

(vi) A person in charge of the First-aid box shall be a person trained in First-aid treatment in the work places where the number of contract labour employed is 150 or more.

(vii) In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance from the works. First-aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.

(viii) Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or person suddenly taken ill to the nearest hospital.

4. DRINKING WATER

(i) In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.
(ii) Where drinking water is obtained from an intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.
(iii) Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and waterproof.
(iv) A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING FACILITIES

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

6. LATRINES AND URINALS

(i) Latrines shall be provided in every work place on the following scale namely:
(a) Where female is employed, there shall be at least one latrine for every 25

females.

(b) Where males are employed, there shall be at least one latrine for every 25 males.

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

(iii) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.

(iv) Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat-resisting nonabsorbent materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system.

(v) (a) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men only" or "For Women Only" as the case may be.

(b) The notice shall also bear the figure of a man or of a woman, as the case may be.

(vi) There shall be at least one urinal for male workers up to 50 and one for female workers up to fifty employed at a time, provided that where the number of male or female workmen, as the case may be exceeds 500, it shall be sufficient if there is one urinal for every 50 males or females up to the first 500 and one for every 100 or part thereafter.

(vii) (a) The latrines and urinals shall be adequately lighted and shall be maintained in clean and sanitary condition at all times.

(b) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.

(viii) Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.

(ix) Disposal of excreta: Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed of by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with a 15 cm. layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).

(ix) The contractor shall at his own expense, carry out all instructions issued to him by the Engineer-in-charge to effect proper disposal of night soil and other conservancy work in respect of the contractor's workmen or employees on the site. The contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such on his behalf.

7. PROVISION OF SHELTER DURING REST

At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 ft.) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sq.m. (6 sft) per head.

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

used for the purpose.

8. CRECHES

(i) At every work place, at which 20 or more women worker are ordinarily employed, there shall be provided two rooms of reasonable dimensions for the use of their children under the age of six years. One room shall be used as a play room for the children and the other as their bedroom. The rooms shall be constructed with specifications as per clause 19H (ii) a, b & c.

(ii) The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.

(iii) The contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the bed room.

(iv) The contractor shall provide one ayaa to look after the children in the creche when the number of women workers does not exceed 50 and two when the number of women workers exceed 50.

(v) The use of the rooms earmarked as creches shall be restricted to children, their attendants and mothers of the children.

9. CANTEENS

(i) In every work place where the work regarding the employment of contract labour is likely to continue for six months and where in contract labour numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the contractor for the use of such contract labour.

(ii) The canteen shall be maintained by the contractor in an efficient manner.

(iii) The canteen shall consist of at least a dining hall, kitchen, and storeroom, pantry and washing places separately for workers and utensils.

(iv) The canteen shall be sufficiently lighted at all times when any person has access to it.

(v) The floor shall be made of smooth and impervious materials and inside walls shall be lime-washed or colour washed at least once in each year. Provided that the inside walls of the kitchen shall be lime-washed every four months.

(vi) The premises of the canteen shall be maintained in a clean and sanitary condition.

(vii) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.

(viii) Suitable arrangements shall be made for the collection and disposal of garbage.

(ix) The dining hall shall accommodate at a time 30 per cent of the contract labour working at a time.

(x) The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square metre (10sqft) per diner to be accommodated as prescribed in sub-Rule 9.

(xi) (a) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.
(b) Washing places for women shall be separate and screened to secure privacy.

(xii) Sufficient tables stools, chair or benches shall be available for the number of diners to be accommodated as prescribed in sub-Rule

(xiii) **(a)** 1. There shall be provided and maintained sufficient utensils crockery, furniture and any other equipment necessary for the efficient running of the canteen.

2. The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.

(b) 1. Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.

2. A service counter, if provided, shall have top of smooth and impervious material.

3. Suitable facilities including an adequate supply of hot water shall be providing for the cleaning of utensils and equipment's.

(xiv) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.

(xv) The charges for food stuffs, beverages and any other items served in the canteen shall be based on 'No profit, No loss' and shall be conspicuously displayed in the canteen.

(xvi) In arriving at the price of foodstuffs, and other article served in the canteen, the following items shall not be taken into consideration as expenditure namely:

(a) The rent of land and building.
(b) The depreciation and maintenance charges for the building and equipment's provided for the canteen.
(c) The cost of purchase, repairs and replacement of equipment's including furniture, crockery, cutlery and utensils
(d) The water charges and other charges incurred for lighting and ventilation.
(e) The interest and amounts spent on the provision and maintenance of equipment's provided for the canteen.

(xvii) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

10. ANTI-MALARIAL PRECAUTIONS

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

11. The above rules shall form an integral part of the contract.

12. AMENDMENTS

NDMC may, from time to time, add to or amend these rules and issue directions - it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

Contractor

Engineer-in-Charge
Executive Engineer (SPECIAL PROJECT)
For & on behalf of NDMC

CONTRACTOR'S LABOUR REGULATIONS

1. SHORT TITLE

These regulations may be called the Contractors Labour Regulations.

2. DEFINITIONS

i) Workman means any person employed by N.D.M.C or its contractor directly or indirectly through a subcontractor with or without the knowledge of the New Delhi Municipal Council to do any skilled, semiskilled or unskilled manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment are expressed or implied but does not include any person:-

a) Who is employed mainly in a managerial or administrative capacity: or

b) Who, being employed in a supervisory capacity draws wages exceeding five hundred rupee per mensem or exercises either by the nature of the duties attached to the office or by reason of powers vested in him, functions mainly of managerial nature: or

c) Who is an out worker, that is to say, person to whom any article or materials are given out by or on behalf of the principal employers to be made up cleaned, washed, altered, ornamental finished, repaired adopted or otherwise processed for sale for the purpose of the trade or business of the principal employers and the process is to be carried out either in the home of the out worker or in some other premises, not being premises under the control and management of the principal employer.

No person below the age of 18 years shall be employed to act as a workman.

ii) **Fair Wages** means wages whether for time or piece work fixed and notified under the provisions of the Minimum Wages Act from time to time.

iii) **Contractors** shall include every person who undertakes to produce a given result other than a mere supply of goods or articles of manufacture through contract labour or who supplies contract labour for any work and includes a subcontractor.

iv) **Wages** shall have the same meaning as defined in the Payment of Wages Act.

3. (i) Normally working hours of an adult employee should not exceed 9 hours a day. The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 hours on any day.

(ii) When an adult worker is made to work for more than 9 hours on any day or for more than 48 hours in any week, he shall be paid over time for the extra hours put in by him at double the ordinary rate of wages.

(iii) (a) Every worker shall be given a weekly holiday normally on a Sunday, in accordance with the provisions of the Minimum Wages (Central) Rules 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.

(b) Where the minimum wages prescribed by the NDMC under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled rest day wages at the rate applicable to the next preceding day, provided he has worked under Contractor for a continuous period of not less than 6 days.

(c) Where a contractor is permitted by the Engineer-in-charge to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at overtime rate.

4. DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clear and legible condition in conspicuous places on the work, notices in English and in the local Indian languages spoken by the majority of the workers giving the minimum rates of wages fixed under Minimum Wages Act, the actual wages being paid, the hours of work for which such wage are earned, wages periods, dates of payments of wages and other relevant information as per Appendix 'III'.

5. PAYMENT OF WAGES

i) The contractor shall fix wage periods in respect of which wages shall be payable.
ii) No wage period shall exceed one month.
iii) The wages of every person employed as contract labour in an establishment or by a contractor where less than one thousand such persons are employed shall be paid before the expiry of seventh day and in other cases before the expiry of tenth day after the last day of the wage period in respect of which the wages are payable.
iv) Where the employment of any worker is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the second working day from the date on which his employment is terminated.
v) All payment of wages shall be made on a working day at the work premises and during the working time and on a date notified in advance and in case the work is completed before the expiry of the wage period, final payment shall be made within 48 hours of the last working day.
vi) Wages due to every worker shall be paid to him direct **by contractor through bank or ECS or online transfer to his bank account.**
vii) All wages shall be paid **through bank or ECS or online transfer.**
viii) Wages shall be paid without any deductions of any kind except those specified by the Central NDMC by general or special order in this behalf or permissible under the Payment of Wages Act 1956.
x) A notice showing the wages period and the place and time of disbursement of wages shall be displayed at the place of work and a copy sent by the contractor to the Engineer-in-charge under acknowledgment.
xi) It shall be the duty of the contractor to ensure the disbursement of wages through bank account of labour.
xii) The contractor shall obtain from the Junior Engineer or any other authorized representative of the Engineer-in-charge as the case may be, a certificate under his signature at the end of the entries in the "Register of Wages" or the "Wage-cum-Muster Roll" as the case may be in the following form:-
xiii) "Certified that the amount shown in column No .....has been paid to the workman concerned through bank account of labour on ..... at ..... ".

6. FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES

(i) The wages of a worker shall be paid to him without any deduction of any kind except the following:
(a) Fines.
(b) Deductions for absence from duty i.e. from the place or the places where by the terms of his employment he is required to work. The amount of deduction shall be

in proportion to the period for which he was absent.

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

(d) Deduction for recovery of advances or for adjustment of overpayment of wages, advances granted shall be entered in a register.

(e) Any other deduction which the NDMC Central NDMC/ Delhi NDMC may from time to time allow.

(ii) No fines should be imposed on any worker save in respect of such acts and omissions on his part as have been approved of by the Chief Labour Commissioner.

Note: - An approved list of Acts and Omissions for which fines can be imposed is endosed at Appendix-X

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

(iv) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to three paise in a rupee of the total wages, payable to him in respect of that wage period.

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

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

7. LABOUR RECORDS

(i) The contractor shall maintain a Register of persons employed on work on contract in Form XIII of the CL (R&A) Central Rules 1971 (Appendix IV)

(ii) The contractor shall maintain a Muster Roll register in respect of all workmen employed by him on the work under Contract in Form XVI of the CL (R&A) Rules 1971 (Appendix V).

(iii) The contractor shall maintain a Wage Register in respect of all workmen employed by him on the work under contract in Form XVII of the CL (R&A) Rules 1971 (Appendix VI).

(iv) Register of accident – The contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars:

a) Full particulars of the labourers who met with accident.
b) Rate of Wages.
c) Sex
d) Age
e) Nature of accident and cause of accident.
f) Time and date of accident.
g) Date and time when admitted in Hospital,
h) Date of discharge from the Hospital.
i) Period of treatment and result of treatment.
j) Percentage of loss of earning capacity and disability as assessed by Medical Officer.
k) Claim required to be paid under Workmen's Compensation Act.
I) Date of payment of compensation.
m) Amount paid with details of the person to whom the same was paid.
n) Authority by whom the compensation was assessed.
o) Remarks

(v) The contractor shall maintain a Register of Fines in the Form XII of the CL (R&A) Rules 1971 (Appendix-XI).

The contractor shall display in a good condition and in a conspicuous place of work the approved list of acts and omissions for which fines can be imposed (Appendix-X)

(vi) The contractor shall maintain a Register of deductions for damage or loss in Form XX

of the CL (R&A) Rules 1971 (Appendix-XII)

(vii) The contractor shall maintain a Register of Advances in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIII)

(viii) The contractor shall maintain a Register of Overtime in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIV)

8 ATTENDANCE CARD-CUM-WAGE SLIP

(i) The contractor shall issue an Attendance card-cum-wage slip to each workman employed by him in the specimen form (Appendix-VII)

(ii) The card shall be valid for each wage period.

(iii) The contractor shall mark the attendance of each workman on the card twice each day, once at the commencement of the day and again after the rest interval, before he actually starts work.

(iv) The card shall remain in possession of the worker during the wage period under reference.

(v) The contractor shall complete the wage slip portion on the reverse of the card at least a day prior to the disbursement of wages in respect of the wage period under reference.

(vi) The contractor shall obtain the signature or thumb impression of the worker on the wage slip at the time of disbursement of wages and retain the card with himself.

9. EMPLOYMENT CARD

The contractor shall issue an Employment Card in Form XIV of the CL (R&A) Central Rules 1971 to each worker within three days of the employment of the worker (Appendix-VIII).

10. SERVICE CERTIFICATE

On termination of employment for any reason whatsoever the contractor shall issue to the workman whose services have been terminated, a Service certificate in Form XV of the CL (R&A) Central Rules 1971 (Appendix-IX).

11. PRESERVATION OF LABOUR RECORDS

All records required to be maintained under Regulations Nos. 6 & 7 shall be preserved in original for a period of three years from the date of last entries made in them and shall be made available for inspection by the Engineer-in-charge or Labour Officer or any other officers authorized by the NDMC/Delhi NDMC in this behalf.

12. POWER OF LABOUR OFFICER TO MAKE INVESTIGATIONS OR ENQUIRY

The Labour Officer or any person authorized by Central Government/NDMC/Delhi Govt. on their behalf shall have power to make enquires with a view to ascertaining and enforcing due and proper observance of Fair Wage Clauses and the Provisions of these Regulations. He shall investigate into any complaint regarding the default made by the contractor or subcontractor in regard to such provision.

13. REPORT OF LABOUR OFFICER

The Labour Officer or other persons authorized as aforesaid shall submit a report of result of his investigation or enquiry to the Engineer-in-charge concerned indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the contractor's bill be made and the wages and other dues be paid to the labourers concerned. In case an appeal is made by the contractor under Clause 13 of these regulations, actual payment to labourers will be made by the Executive Engineer after the Superintending Engineer has given his decision on such appeal.

(i) The Executive Engineer shall arrange payments to the labour concerned within 45 days from the receipt of the report from the Labour Officer or the Superintending Engineer as the case may be.

14. APPEAL AGAINST THE DECISION OF LABOUR OFFICER

Any person aggrieved by the decision and recommendations of the Labour Officer or other person so authorized may appeal against such decision to the Superintending Engineer concerned within 30 days from the date of decision, forwarding simultaneously a copy of his appeal to the Executive Engineer concerned but subject to such appeal, the decision of the officer shall be final and binding upon the contractor.

15. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER

i) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by:

a) An officer of a registered trade union of which he is a member.
b) An officer of a federation of trade unions to which the trade union referred to in clause (a) is affiliated.
c) Where the employer is not a member of any registered trade union, by an officer of a registered trade union, connected with the industry in which the worker is employed or by any other workman employed in the industry in which the worker is employed.

ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by:

a) An officer of an association of employers of which he is a member.
b) An officer of a federation of associations of employers to which association referred to in clause (a) is affiliated.
c) Where the employers is not a member of any association of employers, by an officer of association of employer connected with the industry in which the employer is engaged or by any other employer, engaged in the industry in which the employer is engaged.

iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these regulations.

16. INSPECTION OF BOOKS AND SLIPS

The contractor shall allow inspection of all the prescribed labour records to any of his workers or to his agent at a convenient time and place after due notice is received or to the Labour Officer or any other person, authorized by the Central Government/NDMC/Delhi NDMC on his behalf.

17. SUBMISSIONS OF RETURNS

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

18. AMENDMENTS

The Central Government/ NDMC/ Delhi Govt. may from time to time add to or amend the regulations and on any question as to the application/Interpretation or effect of those regulations the decision of the Superintending Engineer concerned shall be final.

Contractor

Engineer-in-Charge
Executive Engineer (Special Project)
For & on behalf of NDMC

Appendix 'I'

PROFORMA OF REGISTER
REGISTER OF MATERNITY BENEFITS (Clause 19 F)

Name and address of the Contractor…….

Name and location of the work ……

Name of the employee	Father's/husband's name	Nature of employment	Period of actual employment	Date on which notice of confinement given
1	2	3	4	5

Date on which maternity leave commenced and ended

Date of delivery/ miscarriage	In case of delivery		In case of miscarriage	
	Commenced	Ended	Commenced	Ended
6	7	8	9	10

Leave pay paid to the employee

In case of delivery		In case of miscarriage		Remarks
Rate of leave pay	Amount paid	Rate of leave pay	Amount paid	
11	12	13	14	15

Appendix 'II'

SPECIMEN FORM OF THE REGISTER, REGARDING MATERNITY BENEFIT ADMISSIBLE TO THE CONTRACTOR'S LABOUR IN NEW DELHI MUNICIPAL COUNCIL WORKS

Name and address of the contractor……..

Name and location of the work ……

1. Name of the woman and her husband's name.
2. Designation
3. Date of appointment.
4. Date with months and years in which she is employed.
5. Date of discharged/dismissal, if any.
6. Date of production of certificates in respect of pregnancy.
7. Date on which the woman informs about the expected delivery.
8. Date of delivery/miscarriage/death.
9. Date of production of certificate in respect of delivery/miscarriage.
10. Date with the amount of maternity/death benefit paid in advance of expected delivery.
11. Date with amount of subsequent payment of maternity benefit.
12. Name of the person nominated by the woman to receive the payment of the maternity benefit after her death.
13. If the woman dies, the date of her death, the name of the person to whom maternity benefit amount was paid, the month thereof and the date of payment.
14. Signature of the contractor authenticating entries in the register.
15. Remarks column for the use of Inspecting Officer.

*****

Appendix 'III'

Labour Board

Name of work .....
Name of Contractor .....
Address of Contractor .....
Name and address of N.D.M.C. Division.....
Name of N.D.M.C. Labour Officer .....
Address of N.D.M.C. Labour Officer .....
Name of Labour Enforcement Officer.....
Address of Labour Enforcement Officer .....

Sl. No.	Category	Minimum wage fixed	Actual wage paid	Number Present	Remarks
1	2	3	4	5	6

Weekly holiday.....
Wage period .....
Date of payment of wages .....
Working hours .....
Rest interval .....

****

Appendix – 'IV'

Form-XIII (See Rule 75)
Register of Workmen Employed by Contractor
FORM XIII

Name & address of contractor……..
Name & location of work……..
Name & address of establishment in/under which contract is carried on……...
Name & address of Principal Employer……..…..

Sr. No.	Name & surname of workmen	Age and sex	Father's/Husband Name	Nature of employment/ designation	Permanent home address of the workman (Village & The Tahsil, Taluk & District
1	2	3	4	5	6

Local address	Date of commencement of employment	Sig. or thumb impression of the workman	Date of termination of employment	Reasons for termination	Remarks
7	8	9	10	11	12

Appendix-V

Form-XVI (See Rule 78(2)(a)
Muster Roll

Name and address of contractor …….
Name and address of establishment under which contract is carried on ……..
Nature and location of work …….
Name and address of Principal Employer…….……For the Month of fortnight ……

Sl. No.	Name of workman	Sex	Father's / husband's name	Dates					Remarks
1	2	3	4	5					6
				1	2	3	4	5	

APPENDIX -VI

FORM XVII (See Rule 78 (2)(a)
REGISTER OF WAGES

Name & address of contractor……
Name & location of work……..
Name & address of establishment in/under which contract is carried on……..
Name & address of Principal Employer……Wage period: Monthly/Fortnightly……..

Sl. No.	Name of workman	Sl. No. in the register of workman	Designation/nature of work done	No. of days worked	Units of work done	Daily rate of wages/piece rates
1	2	3	4	5	6	7

Amount of wages earned					Deductions if any (indicate nature)	Net amount paid	Sig. or thumb impression of the workman	Initials of contractor or his representative
Basic wages	Dearness allowances	Over time	Other case payment (indicate nature	Total				
8	9	10	11	12	13	14	15	16

Appendix-VII

WAGE CARD

Wage Card No:…….
Name and address of Contractor :……Date of issue :…….
Name and location of work :……....Designation :……
Name of Workman…….…… Month/Fortnight……
Rate of Wages:……..

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Morning															
Evening															
initials															

Date	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Morning																
Evening																
initials																

Received from……..the sum of Rs…….……..on account of my wages.

The wage card is valid for one month from the date of issue Signature

Appendix 'VIII'

Form-XIX
[See rule 78 (2) (b)]
Wages Slip

Name and Address of contractor ……
Name and Father's/husband's name of workman……
Nature and location of work …….
For the Week/Fortnight/Month ending ……

1. No. of days worked ……
2. No. of units worked in case of piece rate workers……
3. Rate of daily wages/piece rate ……
4. Amount of overtime wages ……
5. Gross wages payable ……
6. Deduction, if any ……
7. Net amount of wages paid ……

Initials of the contractor or his representative

******

Appendix 'IX'

Form-XIV [See rule 76]
Employment Card

Name and Address of contractor ……
Name and address of establishment under which contract is carried on ……
Name of work and location of work ……
Name and address of Principal Employer ……

1. Name of the workman .....
2. Sl. No. in the register of workman employed ……
3. Nature of employment/designation .....
4. Wage rate (with particulars of unit in case of piece work) ……
5. Wage period ……
6. Tenure of employment ……
7. Remarks ……

Signature of Contractor

****

Appendix – 'X'

Form-XV (See Rule 77)
Service Certificate

Name and address of contractor ……
Nature and location of work ……
Name and address of workman ……
Age or date of birth ……
Identification marks ……
Father's Husband's Name ……
Name and address of establishment in under which contract is carried on **……**
Name and address of Principal Employer……

Sr No.	Total Period for which employed		Nature of Work done	Rate of wages (with particulars of unit in case of piece work)	Remarks
	From	To			
	2	3	4	5	6

Appendix 'XI'

LIST OF ACTS AND OMISSIONS FOR WHICH FINES CAN BE IMPOSED

In accordance with rule 7(v) of the Contractor's Labour Regulations to be displayed prominently at the site of work both in English and local Language.

1. Willful insubordination or disobedience, whether alone or in combination with other.
2. Theft fraud or dishonesty in connection with the contractors beside a business or property of NDMC.
3 Taking or giving bribes or any illegal gratifications.
4. Habitual late attendance.
5. Drunkenness lighting, riotous or disorderly or indifferent behavior.
6. Habitual negligence.
7. Smoking near or around the area where combustible or other materials are locked.
8. Habitual indiscipline.
9. Causing damage to work in the progress or to property of the NDMC or of the contractor.
10. Sleeping on duty.
11. Malingering or slowing down work.
12. Giving of false information regarding name, age father's name, etc.
13. Habitual loss of wage cards supplied by the employers.
14. Unauthorized use of employer's property of manufacturing or making of unauthorized particles at the work place.
15. Bad workmanship in construction and maintenance by skilled workers which is not approved by the Department and for which the contractors are compelled to undertake rectifications.
16. Making false complaints and/or misleading statements.
17. Engaging on trade within the premises of the establishments.
18. Any unauthorized divulgence of business affairs of the employees.
19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorized by the employer.
20. Holding meeting inside the premises without previous sanction of the employers.
21. Threatening or intimidating any workman or employer during the working hours within the pre

APPENDIX – 'XII'

Form-XV (See Rule 77)
FORM XII (See Rule 78 (2) (d)
REGISTER OF FINES

Name & address of contractor……
Name & location of work……..
Name & address of establishment in/under which contract is carried on……..
Name & address of Principal Employer…….

Sl. No.	Name of workman	Father's/Husband Name	Designation/ nature of employment	Act/Omission for which the fine imposed	Date of offence	Whether workman showed cause against fine
1	2	3	4	5	6	7

Name of person in whose presence employee's explanation was heard	Wage period and wages payable	Amount of fine imposed	Date on which fine realized	Remarks
8	9	10	11	12

APPENDIX – 'XIII'

FORM XX (See Rule 78(2) (d)
REGISTER OF DEDUCTION FOR DAMAGE OR LOSS

Name & address of contractor……
Name & location of work……..
Name & address of establishment in/under which contract is carried on……..
Name & address of Principal Employer…….

Sl. No.	Name of workman	Father's/Husband Name	Designation/nature of employment	Particulars of damage or loss	Date of damage or loss	Whether workman showed cause against deduction
1	2	3	4	5	6	7

Name of person in whose presence employee's explanation was heard	Amount of deduction imposed	No. of installments	Date of recovery First Installments	Date of Recovery Last Installment	Remarks
8	9	10	11	12	13

APPENDIX – 'XIV'

FORM XXII (See Rule 78(2)(d)
REGISTER OF ADVANCES

Name & address of contractor……
Name & location of work……..
Name & address of establishment in/under which contract is carried on……..
Name & address of Principal Employer…….

Sl. No.	Name of workman	Father's/Husband Name	Designation/ nature of employment	Wage period and wages payable	Date and amount of advance given
1	2	3	4	5	6

Purpose (s) for which advance made	No. of installments by which advance is to be repaid	Date & Amount of each installment repaid	Date on which last installment was repaid	Remarks
7	8	9	10	11

APPENDIX – 'XV'

FORM XXIII (78(2) (e)
REGISTER OF OVERTIME

Name & address of contractor……
Name & location of work……..
Name & address of establishment in/under which contract is carried on……..
Name & address of Principal Employer…….

Sl. No.	Name of workman	Father's/Husband Name	Sex	Designation/ nature of employment	Date on which overtime worked
1	2	3	4	5	6

Total overtime worked or production in case of piece rated	Normal rate of wages	Overtime rate of wages	Overtime earnings	Rate at which overtime wages paid	Remarks
7	8	9	10	11	12

Appendix – 'XVI'

(FORM 31)
~~INDENTURE FOR SECURED ADVANCES~~
~~(Referred to in paragraphs 10.2.20 and 10.2.22 of CPWD A Code)~~

~~(For use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)~~

~~THIS INDENTURE made the…… day of ……..20……. BETWEEN …… (hereinafter called the **Contractor** which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) of the one part and the **Engineer-in-Charge on behalf of New Delhi Municipal Council** (hereinafter called the Principal/Owner which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.~~

~~WHEREAS by an agreement dated…….. (hereinafter called the said agreement) the Contractor has agreed AND WHEREAS the Contractor has applied to the Principal that he may be allowed advances on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges) AND WHEREAS the Principal has agreed to advance to the Contractor the sum of Rupees …… on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account Bill for the said works signed by the Contractor on ……and the Principal has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works. Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees ……on or before the execution of these presents paid to the Contractor by the Principal (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the Principal and declare as follows: –~~

~~(1) That the said sum of Rupees …….. so advanced by the Principal to the Contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor in or towards expediting the execution of the said works and for no other purpose whatsoever.~~

~~(2) That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the Principal as security 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 a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnifies the Principal against all claims to any materials in respect of which an advance has been made to him as aforesaid.~~

~~(3) That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made 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 Divisional Officer …….. Division (hereinafter called the Divisional Officer) and in the term of the said agreement.~~

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

(5) That the said materials shall not on any account be removed from the site of the said works except with the written permission of the Divisional Officer or an officer authorized by him on that behalf.

(6) That the advances shall be repayable in full when or before the Contractor receives payment from the Principal of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Principal will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials then actually used in the construction 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 advances made under these presents were calculated.

(7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the Principal shall immediately on the happening of such default be repayable by the Contractor to the Principal together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs charges, damages and expenses incurred by the Principal in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the Principal to repay and pay the same respectively to him accordingly.

(8) That the Contractor hereby charges all the said materials with the repayment to the Principal of the said sum of Rupees .....and any further sum or sums advanced as aforesaid and all costs charges, damages and expenses payable under these presents PROVIDED ALWAYS and 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 Principal may at any time thereafter adopt all or any of the following courses as he may deem best:-

(a) Size and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor 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 advances under these presents and crediting the Contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor, he is to pay same to the Principal on demand.

b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable

or payable to the Principal under these presents and pay over the surplus (if any) to the Contractor.

(c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

(9) That except in the event of such default on the part of the Contractor as aforesaid interest on the said advance shall not be payable.

(10) That in the event of any conflict between the provisions of these presents and the said agreement 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 herein before expressly provided for the same shall be finally resolved as per provisions of clause 25 of the contract.

In witness whereof the said .....and .....by the order and under the direction of the Principal have hereunto set their respective hands the day and year first above written.

Signed, sealed and delivered by..... the said contractor in the presence of
.....
.....

Signature .....
Witness Name .....
Address .....
Signed by.....

by the order and direction of the Principal in the presence of
Signature .....
Witness Name .....
Address .....

Appendix – 'XVII'

(Refer Clause 5)

FORM OF APPLICATION BY THE CONTRACTOR FOR SEEKING EXTENSION OF TIME

1. Name of contractor
2. Name of work as given in the agreement
3. Agreement no
4. Estimated amount put tender
5. Date of commencement of work as per agreement
6. Period allowed for completion of work as per agreement
7. Date of completion stipulated in agreement
8. Period for which extension of time if has been given by authority in Schedule 'F' previously

	letter no. and date	**Extension granted**	
		Months	**Days**
(a) 1st extension **.....** **(b) 2nd extension**			
(c) 3rd extension **.....**			
(d) 4th extension **.....**			
(e) Total extension previously given			

9. Reasons for which extension have been previously given (copies of the previous applications should be attached)
10. Period for which extension if applied for
11. Hindrances on account of which extension is applied for with dates on which hindrances occurred and the period for which these are likely to last (for causes under clause 5.2/ and 5.3).

Signature of Contractor
Dated

Appendix – 'XVIII'

Reference of disputes and amount claimed for each dispute to the Conciliator.
[Refer to Clause 25]

To,
The Chairman/Chairperson (NDMC)
New Delhi Municipal Council,
Palika Kendra, New Delhi.

Subject: Reference of disputes and amount claimed for each dispute to the Conciliator for settlement of
disputes relating to agreement number:

Dear Sir,

In terms of clause 25 of the aforesaid agreement, particulars of which are given below, I/We hereby refer my / our disputes and amount claimed for each dispute to you for settlement in your capacity as Conciliator:

1. Name of applicant:
2. Whether applicant is Individual/proprietorship Firm/Partnership Firm/Company.
3. Full address of the applicant:
4. Name of the work and contract number for which arbitration is sought:
5. Name of the Division which entered into contract:
6. Contract amount:
7. Date of contract.
8. Stipulated date of start of work:
9. Stipulated date of completion of work:
10. Actual date of completion of work (if completed):
11. Total number of claims made:
12. Total amount claimed:
13. Date of intimation of final bill (if work is completed):
14. Date of payment of final bill (if work is completed):
15. Amount of final bi (if work is completed):
16. Date of claim made to Engineer-in-Charge:
17. Date of receipt of decision from Engineer-in- Charge:

I/We certify that the information given above is true to the best of my/our knowledge enclose the statement each claim.
Yours faithfully,

Signature of the applicant
(Only the person/authority who signed
the contract should sign here)

Copy in duplicate to:
1. CE(C-II)
2. SE(BCM-II)
3. EE(Spl. Project)

Appendix – 'XIX'

Notice for appointment of Arbitrator
[Refer to Clause 25]

To,
The Chief Engineer/Superintending Engineer
……(Zone or Circle) ……

Subject: Notice for appointment of Arbitrator for adjudication of disputes relating to agreement number: ……

Dear Sir,

In terms of clause 25 of the aforesaid agreement, particulars of which are given below, I/We hereby give you notice to appoint an Arbitrator for adjudication of disputes mentioned below.

1. Name of applicant:
2. Whether applicant is individual/proprietorship Firm/Partnership Firm/Company.
3. Full address of the applicant:
4. Name of the work and contract number for which arbitration sought:
5. Name of the Division-which entered into contract:
6. Contract amount:
7. Date of contract:
8. Stipulated date of start of work.
9. Stipulated date of completion of work:
10. Actual date of completion of work (if completed):
11. Total number of claims made:
12. Total amount claimed:
13. Date of intimation of final bill (if work is completed):
14. Date of payment of final bill (if work is completed):
15. Amount of final bill (if work is competed):
16. Date of reference made to SDG/ADG for conciliation, if applicable:
17. Date of termination of conciliation proceedings:
18. I/We hereby give consent for appointment of Arbitrator of MoHUA. Waiver agreement as per Appendix-XlX is enclosed.

Or

I/We do not give consent for appointment of Arbitrator of MoHUA.

I/We certify that the information given above is true to the best of my/our knowledge. l/We enclose the following documents:
1. Statement of claims with amount of each Claim.
2. *Agreement of waiver of Section 12(5) of the Arbitration and Conciliation Act, 1996 in Appendix-XlX.
(strike out if not applicable)

Yours faithfully,
……
Signature of the applicant
(Only the person/authority who signed the contract should sign here)

Copy to the Executive Engineer (Special Project)

Appendix – 'XX'

Agreement towards waiver of Section .12(5) of Arbitration & Conciliation Act 1996
[Refer to Clause 25]

1 Whereas certain disputes between M/s……. (claimants) and M/s…… (respondents)relating to agreement No.

2 And whereas the parties are aware that Shri ……..... is on the cadre of NDMC; presently on deputation as Arbitrator, Ministry of Housing and Urban Affairs, Government of India.

3 I/we agree for the appointment of Shri…… as the sole Arbitrator for adjudication of the disputes, and we hereby waive the applicability of Section 12(5) of the Arbitration & Conciliation Act,1996.

Signature
(Only the person/authority who signed the contract should sign here)
Name……..

Date……..

(The name of the Arbitrator, Ministry of Housing and Urban Affairs, Government of India may be enquired from the Engineer-in-Charge, if required.)

GENERAL SPECIFICATIONS FOR CIVIL WORK

CONSERVATION SPECIFICATIONS

1.0 CONSERVATION SPECIFICATIONS

1.1. Demolition, Dismantling & Removal

1.2. Enabling Works – Scaffolding, Mobile work stations & Protective works

1.3. Removal of Biological growth

1.4. Specifications for Lime - Plaster, Pointing and Lime wash

1.5. Specifications for Metal work – Cleaning, Coatings & Paints

1.6. Specifications for Polymer Aided Repair

1. CONSERVATION SPECIFICATIONS

1.1 DISMANTLING, DEMOLITION AND REMOVAL

As this is a prime Heritage Building of Grade I Status, Contractors shall take all precautions to see that any dismantling, demolition work is done in such a sequence and manner as to prevent all damage to usable and any damage to nearby propertyor injury to life. To this effect the Contractor may be required to erect suitable barricades around the works as directed for which no claims for extra payment will beallowed.

A register shall be opened by the contractor on the work site to show a day- to-dayaccount of the turn out of salvaged materials. This register should also show whether dismantled material is properly stacked or wasted. It shall be signed by the representative of the contractor and by the Engineer-in-charge on site.

Any part of the indicated structure shall be dismantled carefully, and the materials removed without causing damage to the serviceable materials and the part of the structure to be retained, and any properties or structure nearby. Any damage to nearby property or structure shall be made good by the contractor without extra claims. The contractor shall be responsible for any injury to the workers or the public. Removal of overlaying adjacent materials if required for dismantling of the structure, shall be included in theitem.

Before demolishing any part of the structure, the contractor shall provide supports andstruts to the existing structure as and when directed by the Consultants. All struts andsupport shall not be removed by the contractor until written permission is obtained from the architect or structural engineer. No extra claims for such skirting or supportsshall be paid for, it shall be included in the tender under respective items for demolishing. All scaffolding will be in steel and will have rubber ends, so as to notdamage any part of the structure.

All the materials obtained from the removal of the structure shall be the property of the owner. Serviceable materials shall be stacked neatly in such a manner as to avoid deterioration and in places directed by the Consultant within a distance of 100m.Different categories of materials shall be stacked separately. Materials which are tobe reused, shall be numbered before dismantling, carefully dismantled to avoid any damages and stacked in an order which facilitates the re-use.

Unless otherwise provided, excavated materials shall be used in back filling the excavation made in removing the structure, in leveling ground or otherwise disposed off, as directed free of cost. Serviceable materials may be issued to the contractor foruse in the new work or elsewhere at the rates and as per conditions provided in thetender. No material shall be disposed off by the contractor without the specific instructions of the Consultants.

Serviceable materials may be issued to the contractor for use in the new work or elsewhere at the rates and as per conditions provided in the tender. No material shall be disposed off by the contractor without the specific instructions of the Consultants

1.2 ENABLING WORKS – SCAFFOLDING, MOBILE WORK STATIONS & PROTECTIVEWORKS

NOTE: THE CONTRACTOR IS TO PROVIDE THE SCAFFOLDING AND ENABLING WORKS LISTED BELOW AS PER THE FOLLOWING SPECIFICATIONS TO BE INCLUDED

The contractors have to provide scaffolding for the external and internal works as per the schematic arrangement given by the Architect, based on which he shall prepare detailed fabrication drawings. The total quantity of scaffolding to be deployed at site with repetitive use should take into account the completion period of the work. However, sufficient scaffolding material should be brought to site to cover a minimumof one third of the total work area.

Various precautions to protect the Heritage Structure and finishes from damage asdetailed herein shall be taken by t hecontr4actor. The cost of scaffolding and various protective measures have to be included in the rates quoted by the contractor. Itshould be clearly understood that no work will be allowed to be carried out without the approval of the Architect/ Engineer for the scaffolding and other protective arrangement mentioned in these special specifications of work.

A safe, (largely free-standing) metal pipe scaffolding with clamp jointing shall be provided for the operation, with metal sheeting / timber plank and lifts at 8 feet heights. To ensure safety for inspection of the surfaces by the Site personneland labour, stiffeners shall be provided at regular intervals, including sturdy metal ladders of the type which are pre-fitted into the scaffolding. The circularpipe sections shall have rubber inserts at the pipe ends at the point of contact with the stone surface, so as to avoid damage to the building. A tarpaulin covering shall be provided to ensure environmental protection and for technical reasons, to prevent inconsistent drying of surfaces during the process. Scaffolding permissions from the Municipal Authorities and the subsequent costs involved will be the responsibility of the Contractor.

The specifications for scaffolding are as follows:

Providing and erecting two legged metal tubular scaffolding, of width 1200 to 1500mm largely free standing, using H frames or tubular pipes of minimum 40mm diameter, with base plates, fixed or adjustable with necessary clamps,couplers, brackets for projections, joint pins, pulleys and other accessories, including steel angle or tubular pipe bracings at adequate intervals, access platforms of metal or timber planks of span not exceeding 2.5 metres, including provision of rubber inserts to pipe ends at points of contact with structure toavoid damage, including access ladders with intermediate platforms. The scaffolding is to be suitably braced and anchored to the building using supportsystems created temporarily at the openings in the walls using vertical and horizontal adjustable steel props. The rate includes provision of high density plastic sheet covering to protect architectural details on the entire buildingface, required, and safety platforms at ground level covering the entrances to the building.

Note: It should be noted that where scaffolding is taken up over floors, adequate supports are to be provided from below the floors to take the loadof the scaffolding.

a) **Providing and erecting exterior scaffolding** as above, including dismantling, shifting and re-erection. The minimum quantity of scaffolding to be deployed shall be at least

one third of the total estimated measured area in elevation

b) **Providing and erecting high density plastic sheet covering fixed to the exterior face of scaffolding** including duck tape with safety signage "work in progress" and "caution" boards at ground level and demarcation of entrances to the building

c) For interior of lobby **providing and erecting internal scaffolding up to vaulted and domed ceiling soffit using two legged metal tubular arrangement as described** in ENB/1 in rows spaced at a distance not exceeding 2.5 meters, including suitable cross and horizontal bracing in both planes to make the entire scaffolding erected over the floor as self supporting,space frame arrangement without anchorage from the building components. The rate includes for providing planks below base plates of tubular scaffolding pipes. Minimum of one third of the quantity of the total measured area in elevation shall be deployed at site. The measurements will be calculated by multiplying the lengths of the two legged units at the centre line of the 1200-1500mmscaffold unit widths x heights of the individual rows. The rates will include for thecross bracings between the rows of the scaffold units. Where scaffolding is taken over upper floors or terrace these shall be adequately shored and supported from below.

d) **Supplying and providing mobile working platform fabricated with tubular pipes** of 50/40 mm dia. With solid rubber castor wheels and platforms for working at various heights, over all size of unit to be 5m long x 1.8m wideextendable up to 5m height complete with access stairs, safety railings etc. A minimum of two such mobile units will have to be deployed at site.

e) **Careful Packing of all sculpture details / decorative grill work / delicate tracery and statuary in bubble wrap plastic sheeting** with masking tape andduck tape to ensure absolutely no damage to the details during the site works.

f) **Plaster of Paris covering of 30mm thickness over the entire floor area** with a bottom layer of high density plastic sheet over Minton Tiles in side the Lobbyand verandah areas to ensure that scaffolding/ movement of machine andtools do not damage the historic flooring.

g) **Providing and erecting a temporary partitions using 6 mm thick commercial plywood** of approved quality and make and with adequate supporting framework to make it largely free standing to provide protection from other works in progress. The partitions shall be such that they can be removed and reused at different locations without damaging the property. Item to include printed duck tape with safety signage and words "Site Works in Progress" and "Caution" printed to cordon off areas of work. Adequate site signage in boldprinted signs should be placed as per Architect's instructions for safety instructions. **Providing and fixing temporarily 4mm thick commercial plywood** protection to glazed panels and stained glass, to be removed from site after completion of all work.

h) **Careful removal of cupboards,** loose furniture etc stored in the verandahs, staircases and other areas that need to be removed from the building and unloading at a site identified within the premises. The clearing should be donewith utmost care to avoid any breakage or damage to furniture or architectural features of the building.

Note: Unless the above enabling works are done and approved, the work of restoration in the concerned areas cannot be started

1.3. REMOVAL OF BIOLOGICAL GROWTH

1.3.1. Removal of Ficus Growth

Ficus plants grow out of joints in the masonry walls. As the root system embedsitself deep into the masonry they cause widening of cracks, and often-greater structural problems within the building.

The process of removal of such growth shall be as follows:

Uprooting of the plant

The parasitic plant growth shall be physically pulled out and uprooted, or in case of a very sturdy growth, chopped off above the stone surface.This shall be done at the time of stone cleaning, when the scaffolding is in place, for those plants that are not easily accessible.

Injecting a suitable biocide

Biocides that are least damaging to the adjoining stone masonry shallbe used. Some recommended chemicals are as follows:

Active Ingredient

MCPA Agrozxone/ Agritox/ Cornox2, 4-D + dicamba

2, 4-D + dicamba + ioxynil2, 4-D + ichloroprop

2, 4-D + mecpropGlyphosate

Note: These are just some recommended chemicals and any suitablealternative may be suggested.

Application of paste on the cut stem and root of the ficus plant

After cutting out the ficus, to the stump of the plant may be applied, apaste of 1 part powdered "Hing" (asafoetida) and two parts slaked limeputty. This may be applied as a paste over 2 –3 times and allowed todry.

1.3.2. Removal Of Algae, Lichens And Other Biological Growth

Algae, lichen and other biological growth occur at places where there is moisture accumulation due to leakage, poor drainage and damaged plumbing. This shall be attended just prior to intensive stone cleaning at thesame time that the scaffold, is erected for pointing and cleaning of the stonesurface. The tasks shall be as follows:

Scraping of the surface

The microbiological growth shall be removed by spatula, knife blades or stiff bristles or non-ferrous soft wire brushes.

Chemical Application

A chemical solution of quaternary ammonium based biocide shall be applied to the surface, or could be sprayed on to the affected surface and left for a few days. Tributyl tin oxide is also a proven biocide. This shall be then followed by gentle scraping and stone cleaning. Branded chemicals such as "Fongifluid" or equivalents may be also used in 2 coats for biocide wash.

1.4. SPECIFICATIONS FOR LIME (PLASTER / POINTING & LIME WASH)

1.4.1. LIME

The lime shall be made of approved limestone or *kankar* and properly burnt and slaked with fresh water, on site of work or nearby the site. They shall be crushed properly before slaking. These *kankar* shall be slaked on site for use. Fresh quick lime or *kankars* should be added to water, (and not the other way around) and stirred to a thick creamy consistency, suitable for running through a sieve of 256 mesh to one square inch and all materials that will not pass through the sieve shall be rejected. It shall be free from excess of unburnt *kankar*, ashes, cinders, salt or other impurities and if the lime *kankar* be considered to be of inferior quality, it shall be rejected. All pieces of unburnt lime or other impurities shall be rejected. All pieces of unburnt lime or other impurities shall be screened or picked out and removed at once from the site.

In case not separately specified by Architect, the lime shall conform to IS-712 (Building limes). The sand shall conform to IS-1542 (sand for plaster). The sand shall not contain any particle larger than 3mm and shall be washed before use.

Lime that has perished by forming lumps in case of slaked lime and that which has become air slaked in case of the unslaked fresh lime, shall be rejected and be removed forthwith from the site.

1.4.2. SLAKING LIME

All impurities, ashes or pieces improperly burnt shall be screened or picked out and then slaked not less than 2 weeks before use. The slaked lime shall be screened through IS 240 sieve for mortars used for first coat or through IS 120 sieve for mortars used in subsequent coats. The slaked lime shall be stored in a weather proof shed with a impervious floor (IS:712). The lime shall be used when fresh. The lime shall be kept wet for at least 6 days in a water tank (or drums) before using.

1.4.3. LIME MORTAR

The lime shall conform to IS-712 (Building limes). The sand shall conform to IS-1542 (sand for plaster). The sand shall not contain any particle larger than 3 mmand shall be washed before use.

The lime mortar shall be made of good fresh lime and clean sand, approvedby the Consultants and mixed in the proportion as specified in the Bill of Quantities. The lime and sand shall be stacked before grinding, in alternateequal layers of about 6" in depth, measured in the stack. The materials shall be carefully mixed in small quantities in a roller pan mixer. The grinding shall be performed with a sufficient quantity of fresh water, twice before the mortar is used in the work.

The lime mortar shall be made of good fresh lime and clean sand, approved by the Consultants and mixed in the proportion as specified in the Bill of Quantities. The lime and sand shall be stacked before grinding, in alternateequal layers of about 6" in depth, measured in the stack. The materials shall be carefully mixed in small quantities in a roller pan mixer. The grinding shall be performed with a sufficient quantity of fresh water, twice before the mortar is used in the work. The grinding shall continue for at least 12 hours each time or for 80 revolutions of the mill and an interval of at least 24 hours shall lapse between each grinding operation. The mortar shall be kept moist and wellsheltered from the sun till it is used in the work.

Mix sand well with proper "chakki" and this lime and sand mix in fact may bestored in batches in air tight plastic buckets/ containers with a wet hessianpacking over the lime sand mortar. The mix must be left to mature in timberlined pits, so that the excess water can continue to drain from the mortar, andit should be covered up in plastic to prevent excess drying out. Good mature lime putty should have a consistency of mature cheese and should retain its shape when turned out of a container. This putty will return to workable statewhen knocked up. Knocking shall be done just before using for mortar. Small amounts can be knocked by hand, for larger amounts roller pan mixer should be used. After working a good plastic consistency transfer it to a small bucket, cover the bucket so that it does not dry out. Once the pointing is being done, it should be taken out only a small workable quantity of mortar and beat well with spatula, chopping and aereating the mortar well to get it into a workable and malleable shape for application.

1.4.4. LIME POINTING

The old mortar in the joint should be removed carefully without chipping any part of the adjacent stone. Old mortar should be removed off by a hack saw blade. After flushing out open joints with a jet of clean water. Mortar mix should be same as that specified for repointing in the Bill of Quantities and specifications. Once the pointing is being done, it should be taken out only a small workable quantity of

mortar and beat well with spatula, chopping andaereating the mortar well to get it into a workable and malleable shape forapplication.

The mortar for the pointing shall consist of one part lime and two parts sand and shall be applied to wetted joints uniformly. The joints of the pointed work shall be regular and uniform in breadth. The edges of the pointing shall be cutoff parallel so as to leave well defined lines. The pointing shall be kept well wetted for five days after the pointing is done. Natural stone dust and such powders or chemical colourants and natural colourants such as *kattha* as approved by the architect may be employed for staining the stone to matchthe original mortar and stone. A sample panel must be done and shown to the Consultant for approval before proceeding.

Mortar for repointing should be inserted with the slide of steel blade or edge of a fine spatula/trowel, using a masking tape to ensure clean lines of the pointing, pressing the mortar into the joint with a flexible spatula blade or withthe ball of the thumb. To achieve a fine edge, masking tape may be used to get the required sharpness of the pointing. It is necessary to ensure that the depth of the new mortar should be a minimum of 30-40 mm. When the mortar starts to dry up it should be tapped back with a soft wood mallet to eliminate any shrinkage cracks. The exact detail of surface finishing of the joints should match any surviving original weathered mortar.

The joints of the masonry to be flat pointed shall be raked to a depth of about 20mm while the mortar in the joint is still fresh and the joints shall be kept wellwetted till the pointing is done. The mortar for the pointing shall consist of one part lime and two parts sand and shall be applied to wetted joints uniformly.The joints of the pointed work shall be regular and uniform in breadth. Theedges of the pointing shall be cut off parallel so as to leave well defined lines. The pointing shall be kept well wetted for five days after the pointing is done.

Measurement

The quoted rates shall include the preparation of surfaces, erection and dismantling of scaffolding, materials, labour, curing, all tools and equipmentrequired to complete the plaster work in all respects.

The plastered and pointed surfaces shall be measured and paid on an area basis (m2) for the area actually plastered in accordance with IS:1200. No separate payment shall be made for coving and finishing around skirting, door and window frames.

1.4.5. LIME PLASTERS/ STUCCOGeneral

All plaster work shall comply to IS-1661 (Application of cement and cement lime plaster finishes). The lime shall conform to IS-712 (Building limes). The sand shall

conform to IS-1542 (sand for plaster). The sand shall not contain any particle larger than 3mm and shall be washed before use.

Preparation of surfaces

Plastered surfaces shall be roughened by wire brushing, hacking, or bush hammering or chiselling. If the Architect is not satisfied with the roughening achieved by these methods he may order other methods such as washing with acid etc.

Loose layers of dust etc. on surfaces to be plastered shall be washed. The surface shall be cleaned to remove oil, paint or any other material that might interfere with satisfactory bond and saturated with water so as to be damp when the plaster is applied.

Proportioning

The materials used in the preparation of plaster may be measured either by volume using gauge boxes or by weight. The mix proportion of lime, unless otherwise stated generally refers to the volume of putty.

Lime-plaster: Lime putty and sand shall be mixed dry in the required proportions and kept protected from drying out till the time of use. Water shall be added if necessary but only to the minimum extent required to give a working consistency for the plaster. Mixing shall be done mechanically in "Mortar Mill". If hand mixing is allowed by the Engineer, mixing shall be carried out on a clean, water tight platform protected from sun and rain.

Application

Patches of plaster 150mm x 150mm shall be placed about 3m apart as gauge to ensure even plastering. The mortar shall be firmly applied in a thickness slightly more than the required thickness and well pressed into the joints, rubbed and leveled with a flat wooden rule to required thickness. All plastering shall be made good upto metal or wooden frames, skirtings and around pipes or fittings.

For internal plastering, scaffolding shall be erected independent of walls. No members of scaffolding shall be allowed to be housed in the walls being treated with plaster. Scaffolding for external plaster shall also be supported independent of walls as far as possible to avoid patchy appearance.

General Guidelines for Historic Plaster

- A skilled professional plasterer is necessary to undertake repairs.

- Small hairline cracks may be filled with lime slurry coat

- For part patching up repair of a damaged patch, cut out a section of the adjoining stucco/ plaster to about 1' of adjoining wall surface to ensure a good anchoring for the new stucco/plaster replacement. Cutting out the stucco at a diagonal angle may help anchor the new stucco well.

- Do not use a portland cement stucco/plaster repair on an old lime stucco/plaster as this will not be physically compatible with the softer lime rich stucco and the differing expansion and contraction rates of lime stucco and portland cement stucco will cause the stucco to crack.

- Score out old stucco/plaster in the patch to be repaired till one hits the base masonry. The area of the patch should be cleaned of all debris with a bristle brush and all plant growth, dirt, loose paint, oil or grease should be removed. If necessary, brick or stone mortar joints should be raked out to a depth of approximately $3/4^{th}$ of an inch to ensure a good bond. Damp the base wall and begin application of new stucco.

- The first scratch coat is normally ¼" to 3/8" or that corresponding to the original scratch coat. Upon this, start building the base coats of stucco to build up the thickness of the adjoining stucco and finish with the final surface coat.

- The second coat should be roughened using a wood flat with a nail protruding to provide a key for the final or finish coat. The finish coat normally is about ¼" thick and is applied after the previous coat has set. The base coat should be thoroughly dampened before the final coat is applied.

- Mix only as much stucco/plaster as can be used in one and one half to 2 hours. This will depend on the weather (mortar will harden faster under hot and dry or sunny conditions) and experience is likely to be the best guidance. Any remaining mortar should be discarded and it should not be retempered.

- Wood lath should be wetted and not metal (expanded G.I. wire mesh).

- To prevent cracking, it is imperative that plaster not dry too fast. Therefore, the area to be stuccoed should be shaded or even covered if possible, particularly in hot weather. It is also a good idea in hot weather to keep the newly stuccoeed area damp at approximately 90% humidity for a period of 48 to 72 hours.

- <u>Sand should be clean and should match the original as close as possible.</u>

- Water should be clean and potable.

- If hair or fiber is used, it should be goat or cattle hair or pure manilla fiberof good quality, ½" to 2" in length, clean and free of dust, grime, oil and other impurities.

- Too much lime will make the mixture more plastic but stucco mortar witha very large proportion of lime to sand is more likely to crack because of greater shrinkage, it is also weaker and slower to set. More sand or aggregate will minimize shrinkage but make the mixture harder to trowel smooth and will weaken the mortar.

Recommended composition of soft lime stucco
Vieux Carre Masonry Maintenance Guidelines

Base coats (2)

1 part by volume hydrated lime

3 parts by volume aggregate (sand) – size to match original 6 pounds/ cubic yards hair or fiber

Water to form a workable mix

Finish Coat

1 part by volume hydrated lime

3 parts aggregate (sand) – size to match original
water to form a workable mix

Note: No portland cement is used in this mix. Even if this is added to increase workability of the mix and to decrease setting time, the white cement should never exceed 1 part white cement to 12 parts lime and sand

In case of using Brick Dust (Surkhi)

The lime plaster should be made of good fresh lime and clean sand, approvedby the consultants and mixed in the proportion of Lime putty, fine quartz sandand brick dust in the proportion of 1: 2 ½ : ½.

Alternately, the proportion of lime and quartz sand could be 1:3 or 1:4 (make two samples on site), using 20% white cement in the lime by volume.

The lime and sand shall be stacked before grinding, in alternate equal layers of about 6" in depth, measured in the stack. The materials shall be carefully mixed in small quantities of fresh water, twice before the mortar is used in the work. The grinding shall continue for at least 12 hours each time or for 80 revolutions of the mill and an interval of at least 24 hours shall lapse between each grinding operation. The mortar shall be kept moist and well sheltered fromthe sun till it is used in the work.

Additives like natural animal hair or synthetic alkali resistant fibres may beadded for strengthening and reinforcing the plaster. The proportion required is4 kgs of hair / fibre to 1 cubic meter of plaster. In order to build up the plasterthickness, this could be worked in three coats, viz **1) Render Coat:** (1:3)In thiscoarse stuff is reinforced with hair or synthetic fibre. This coat is laid over the uneven cross keyed wall surface or wire mesh as the primary coat. **2. Floating Coat:** (1:3) Applied as the second coat of plaster just before the first coat has set in. to make up a total thickness of 4/5 of the required plaster thickness andto completely embed the mesh. Adequate time for setting should be allowedfor one section before starting on the adjacent section. **3. Setting Coat:** (3:2) This thin coat is applied in three operations, a) trowel on with trowel b) trowel and float c) compact by scouring with wood float lubricated with water to avoid shrink crazing of the plaster. For this coat, additives like gypsum that has been gauged along with the lime may be used for a smoother finish to this last coat. (1:1)

In order to build up the requisite thickness of the plaster, galvanised and stainless steel expanded metal wire mesh may be used, that is secured to the wall surface by means of non corrosive nails. Proper wetting and curing is required.

1.4.6. LIME WASH

Unbranded Lime Wash

Lime wash should be prepared by slaking fresh quicklime, sieving the resultant putty and adding sufficient water to make a thin cream. 1 egg white to theproportion of 5 litres of lime wash should be added to give it a good glaze. Pigments shall be used if the colour is specified. A range of samples should be put up on the wall for approval from the Architect. When lime is to be used on the exterior, add tallow (clarified animal fat) to the lime during the slakingprocess.

All surfaces to be lime washed should be brushed down to remove loose dust and scale using a stiff and then a soft bristle brush. Any organic growths like algae or lichens should be treated with a biocide and brushed or scraped clean. Immediately before painting, the wall surface should be sprayed with water to avoid suction on lime wash. A suitable soft hair brush should be usedto apply lime wash.

Branded Lime Wash

Name of Paint	Pack Size	Yield	Application by
LIME PAINT Verona / others	14 Litre	5 – 8 Sq.Mtr. per litre in 2 Coats	Brush

Technical qualities: LIME PAINT VERONA is a mineral finish paint for exterior and interior. The product, based on mature lime putty, has a smooth matt finish. Theproduct is ideally used in refurbishment of prestigious buildings and whenever antique kinds

of decoration with lime shall be maintained or re-created. **Dilution**: 20 - 30% with water. **Yield**: 5 - 8 sq.mtr. per litre in two coats, according to the absorbency of the support.

Application: The surface must be dry; the plaster must have matured at least 30 days. Detaching and flaking parts must be removed; a paint stripper shall be used in case of unstable old coats of paint. Walls under refurbishment shallnot present water leaks or significant areas of strong humidity. Optionally SEALER FOR LIME CYCLES could be applied if the surfaces have old flaking or powdery plasters. On new surfaces or well painted old surfaces one coat of PRIMER for LIME CYCLES is recommended.

The application can be conducted by brush: the first coat diluted 20 - 25%, thesecond coat diluted 25 - 30%, waiting approximately 4 hours between coats. During the first 24 – 48 hours from the application the surface shall be protectedfrom the rain. In exterior application it is optionally recommended to protectthe product with WATERPROOFING COATING.

1.5. SPECIFICATIONS FOR METAL WORK – CLEANING, COATINGS & PAINTS

1.5.1. Note for surface coating of cast iron / decorative metal work

The preparation of a sound surface usually involves removal of old paint. Rust, loose mill scale and soluble corrosion salts from the surface. It may be considered that paint removal may reveal cracks, corrosion and casting defects that are not previously visible and allowances may be kept for dealing with this with minor in situ welding andrepair.

All paint that is loose, flaking or delaminated must be removed. Sound paint surfacesmay be simply rubbed down and refinished with one or two suitable coats if directed by Architect. Only wet hand processes should be used because of the risk from dust from lead pigments. Rubbing down should remove residual gloss, surface deposits and blemishes. Chipped areas of paintwork can be similarly rubbed down, ensuringthat the surface under the paint to which corrosion has spread is also cleaned. Locallydamaged paint areas should receive a shallow feathered edge and new paint coatings should overlap at least 50 mm on to existing sound surrounding paint coatings, and must be compatible with the existing coatings.

De greasing

Any oil or grease should be removed by gentle scraping followed by warm water and non ionic detergent thoroughly rinsed off with water. Non caustic based degreasing agents re also available, although a wipe over with white spirit and a succession of clean swabs is also sufficient.

Mechanical Cleaning

Mechanical processes may involve rotary wire brushes. A marginal improvement with this can be achieved over manual processes. An oxyacetylene or oxy propane flame may be used to remove old rust marks and paints but must be handled very carefully so as to quickly go over the surface without overheating or causing fire

threats, specially since the adjoining ceiling is in timber. The thermal differential caused by the flame torches results in therust and loose mill scales to de laminate.

As an alternative to flame torches, mechanical dry abrasive cleaning may beadopted under supervision by a trained conservator, using the right grits and supply of air pressure. Test areas should be done to check the efficacy of this method before embarking on the entire surface. Start at a pressure of 40 Psiwith a fine copper slag grit and never exceed 60-70 Psi.

Wet abrasive cleaning is preferable to dry where lead based paints are to be removed. It is also useful in washing from the surface soluble iron salts such as chlorides and sulphates that form within the corrosion pits. Cleaning should be done with a nozzle which has independent control over air, water and abrasiveparticulates. This should be done with utmost care to prevent any leakages/ over wetting of surrounding areas.

Chemical Cleaning

Orthophosphoric acid is the basis of many rust remover solutions. Methylene chloride is also one such paint stripper for small areas and their residues removed with white spirit or water, as directed. Solutions which are described as neutral are based on a combination of acid and alkali materials. Though best results are obtained by immersion, application may be tried out in trials. Rust convertors may be applied to sections that indicate symptoms of rusting.

Acid pickling

In case of an entire panel being carefully removed, it may be immersed in abath of a suitable acid (normally warm dilute sulphuric acid or phosphoric acidwith adequate health and safety precautions) which dissolves mill scale andrust. On removal from the bath, the iron must be thoroughly rinsed with cleanwater.

1.5.2. Paint Coatings and Protective primersPrimers

Red lead is traditionally used as a primer and though lead abatement is an increasing issue for health reasons, if applied with suitable precautions of masks, etc., toxicity can be kept to an acceptable level. Iron oxide is also a primer, with a minimum of 2 primer coats.

Zinc rich coateings are considered among the best protective treatments. Zinc phosphate is a more recent and more used inhibiting pigment which is nontoxic. A zinc dust primer may require a sealing coat and subsequent coatings need to be non saponifiable (non solvent in soaps) such as epoxies, chlorinatedrubbers or vinyl paints. A second coat of primer rather than an extra finish coatincreases the life of the paint system.

Binders

These are basic film forming materials. Paint binders may range from drying oil based (containing traditional raw, boiled or heat treated linseed oils dried by oxidation with air). These include alkyd resin paints; polymers such as chlorinated rubber and vinyl in solvent or what is most advisable, two pack epoxy and polyurethane coatings for corrosive environments. The performance of the drying oil can be improved by using micaceous iron oxide (MIO) pigmentation in undercoats and finishes (not in the primer).

Methods of Applying Paint

Brush application is the traditional method of applying paint and results in good adhesion of the dry paint film. Before painting, the metal surface should be free of dust, dirt or debris. Lead based paint should be applied by brush. One pack and two pack chemical resistant binders are however not suited to brush application.

Paints should never be applied to damp surfaces, unless manufacturer's specifications recommend that. For a good protection, a paint system should provide a total film thickness of 125 microns to 250 microns. This normally means at least four coats of air drying paint. 2 coats of primer are recommended. Final protective coatings over painted surfaces may include beeswax or varnish/shellac.

Pigments

Pigments are used to make the paint opaque and to give it a colouration. White lead, a whitish corrosion product of lead, was historically used as a hiding pigment. Since the early 20th century, Titanium oxide was introduced. Zinc oxide was used briefly in after 1850 and may be employed for this Victorian structure.

Tinting pigments include earth pigments (ochres, siennas, umbers from iron oxide, greens from copper compounds and a few systhesized colourants such as Prussian blue or mercuric sulfide (crimson).

HARDWARE

The hardware used shall be consistent for the entire work and from the approved manufacturer. The Contractor may have to provided a range of samples from different sources before the decision for the exact material make is arrived at and no extra shall be claimed or delay for work in this regard.

1. Brass hardware of heavy duty guage of approved grade shall be used

2. Stainless steel to be of grade S.S 304 with gauge not thinner than 16 SWG or as specified in the details.

3. All brazing and welds to be executed in the best possible finish of workmanship, rubbed down and completed in the flattest and tidiest manner, especially where exposed.

4. Chromium plating shall be in accordance with IS Standard for general outdoor conditions and shall be on a parent material of copperor brass.

5. Unless otherwise specified, fittings shall be brass oxidised and approval would have to be obtained from the Architects before being used for the project work.

6. The Contractor should adequately protect the brass and bronze surfaces by application of a thick grease or other suitable protection layer, reapply as required from time to time and clean away completely on completion.

7. Screws are to perfectly match the finish of the article to be fixed andare to be round or flat headed or counter sunk as per details.

GLAZIER

1. All glass should comply with IS 3548 – 1966 or as directed by Archiect asper the approved sample and free from bubbles, smoke, wanes, air holesand any other defects.

2. 'Glazing Glass' (G.G) quality polished plate glass shall be used and mirrors shall be 'Silvering Quality' (S.Q) conforming to IS 3438 - 1965, as per approved sample and quality.

3. The compound for glazing to metal is to be a special non-hardening compound manufactured for the purpose and of the brand and quality as approved by the Architects.

4. Proper allowance to made for expansion while cutting glass. Each square glazier to be on whole sheet. Glass surfaces should be cleanedon completion and all chipped broken panes should be removed immediately from site.

5. The quoted rates for glass work to include cutting, handling, breakage, transport etc., and any claim for extra shall not be entertained.

6. For stained glass items, glass to be as directed by Stained Glass Conservator Consultant

1.6 SPECIAL SPECIFICATIONS & SEQUENCE OF OPERATIONS FOR POLYMER AIDED STRUCTURAL REPAIRS

1. Provide adequate supports to the slab around the columns and beams with props and wooden runners to relieve the load on the structural members before cutting open the loose concrete to expose the steel reinforcement.

2. Clean the reinforcements thoroughly by wire brushes and tapping and remove all rust flakes and powder by dry dusting. Apply a coat of RUSTICIDE with a swab or small brush, and dust off after complete drying and hardening of the coat to render the surface of steel passive.

3. Completely clean the concrete surface after cutting to proper level, with blower, clean the reinforcement of all dust and apply Polymeric protective coat of Acrylic Polymer Latex in proportion 1:1.5 (Polymer : Portland Cement by weight), and allow to dry completely.

4. Additional rings are to be added to columns where corroded and to beams at the two ends by cutting grooves and anchoring from 50mm below the slab soffit upto L/4 of the span on either side. The anchoring is done by drilling holes in the concrete and sealing with Polymer : Cement grout, the bent steel hook at the top of the U shaped stirrup. Additional main steel can be added to the columns or beams within the rings. Also shear connector bars are to be fixed in to the structural member such as columns by drilling holes and fixing the shear connector bar in to the concrete bonded with epoxy or polymer formulation.

5. Apply Polymer modified cementitious mortar by hand and trowel with Acrylic Polymer Latex : Portland Cement : Graded Coarse and fine Quartz Sand in proportion 1:5:15 by weight of each constituent, over bonding coat slurry of 1:1 Acrylic Polymer Latex : Cement by weight, brushed on to the concrete surface and between layers of mortar, to build up the column and beam section to original size, and finished smooth in final layer to line & plumb. Records of weight of all constituents used in different batches should be recorded in site log book with time batch number etc. The mixing of the mortar and bonding coat to be done in plastic trays of adequate size, but each batch should not exceed 21 Kgs. Precautions are to be taken to see that the applicators and batch mixing labour should wear rubber handgloves, goggles & masks. For mixing the mortar about 1 to 1.5 litres water should suffice to make a highly plastic mix, which should form a ball without disintegrating.

6. For building up cover concrete of the beams, a floating shuttering arrangement over adjustable props has to be provided, with the bottom plank covered with plastic sheet, kept 10mm below the original beam soffit level. The structural

Polymer Mortar is pushed inwards over the plank from two sides of the beambottom and packed properly after applying bonding coat to the cut concrete surface till the entire section is built up. After about 10 to 15 minutes the bottom shuttering plank is jacked up by 10mm by operating the adjustable props below the shuttering, which is brought to proper line and level with a string tied for perfect alignment of the bottom. The sides of the beam, which have been cutare brought to original size with, Polymer mortar and finished, as described in para 5. The bottom shuttering can be lowered after 24 hours.

7. The Polymer mortar repaired surface is to be air cured for 24 hours and thencured with water mist spray for 7 days.

8. Specially trained and experienced labour and supervisor are necessary for theabove operations – which will be ineffective if not batched, mixed or appliedproperly with care.

9. The brand of Polymer Latex and chemicals recommended shall be of standard manufacture, purchased preferably directly from manufacturers or their dealers, accompanied with test certificates showing minimum solid content of polymer as 40%.

PROTECTION WORKS

Providing and erecting high density plastic sheet covering fixed to the exterior face of scaffolding including duck tape with safety signage "work in progress" and "caution" boards at ground level and demarcation of entrances to the building

Careful Packing of all sculpture details/ decorative grill work/ delicate tracery and statuary in bubble wrap plastic sheeting with masking tape and duck tape to ensure absolutely no damage to the details during the site works.

Plaster of Paris covering of 30mm thickness over the entire floor area with a bottom layer of high density plastic sheet over Minton Tiles inside the Lobby and verandah areas to ensure that scaffolding/ movement of machine and tools do not damage thehistoric flooring.

Providing and erecting a temporary partitions using 6 mm thick commercial plywood of approved quality and make and with adequate supporting framework to make it largely free standing to provide protection from other works in progress. The partitions shall be such that they can be removed and reused at different locations without damaging

The property. Item to include printed duck tape with safety signage and words "Site Works in Progress" and "Caution" printed to cordon off areas of work. Adequate site signage in bold printed signs should be placed as per Architect's instructions for safety instructions. **Providing and fixing temporarily 4mm thick commercial plywood** protection to glazed panels and stained glass, to be removed from site after completion of all work.

GENERAL SPECIFICATION FOR CIVIL WORKS

1. **Siporex Blocks:** SIPOREX blocks to be used in masonry shall be "SIPOREX BLOCK" manufactured by SIPOREX (I) LTD., PUNE. The blocks shall be thoroughly soaked in water for eight hours before use. Joints in Siporex masonry work shall be raked 1/2" deep as the work proceeds and before the mortar sets. All the masonry work shall be thoroughly watered and wetted at least three times a day for 10 days. The joint in Siporex masonry shall not exceed 3/8" in thickness. Siporex block masonry in 4" or 8" thickness shall be done in cement mortar 1:4 proportion (1 cement: 4 sand).

2. **Cement:** The Cement used shall be ordinary Portland cement conforming to IS: 269. Itshall be any one of the following makes i.e. L & T, Gujarat Ambuja, Rajashri & T, Narmada or ACC preferably supplied in paper bags. Cement shall be used in the order in which it is received (i.e. first lot received should be used first, second lot received should be used second etc.). Cement in bags in storage for more than 3months shall be tested before use.

3. **Cement Testing**: A sample taken once for every 1000 bags shall be tested. Tests shallbe carried out for fineness, initial and final setting time and compressive strength (IS:4031) and the results approved by the Engineer before use of the cement in permanent works. Samples shall be taken immediately on receipt of cement at site. The methods and procedure of sampling shall be in accordance with IS: 3535. The Engineer may specify other forms of sampling and tests including chemical analysis, (IS: 4032) if in his opinion the cement is of doubtful quality, the cost of such additional tests shall be borne by the Contractor, otherwise the cost of testing will be borne by the Owner

4. **Sand:** It shall be river or pit sand conforming to IS: 383, obtained from sources approved by the Engineer. If considered by the Engineer as necessary, the sand shall be washed. This shall be done at least one day before using it in concrete and/or in plaster. Sand shall be clean sand of approved quality free from salt, earth, dust or other impurities. The sand should be stored in such a manner as to avoid contamination. If grading of sand can be improved by mixing two sands, the Engineer may at his discretion specify such mixing, and may permit the use of crushed sand as one of the two sands forming the mixture. The provision of two types of sand and their mixing in the specified proportions shall be at the Contractor's cost.

5. **Sand Testing:** The sand shall be subjected to tests in accordance with IS: 2386 as maybe ordered by the Engineer.

6. At every 1200mm height, all Masonry shall have a 100mm thk cast in situ R.C.C band laid in a 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate, 12.5mm nominal size down-graded), in partition walls including providing, laying and fixing tested quality, mild steel reinforcement 2 Nos. 8mm dia. bars at bottom and 2 Nos. 8 mm dia. at top with 6mm dia, stirrups spaced at 300mm centers including lappings.

7. ***Brick work:***
   - All brickwork shall be carried out as per IS 2212: 1991.

- The building bricks are to be the best quality table moulded kiln burnt, patent bricks, hard sound, square with sharp arises, even and uniform in shape and colour, free from cracks, stones, flaws and other defects
- Samples of bricks are to be submitted to the Architect for approval before full quantity is ordered. All supply of brick shall conform to the sample approved.
- No brick after 24 hours immersion in water shall absorb water more than 15% of its own weight.
- All bricks to be plastered are to afford a good key.
- The cement and sand mortar is to be composed of one part cement to four parts of sand by volume, thoroughly mixed by machine. If mixed by hand 10 % extra cement shall be added to mortar.
- No mortar that has commenced to set shall be used in the work.
- Every brick shall be thoroughly soaked in water before use. Broken bricks shall not be used except as closures. The courses shall be truly horizontal and the work strictly plumb, joint shall be broken vertically and they shall not exceed 1/2" in thickness. All joints in brickwork are to be well filled with mortar.
- The brickwork shall not be raised more than 12 single courses per day and shall be built in English Bond, except brick on edge (brick cladding) and half brick thick walls shall be built in structure Bond. Except for brick on edge work (Brick Cladding), the bricks shall be placed with "frog" facing upwards.
- All joints in brickwork shall be raked out 1/2" deep as the work proceeds, and before the mortar sets.
- At every 1200mm height, all Masonry shall have a 100mm thk cast in situ R.C.C band laid in a 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate, 12.5mm nominal size down-graded), in partition walls including providing, laying and fixing tested quality, mild steel reinforcement 2 Nos. 8mm dia. bars at bottom and 2 Nos. 8 mm dia. at top with 6mm dia, stirrups spaced at 300mm centers including lappings.
- The brickwork is to be carried out with all necessary set backs, projections, cuttings and toothings in conformity with the drawings.
- The brickwork shall be cured by watering at least three times a day for 10 days, and the work shall be well protected during the rainy season.
- All uneven, irregular and bad brick work poor in workmanship shall be demolished if deemed necessary by the Architect and rebuilt by the Contractor at the contractor's expenses.
- If necessary the contractor will have to provide wooden plug, etc., for his own work and for which there will be no special payment on that account.
- The work will have to be executed at any height and lift will not form the criterion for any extra amount.
- The rates for brickwork should include cost of all materials and labour, the cost of providing and fixing necessary single or double scaffolding and removing the same after the work is completed, watering, curing, lifting of materials to any height, raking of points to receive plaster, forming cavities for expansion joints, cutting or leaving holes for legs of windows, doors etc., conduits, pipes, bolts or other articles passing through wall etc., complete.
- Should any efflorescence be observed in brick work, it should be washed down by clean water and brick surface treated with such chemicals as are deemed necessary by the Architect without any extra charge and at the Contractor's own expense, till efflorescence subsides. Should the efflorescence persist, the

brickwork shall be demolished if deemed necessary by the Architect and the work rebuilt with new bricks including making good all the work disturbed without any extra charge.

- Finishes to the brickwork such as plaster and cement pointing will be paid for separately under "PLASTERER".
- 115 mm thk brickwork shall be called as half brickwork. Laying bricks in stretcher bond shall build it. Mortar shall be as specified in the BOQ. These walls may be used for forming cavities or partition walls inside buildings.
- One brick or more thick walls shall be measured in cubic meter that is length multiplied by the thickness. Thickness shall be measured in multiplies of half brick which be deemed to be inclusive of the mortar joints. Half brick thick or brick-on-edge walls shall be measured in square feet.
- Deductions shall be measured the net sizes of the openings and recesses. No deductions shall be made for the openings 0.1 Sq.m and under.
- Lintels will not be deducted from the volume and/or area of brickwork and cost for the same will be included in the cost for brickwork.
- Anchoring, horns of teakwood frames fastened into the masonry will not be deducted.
- Mortar and plaster shall be mixed in G.I. trays or in similar arrangement and not on the existing floor.
- Mortar for block work and brick masonry shall be 1 part of cement to 4 parts of sand by volume, unless otherwise specified. Joints shall be raked out to a depth of 1/2 inch.

ACC Cement Blocks

Autoclaved Aerated Concrete is an eco-friendly and certified green building material which is lightweight, load-bearing, high-insulating, durable building blocks and 3 times lighter when compared to red bricks.

Manufacturing process

ACC is a precast product manufactured by combining pulverized fly ash, gypsum, lime, cement, water and Aluminium powder poured into a mould. Once added to the concrete aluminium powder reacts with lime and fly ash resulting in the formation of millions of microscopic hydrogen bubbles. The hydrogen bubbles cause the concrete to expand to roughly double the times of its original volume the hydrogen subsequently evaporates leaving a high closed shale aerated concrete. Then aerated concrete is cut into blocks which are then steam and pressure cured in an autoclave for 8to 12 hours.

Laying Process

Laying of ACC blocks masonry shall be as per IS 6041 of 185 and IS 105 of 187. ACC Blocks laying process is almost similar to brick masonry only a few differences are there. Opening and odd angles should be cut with handsaw. Bond beams should be placed at the top of the wall and we can use them for heavy-duty fixed attachment. The vertical joints shall not be in a straight line. Overlapping of blocks in the structured course should be minimum of 250mm over the bottom course.

Thickness of joints

The thickness of the joints should be kept at 10 mm I case of cement sand traditional motor if we are using dry mix mortar on ACC blocks then only 3 mm to 5 mm tick mortar is required. A dry mix mortar that contains cement, graded sand and polymers.

Precautions to be taken while laying of ACC masonry

- Do not use the blocks below plinth level like in the foundation, drainage pit, water tank and where excessive dampness is likely. It is the reason we don't use ACC blocks in toilet and bathroom similar to brick masonry it is not recommended to have an ACC Block wall without stiffeners.
- It is necessary to provide stiffeners after everything three-metre length.
- It is recommended to provide bond beam after every fourth course with starter reinforcement, so the wall load is uniformly distributed to avoid nu shear crack and horizontal crack.
- Mortar mix should be 1:4 and cracks in the wall should not take place due to the mix.
- Preferably used Portland pozzolana cement for better results.
- Do not store the locks on the unlabelled surface.

Precautions to be taken while handling ACC blocks

Brittle Nature – ACC blocks are brittle material due to which it may break easily. Also, they havevoids due to which they may break while dropping from a low height.

Due to dry shrinkage – After manufacturing, ACC blocks require 28 days curing and also need to dry for 10 to 15 days to obliterate its expansion and contraction. If manufacturers do not follow this process and deliver material early on-site, then there are more chances of racks dueto expansion and contraction.

Due to the use of cement mortar – We can use cement mortar as well as an adhesive for the installation of ACC blocks. But we should always use adhesive to avoid the development ofcracks. As per IS code 2185 part-3 AAC blocks density is 551-650 kg/m3 and compressive strength in 4 N/ mm2 for grade one that means it is non-load bearing material. Hence always provide RCC bend runner or stiffeners of 100 to 150 mm thick with reinforcement.

PLASTERING AND POINTING

GENERAL:

A.1 All plaster work shall comply to IS-1661 (Application of cement and cement lime plaster finishes). The cement shall be ordinary Portland cement conforming to IS:269. The lime shall conform to IS-712 (Building limes). The sand shall conform to IS-1542 (sand for plaster). The sand shall not contain any particle larger than 3mm and shall be washed before use. Internal Gypsum Stucco plaster to comply to IS 2547 (Part I)-1976.

PREPARATION OF SURFACES:

A.2 Plastered surfaces shall be roughened by wire brushing, hacking, or bush hammering or chiseling. If the Architect is not satisfied with the roughening achieved by these methods, he may order other methods such as washing with acid etc.

A.3 Loose layers of dust etc. on surfaces to be plastered shall be washed. The surface shall be cleaned to remove oil, paint or any other material that might interfere with satisfactory bond and saturated with water so as to be damp when the plaster is applied.

APPLICATION:

A.10 Patches of plaster 150mm x 150mm shall be placed about 3m apart as gauge to ensure even plastering. The mortar shall be firmly applied in a thickness slightly more than the required thickness and well pressed into the joints, rubbed and levelled with a flat wooden rule to required thickness.

A.11 All plastering shall be made good upto metal or wooden frames, skirting's and around pipes or fittings.

A.12 For internal plastering, scaffolding shall be erected independent of walls. No members of scaffolding shall be allowed to be housed in the walls being treated with plaster. Scaffolding for external plaster shall also be supported independent of walls as far as possible to avoid patchy appearance. All rates quoted shall be inclusive of scaffolding for all items.

WETTING & CURING:

A.13 Surfaces to be plastered shall be profusely watered well in advance before plastering so as to keep the surface damp. Plastered surfaces shall be kept thoroughly wet by sprinkling water for at least 7days as directed by the Engineer. Surface with craziness or cracks shall be rejected and the contractor shall dismantle such plaster forthwith and apply plaster all over again.

Plaster

- The Portland cement used for plastering shall be Grade 43.
- The sand to be used shall conform to IS 1542: 1992.
- The sand to be sieved so that it shall not contain particles greater than one eight of an inch and shall be most carefully washed.

- The sand for external plastering is to be clean and the whitest available. Sand from beds of rivers carrying saline water is not to be used.
- The surface to receive plaster shall be cleaned of all dust, dirt, and mortar sticking on surfaces etc., and the masonry (concrete, brick or stone) shall be thoroughly watered, for 10 hours immediately prior to applying backing coat.
- The external plaster shall be of two coats of an overall thickness of 20mm, backing coat to be one-part cement and six parts of sand by volume and finished fair and even applied after adequate interval and finished as specified in the Schedule of Quantities. Backing coat shall be combed on wet surface to form keys for finishing coat. External plaster shall be waterproofed with approved waterproofing powder added to cement in proportion of 1.5 kg, to 50 kg of cement as per the manufacturers' specification for both the coats.
- The internal plaster shall be of one coat of an overall thickness of $^{3}/_{4}$" of one-part cement and four parts of sand by volume, finished smooth without neroo finish to receive coat of P.O.P. To form a base or key for P.O.P., the plastered surface shall be finished even.
- For rough cast plaster, the backing coat when hard but still wet, shall be floated 3mm thick with cement mortar (1:4) proportion with fine sand, spread in small areas at a time not exceeding 2Sqm and whilst it is still wet, the rough cast containing a mixture of 1 part of cement, 2 parts of fine sand and 1 part of pea-gravel 3mm to 6mm size shall be dashed on the floated coat to a uniform thickness of 18mm and finished in level, and even surface.
- The internal plaster for ceilings shall be of one coat of an overall thickness of 12mm of one-part cement and four parts of sand by volume, finished smooth with thin layer of neeroo finish. To form a base or key for neeroo, the plastered surface shall be combed with wire brushes.
- Where smooth finished internal cement plaster is specified in schedule of quantities to receive wall paper decoration, layer of neeroo finish will not be applied, but the plaster surface will be finished smooth with floating coat of neat cement and even by wooden floats and steel toweling.
- Where rendering is specified in internal plaster in "Schedule of Quantities", it will consist of only a backing coat $^{3}/_{4}$" thick in (1:4) cement mortar applied uniformly and evenly by wooden floats but not finished smooth.
- All angles, arises in external and internal plaster must be finished straight, true and sharp.
- Plastering of entire or unobstructed area shall be done at one stretch and on occasion when arising due to the extent of the area being too large or for some other reason, the work is to be left over for completion on the next working, down with carborandum stone or the work carried out in such a manner as to have no marks left in the finished work.
- All plaster shall be kept wet for seven days after being applied.
- No paint, distemper, colour wash or white wash shall be applied to plastered surfaces for at least two months or until the contractor has satisfied the Architect that the walls and plaster are thoroughly dry. Brickwork above false ceiling heights will be flush pointed in cement mortar (1:4) and will be plastered. The soffits of slabs, beams above false ceilings will be plastered.
- The rates quoted should include for all materials and labour and for execution of work at any level. Lift of materials will not form a criterion for any extra amount. It also includes providing and fixing scaffolding and removing the same after completion of work, raking out joints, hacking and hatching the concrete surface and providing the key for

holding down the plaster, watering, curing etc., complete. Nothing extra will be paid for work in arises, rounded angles, fair edges, narrow returns, quirks, V-joints, splays, drip mouldings, making good around pies, conduits, timbers, cills, brackets, railings etc., and making good after all the specialists have done their work. Measurement will be of the actual area of work done. No deduction in quantity will be made if the superficial area of any individual opening is less than 2.0 square feet.

- Plaster and pointing will be measured in Square meter of actual work done.
- Plaster samples approx. 3'x 3' in size be prepared prior to execution of work for the Architects approval. Nothing extra shall be paid for the same.
- For for chemical characteristics & physical characteristics

Gypsum Stucco Plaster

Background Preparation: - Surfaces should be reasonably dry, clean and protected from the weather, and suitable for the chosen specification. In addition, before plastering concretebackgrounds, ensure that any mould oil or other agents present are removed from the surface. No-fines concrete does not require wetting prior to plastering. Plaster should not be applied onto a 'green' background or when any free water is visible. Clean water should be applied 5-10 minutes before plaster application to control the suction. In-situ or pre-cast concretewhich are exceptionally smooth or having low suction will require pre-treatment with Gyproc Bond-It bonding agent.

Mixing: - Gypsum Stucco plaster is mixed with only clean water for preparation. Mixing shouldbe carried out in a clean tray or bucket. Excessive mechanical mixing should be avoided. Tools and water used in mixing must be clean. Contamination from previous mixes can shorten the setting time and in turn reduce the strength of the plaster when set. Water to plaster ratio (1 part of water: 1.25 part of plaster by weight) should be maintained to have good cohesive workable mix. Prepare plaster mix as much as required depending upon the immediate scope of work. Once the mix has begun to set, water addition is not recommended, as performance properties of plaster will get altered, thus affecting workability, cohesiveness, adhesion properties and strength.

Application: - Gypsum Stucco plaster should be applied with firm pressure, built out to therequired thickness, and ruled to an even surface and left as an undercoat to form a key for finish coat. A thin plaster mix is made and applied as a finish coat to provide smooth surface. It can be applied to an average thickness range of 3-15 mm on walls in one coat and up to 10 mm on ceilings. For punning S/C plaster surface should be wetted before application toprovide firm bonding. After complete drying for usually 72 hours (depends upon thickness andweather conditions) the plain smooth levelled surface is ready for painting.

Gypsum Plaster to surface of concrete or brickwork is to be two-coat as follows:

a. Undercoat composed of one part "browing" or slow setting browning plaster as described above with two parts of sand, the whole laid on evenly, straightened with a rule and scratched to form a key. b. Finishing coat to be as described above, applied neat or with an as mixture of not more that 25% volume by lime putty, troweleld with a steel trowel to smooth even surfaces.

The total thickness of two-coat work must not exceed ½".

Gypsum plasterboard shall be of approved manufacturer and in accordance with B.S. 1230. Consisting of a core of set gypsum plaster in accordance with B.S. 1191 sandwiched between two sheets of heavy paper to a nominal thickness of 3/8" dia. Plasterboard is to be nailed to timber or G.I channels with 1.25" x 12 S.S.G. galvanized screws with s'8" dia. Heads, spaces about 6" apart and not less than ¾" from the edges and ends. Nailing is to commence at the center of the board. Boards are to be spaced 1/8" to ¼" apart at the joints and end joints are to be staggered to break bond. The boards are to be fixed and cleaned at least 24 hours before the application of plaster and in no circumstances should it be wetted before plastering.

Gypsum plaster board is to be prepared for plastering by filling the joints with 'board finish' gypsum plaster as described above and pressing into the plaster, dry reinforcing jute scrim cloth 3.5" wide trowelled as flat as possible. When the plaster to the scrim joints has set, thin coat of neat gypsum plaster is to be applied over the whole surface to level up followed immediately by a finish coat to a total thickness of 3'16". The finish coat when almost set is to be trowelled to a smooth surface using as little water as possible applied with a brush. The admixture of lime with gypsum plaster will not be permitted.

Waterproofing for Toilets

Providing cement based waterproof treatment to toilet blocks by Internal Tanking Method.

- ***Floor***

i) Chasing, grooving and grouting the junction of floor with the drop wall in polymer cement grout.
ii) Giving polymer cement slurry injections by gravitation method until full saturation as required.
iii) Laying total 50 mm thick waterproof screed in cement concrete (1:2:4) with 2% Proofsol in two layers of 25 mm thickness of each smooth finished including coving at the junction.

- ***Walls***

i) Racking out the joints of masonry and grouting the same.
ii) Applying chemical wash mixed with cement
iii) Providing 10 mm thick cement mortar (1:4) waterproof rendering with 2% Proofsol for the full height of bath walls in toilet block and 1200 mm height for rest of the walls.

- ***Brickbat coba filling in sunk portion***

i) Laying 10 mm thick cement mortar (1:4) with 2% Proofsol as padding coat.
ii) Providing half cut bricks and brick bats of required size over the green mortar pad and grouting the joints in cement mortar (1:4) with 2% Proofsol.
iii) Providing 6 mm thick cement mortar (1:4) with 2% Proofsol screed topping, rough finished to receive flooring.

The work will have to be executed at any height and lift will not form the criterion for any extra amount.

Chases in plaster / brickwork

In electrical chase, the channels of around 50 to 100 mm width and 50 to 75mm depth to be carved in the masonry or concrete elements to place the electrical conduit and other services of house and conceal them in the walls for better aesthetics. An angle grinder with two parallel cutting blades with a depth setting to be used. The depth gauge simply sets and runs the grinder up, down or across the wall making two parallel cuts. The waste between the cuts is knocked out with the use of a cold chisel. There should be a minimum of 10mm width between two chases. The Depth of full thickness of plaster should be minimum 6mm over conduits.

Guideline for cutting Electrical chases in brick wall:

1. Cutting of electrical chases in one brick thick and thicker load bearing walls
    - As far as possible, the services should be planned with the vertical chases. Horizontal electrical chases should be avoided, as they reduce the strength of the wall.
    - The depth of vertical chases and horizontal chases should not exceed one-third and one-sixth of the thickness of the masonry respectively.
    - If horizontal chases are unavoidable, then it should be located in the upper or lower one-third of storey and not more than three chases should be permitted in any stretch of a wall.
    - No continuous horizontal chase should exceed 1 meter in length.
    - Vertical chases should not be closer to 2 meters in any stretch of a wall.
    - Electrical chase should be kept away from bearings of beams and lintels.
    - If unavoidable, stresses in the affected area should be checked and kept within the permissible limits.
    - Vertical chases for fixing electric conduits, I pipes or a recess for fixing electrical metal boxes should not be cut within 1.5 feet from the edge of the wall.

Filing electrical chase

Once the cable is installed, use a paint brush to wet the sides and back of the chase by using clean water, and then apply a coat of neat PVA adhesive to the sides/back of the chase and conduit/ pipe. This will aid the adhesion of the filler.

As a filler, the materials to be used are:

- A strong sand/ cement mix (3:1:1 – 3 part of soft sand: 1 part of sharp sand: 1 part of cement).
- One coat of plaster or patching plaster.
- A standard decorator's filler.
- If applied to a deep chase, both the plaster and filler may sag and hence they need to be built up in layers.

The chases must be filled from the back and around the conduit/ pipe from the front. A small trowel will help push the filler into the back corners and behind the conduit/ pipe. Use the trowel across the sides of the wall surface to cut off the filler to the line of the wall. If channeling is used, there is no need to try to fill the chase behind it.

Electrical chases can also be filled with a plaster called patching plaster or one coat plaster. This can generally be applied in coats up to 50 mm thick. If there is a deep chase, build the fill

up in layers. If using one coat plaster, make sure that you wet the chase really well before applying it. The plaster will dry out quickly and crack badly if its moisture content is not maintained. Recon fibers with mortar can also be used for filling the chases.

FLOORING WORKS

- Hydrophobic cement as per IS 8043 used in mortar shall be thoroughly machine mixed.

- Contractor shall submit samples of all kinds of tiles, stones marble etc., for approval before ordering the same.

- Where required the flooring shall be machine polished.

- Surface to receive flooring tiles etc., shall be cleaned thoroughly from all dust, dirt, mortar deposits, laitance, water etc., and washed clean with water.

- Cement mortar bedding in proportions specified in the Schedule of Quantities shall be laid in such levels and thickness as required in the area of work. The thickness mentioned in the schedule of quantities is only indicative and may vary in some particular areas. No extra will be paid on account of any variations in thickness of the bedding mortar. The bedding mortar shall be compacted with wooden floats and floated with neat cement slurry for fixing the tiles.

- The joints in tiles shall be neatly pointed with coloured cement to match with the tile.

- Indian patent stone flooring shall be 1 - 1/2" or of thickness specified and laid in two layers, bottom layer 1 - 1/4" thick or as specified in 1 part of Portland cement, 2 parts of sand and 4 parts of crushed stone aggregate 1/2" down well graded machine mixed with not more than 5 - 1/2 gallons of water for each bag of cement and top layer 1/4" thick in 1 part of Portland cement, 2 - 1/2 parts of selected crushed stone chips 1/8" down with just enough sand maximum 1 part to make workable mix, machine mixed with not more than 5 gallons of water. Top layer to be laid before the bottom layer has hardened. Flooring shall be laid in squares or bays as directed and each layers shall be well compacted by ramming with heavy teakwood floats. The top shall be brought to a smooth and even surface free from blemishes and finished smooth by steel toweling. After the concrete surface has hardened sufficiently to prevent dislodgement of aggregates, the patent stone shall be polished with No. 1,2 & 3 polishing stones. The flooring shall be kept wet for 7 days for curing. Where Ironite topping is specified in the "Schedule of Quantities" the bottom layer shall be 1" thick (instead of 11/4") as described above and the top layer shall be mixed with "ironite" as per manufacturers specification and finished fair.

- The rate quoted should include for all materials and labour and for execution of work at any level. Lift of materials will not form a criterion for any extra amount. It also includes providing and fixing scaffolding and removing the same after the completion of work, machine polishing, double polishing and hand polishing, curing and cleaning the entire work on completion.

- Flooring paving and wall tiling will be measured in square meter of actual work done.

- Flooring Joints: Floor tiles/stone slabs in flooring shall be close jointed to obtain fine line. All joints shall be true to straight lines and unbroken. All cross-joints to beat line right angles. The joints are filled by rubbing over the floor with a brush, a slurry of neat Portland gray/white cement with pigment to match the stone/tiles/marble/granite, and polymer binding as required before the cement has set the surplus cement/pigment is cleaned off the face of tiles with dry deal sawdust. All joint lines shall be of regular straight pattern with joints crossing each other at true right angles. The tiles/stone shall be generally leveled with a wooden staff and the joint lines regulated and straightened before the bedding cement begins to set.

- Precautions: Flooring in lavatories and bathrooms shall be laid after fixing of water closet and squatting pans and floor traps. Traps shall be plugged, while laying the floors and opened after the floors are cured and cleaned. Any damage done to WC's squatting pans and floor traps during the execution of work shall be made good.

Indian / Italian Marble

Marble/Stone shall adhere to IS 1130: 1969 code and shall be the best Indian/ Italian Marble or stone as approved by the Architect. The quality shall be uniform and it shall be hard and free from any discolourations, cracks, flaws, veins of foreign materials or any other defects. When marble/stone of different colour and kinds associated care shall be taken to see that they are of equal hardens so as to wear evenly. The marble/stone slabs shall be machine cut true to the shape and size and machine polished. Care shall be taken to cut the slabs so as to provide a pattern as indicated. Marble/ stone slabs for wall lining and dadoes shall be machine polished before they are fixed in position and shall have machine cut and polished edges. The wall shall be lined with the marble/stone in courses as indicated and grain of the marble/stone shall be arranged in pattern as per detailed drawings. The marble /stone shall be bedded in cement mortar backing covering the full area of the marble/stone. The wall surface shall be cleaned from all dirt, mortar droppings etc., before applying the base plaster. The marble /stone shall be fixed to the walls by Bronze cramps 5" X 1-1/2" X 1/4" and bronze pins 1/4" diameter X 2: embedded firmly into wall by cutting hole and grouting. The load of one marble /stone slab shall not be borne by the slab below. Joints between slabs shall be hair fine and filled with coloured cement to match the marble/stone.

Curing, Polishing & Finishing: -

The curing of slab by wetting the surface shall be continued for a minimum period of seven days. Thereafter the surface shall be ground evenly with a machine fitted with fine grade grit block (No. 120). After grinding the surface should be prepared by thoroughly washing and cleaning for final grinding. Final grinding is done the day after the first grinding with machine fitted with the finest grade grit blocks (No.320).

Hand polishing may be allowed instead of machine polishing for small areas after laying. Incase of hand polishing carborundum stones of medium grade (No. 80) and fine grade (No.120) shall be used for first and final polishing respectively.

The polished surface is then rubbed hard with oxalic acid sprinkled with water and spread at the rate of 33 gm. per square metre using pad of woolen rags, also known as namdah block.

The marble/ stone shall be sealed if specified in the schedule of quantities. The sealant shall be of aquamix or equivalent make (approved by the Architect) and shall be applied as per Manufacturer's instruction and specifications.

Kota Stone

Kota stone slabs to be obtained from approved quarries and to be free from all defects, variations, grains or patterns and shall be hard and uniform. Quality checks, polishing, fixing, cleaning specifications etc will be the same as for marble as described in points above. The slab should be of desired quality, hard, dense, homogeneous and free from any cracks, decay, weathering, etc. It could be either hand or machine cut for the required thickness. The exposed face of slab should be polished before being placed at site and also the contractor shall get the slab sample approved by the concerned Architect / PMC

Dressing of slab: -

Each slab shall be tailored to the required size and shape and chisel dressed along the sides to obtain a straight edge. The edges shall be either table rubbed or machine rubbed with coarse sand before paving.

Utmost care should be taken to ensure all angles and edges are true, square and free from chippings. Tolerance of ±2mm is acceptable for thickness. With respect to length and breadth of the slab, a tolerance of ±5mm and ±2mm for hand cut and machine cut respectively is acceptable.

Preparation of surface: -

The surface (usually concrete) upon which the slabs are to be laid should be cleaned, wetted and mopped. The bedding mortar of slab shall be of specified thickness.

Laying of Kota stone: -

Mortar of specified mix (usually 1:4 Cement: Coarse Sand) to be prepared and spread under the area of each slab for the indicated thickness (usually 20mm).

The cleaned slab to be laid on top, pressed and tapped with a wooden mallet in order to bring in same level of the adjoining slab. The slab is then lifted and placed aside. The top surface of the mortar is made uniform by filling up the hollows with fresh mortar and is allowed to harden.

The mortar is then topped with cement slurry of honey like consistency at the rate of 4.4 kg of cement per square meter. The slab to be laid is lowered gently back in its position. Subsequent slabs are laid in similar manner and the excess grout coming out of the joints of the slab is cleaned off.

Vitrified Tiles Flooring / Dado / Skirting

Providing and fixing heavy duty interior grade square or rectangular vitrified tiles not exceeding beyond 1200 mm in size in the terrace area as per site conditions as indicated by the Architect of approved make and shade at specified height, fixed with cement slurry and mortar bed

with joints finished in pigmented Bal or Roffe grouts as per manufacturer's instructions complete.

Coloured, Textured Vitrified tiles shall be 'Kalinga stone' make (or any other equivalent make approved by the Architect) in sizes and specified in the drawings The Architect will select the pattern and colour before ordering these items. Chipped, cracked or worn out tiles shall not be used in the work. The tiles shall be minimum 3 – 8 mm thick as per manufacturer's specifications and the best quality.

Procedure for fixing / laying of full body tiles:

The existing floor to be got rid of oil, grease, mud and other materials if any incompatible with the bedding using wired brushes, emulsion cleaners or mechanical scrubbers and washing the same with clean water. Further chipping of the floor should be done with breaker for embedment of sandcement mortar. Rich cement mortar 1:4 (1 cement 4 coarse sand) bedding of 10mm or 16mm thickness to be laid to withstand the load and impact of present working conditions of the shop floor. This process is not required incase any kind of clean concrete floors.

Mortar shall be spread, tamped and corrected to proper levels and allowed to harden sufficiently to offer a fairly rigid cushion for the tiles to be set.

Bharat Tiles

Bharat Tile Flooring to be procured as per manufacturers specifications as approved by Architect and laid in a combination of one or more colours as per the design indicated by the architect and matching to the original flooring pattern in cement mortar 1.5 to 3.5cm sand : cement bed mortar of 36 grade cement of ratio not leaner than 7:1 with a neat cement slurry on op, of approved thickness. Joints should be as fine as possible and filled with matching cement mortar as directed by architects. Joints to be filled by with a grouting mixture provided by manufactures. Polishing recommended by manufacturers is with an Italian polishing machine using No. 1 polishing stones. Grouting is to be left for 2 days and cured with water before the tiles are to be subjected to the second coat of polishing using No. 2 stone following No. 3,4,5 and final polishing with 5X stones (very fine stones).

Providing & Laying of Bharat Tiles of terrazzo type 200 x 200 mm size to match historic finish in building of plain colour (either Buttercup or Jaisalmer or Macao or Silver grey or Dark Brown) laid in a combination of one or more colours as per the design indicated by the architect and matching to the original flooring pattern, in cement mortar 1.5 to 3.5cm sand: cement bed mortar of 36 grade cement of ratio not leaner than 7:1 with a neat cement slurry on op, of approved thickness. Joints should be as fine as possible and filled with matching cement mortar as directed by architects. Joints to be filled by with a grouting mixture provided by manufactures. Rate to be inclusive of tile, storage, handling, delivery on site, laying as well as cutting as required wastage and subsequent curing, polishing as specified by Bharat tile inclusive of all taxes etc. complete. Polishing recommended by manufacturers is with an Italian polishing machine using No. 1 polishing stones.

Granite Stone:

All granite shall be of standard architectural grade, free of cracks, seams, starts, or other traits which may impair its structural integrity or function. Inherent color variations characteristic of the quarry from which it is obtained will be acceptable. Texture and finish shall be within the range of samples approved by the Specifying Authority.

The type, quality and thickness of Granite slabs for cladding shall be of the best quality as described and approved by the Architect and shall be hard, dense, uniform, homogenous in texture, have even crystallizing grains and be free from cracks and other defects. The Contractor shall provide the Architect the samples for approval and only approved slabs shall be bought on the site. The slabs shall be machine polished. Flamed or honed as mentioned in the drawings at the factory prior to being bought to the site. All edges shall be machine cut to have the slabs to required correct sizes and the edges shall be ground smooth and even to full depth. A straight edge laid along the side of the slab shall be in full contact with it. All angles and edges of the slabs shall be true and square and free from chipping.

Flaming on polished granite to achieve the required undulated flame finish shall be done using the thermal torch. Before laying sub-surfaces shall be thoroughly cleaned and washed of all loose materials, dirt, laitance and the like and then well wetted. Cladding shall be laid in cement slurry over a cement mortar bed approximately 18mm thick (one part of the cement and six parts sand) evenly spread over sub-surface.

Cladding shall be gently tapped with a wooden mallet until properly bedded and level with adjoining slabs. Joints not exceeding 1mm wide shall be perfectly straight and uniform in thickness. Slabs shall be laid perfectly level unless otherwise specified or directed by the Architect. After laying joints shall be finished with cement.

False Flooring

The system should be of nominal 600mm x 600mm (35mm thick) modular panels with heavy-duty pedestals. The total system weight shall not exceed 40 kg/sq. m. The system shall be

able to withstand a UDL of 2000 kg/m2

PANEL: - Panels shall be made of steel with an infill of lightweight, non-combustible having fire resistance, thermal insulation, and flame resistance properties at 60 min cementitious material. The bottom of the panel shall be embossed in hemispherical shape to give strength and flexural rigidity. The infill material shall not become loose when the panels are cut. Panel shouldbe able to withstand an ultimate load of at least 2.5 (3.00) times the designed point load.

The entire panel shall be coated with epoxy powder coating of 75-100 microns on the exposed surface. The panel top & bottom sheet shall be 0.9/0.7mm (0.7/0.6mm) resp. Flatness should be 0.2mm.

The panels shall have a top covering of anti-static high pressure laminate with resistance of 2x105 –

5x108 ohms. The HPL thickness shall not be less than 1.5mm.(1.6mm).

PEDESTAL: - Pedestal base shall be square of 100mm x 100mm x 2mm bearing area andassemble to

a tube of 22mm dia with 2mm wall thickness. The pedestal head should not be less than 3mm thick.

The pedestals should be able to accept an axial load of 22,500N and an ultimate load not less than 45,000N. Pedestal head shall be galvanized die-cut steel welded to a counter locking leveling nut.

The pedestal head shall be provided with PVC cap for acoustic dampening. Height of pedestal shall be approximate 300 mm for floor /150mm for steps.

(**STRINGER:** - Stringer shall be 20mm x 30mm x 1.5mm thick (25mm x 25mm x 1mm) galvanized steel hollow pipe capable of supporting a 205kg point load at the center of the stringer. Stringers shall be individual and rigidly fastened to the pedestals with 6.35mm (1/4") fasteners.

Note: The False Floor System shall be tested as per CISCA standards for Point Load, Uniform Load,

Ultimate Load and Pedestal Axial Load. Test reports from an accredited laboratory to be furnished along with the quotation.

Engineered wooden Flooring

Engineered wood floors are real wood floors that are manufactured using multiple layers of wood veneers. The grain of each layer runs in perpendicular directions, which creates exceptional dimensional stability. This means the wood will expand and contract less than solid wood flooring during fluctuations in humidity and temperature.

The first thing that you need is to ensure that the subfloor or surface that the Engineered wood floor is being installed over is level. Using a 1 metre straightedge, the subfloor level should not exceed +/- 3mm over 1 lineal metre in any direction. Remember, uneven floors may lead to movement and noise, so it is necessary to assess the levelness and get it right.

FALSE CEILING WORKS

The false ceiling comprises of Gyp-Board, Armstrong or equivalent USG & POP. The POP & Gyp board false ceiling is to be in different shapes such as Vaults, Coffers, cove's and Plain in unison with Armstrong Ceiling. The technical assistance and guidance is to be taken from manufacturers and work has to be done according to the manufacturer specifications and manuals. A sample of each finish shall be got approved before proceeding for bulk production. GI framing shall be erected as per recommendation of the manufacturer specification and approval of the Architect. False ceiling work shall be carried out in accordance with the actual site conditions at different / split-levels. Any sagging, unlevelled stretch of work shall be redone / replaced and made good, at no extra charge, to the satisfaction of Architect. No compensation shall be paid on account of provision / coverage of openings for lighting fixtures, air – conditioning ducts and the likes as detailed in drawings and / or directed. Measurements shall be taken on plan area of the completed work or as specified. Deductions for openings, wherever applicable, shall be implied upon as per LS. Specification.

Gypsum False Ceiling

Providing and fixing single layer flat Gypsum board false ceiling fire rated using G.I. perimeter channels of size 0.55mm thk (having one flange of 20mm and another flange of 30mmand a web of 27mm) along with perimeter of ceiling, screw fixed to brick wall/ partition with the help of nylon sleeves and screws, at 610mm centres. Then suspending G.I intermediate channels of size 45mm (0.9mm thk with two flanges of 15mm each) from the soffit at 1220mm centres with ceiling angle of width 25mmx 10mmx0.55mm thick fixed to soffit with G.I. cleat and steel expansion fastners ceiling section of 0.55mm thickness have knurled web of 51.5mm and two flanges of 26mm each with lips of 10.5mm are then fixed to the intermediate channel with the help of connecting clip and in direction perpendicular to the intermediated channel at 457mm centres. 12.5mm tapered edge Gypboard (conforming to IS : 2095-1982) is then screw fixed to ceiling section with 25mm drywall screws at 230mm centres. Screw fixing is done mechanically either with screw driver or drilling machine with suitable attachment.

Quality of Work. All materials, article and workmanship shall be best kind for the class of work described in the Bill of Quantities and Rates. All materials to be used in various items of works shall be subjected to the approval of the Architect. The Architect shall have the power and rights to make the contractor purchase and use materials of particular source as may in his opinion, be obvious for proper and necessary compliance with specifications and description of items of work. The contractor shall provide all materials and fittings to perform any work which are obviously necessary to complete the work, which are generally provided in accordance with good accepted trade practice even though such items articles may not be explicitly mentioned in the specification and Bill of Quantities and rates or shown in the drawings. The contractor shall, without any additional charge, renew or replace any work which in the opinion of Architect are defective, improper handling during transportation / carriage or interior materials provided. Only approved bolts, screws and other metal fixing devices shall be used to secure frames, panels and other units in position. Holes shall be formed with electrical drills wherever required. Structural members shall not be cut or drilled without prior consent of Architect.

Gypsum Works

1. METAL STUD PARTITION

Providing and fixing vertical partition above false ceiling level with necessary cut out as specified in architects/consultants drgs including one layer of 3mm thk commercial plywood and one layer of tapered edge 12.5mm thk Gypboard (conforming to IS-2095 - 1982) screw fixed with drywall screw of 25mm at 300mm centres to both sides of 48/70mm studs (0.55mm thick having equal flages of 32mm made of G.I. Steel) with joints staggered to avoid through joints. The partition will be acoustically treated by overlapping the GI framework with fibreglass sheets, TWIGA INSUL' - IT - 1000 of 50mm thickness. Finally, square and tapered boards are to be jointed and finished so as to have a flush look which includes filling and finishing with jointing compound, paper tape and two coats of Gypboard Top coat suitable for Gypboard (as per recommended practices of India Gypsum or equivalent).

2. M/F SUSPENDED CEILING REGULAR (SINGLE LAYER)

M/F Suspended Ceiling which includes G.I. perimeter channels of size 0.55mm thick (having one flange of 20mm and another flange of 30mm and a web of 27mm) along with

perimeter of ceiling, screw fixed to brick wall / partition with the help of nylon sleeves and screws, at 610mm centres. Then suspending G.I intermediate channels of size 45mm (0.9mm thick with two flanges of 15mm each) from the soffit with G.I. cleat and steel expansion fasteners Ceiling section of 0.55mm thickness having knurled web of 51.5mm and two flanges of 26mm each with lips of 10.5mm are then fixed to the intermediate channel with the help of connecting clip and in direction perpendicular to the intermediated channel at 457mm centres. 12.5mm tapered edge Gypboard (conforming to IS: 2095-1982) is then screw fixed to ceiling section with 25mm drywall screws at 230mm centres. Screw fixing is done mechanically either with screwdriver or drilling machine with suitable attachment. Finally the boards are to be jointed & finished so as to have a flush look which includes filling & finishing the tapered & square edges of the boards with jointing compound, joint paper tape and two coats of Drywall Top Coat suitable for Gypboard (as per recommended practices of India gypsum or equivalent).

3. M/F SUSPENDED CEILING (3 HR. FIRE RESISTANCE)

Providing & fixing 3 hr. fire resistant suspended ceiling which includes G.I. perimeter Channels of size 0.55mm thick having one flange of 20mm and another flange of 30mm and a web of 27mm along with perimeter of ceiling, screw fixed to brick wall / partition with the help of nylon sleeves and screws, at 610mm centres. Then suspending G.I. intermediate channels of size 45mm (0.9mm thick with two flanges of 15mm each) from the soffit at 900mm centres with M.S. Flat of width 25mm x 3mm thick fixed of soffit with G.I. cleat and steel expansion fasteners.

Ceiling section of 0.55mm thickness having knurled web of51.5mm and two flanges of 26mm each with lips of 10.5mm) are then fixed to theintermediate channel with the help of connecting clips and in direction perpendicular tothe intermediate channel at 457mm centres. 15.0mm tapered edge fire line board(conforming to IS: 2095 - 1982) is then screw fixed to ceiling section with 25mm drywall screws at 230mm centres. Screw fixing is done mechanically either with screwdriver or drilling machine with suitable attachment. After fixing first layer of Fire line board, second layer of 15.0mm tapered edge Fire line board is screw fixed with 45mm drywall screws at 230mm centre as above, but the joints are staggered to avoid leakage through joints. Then tapered& square Edges of the boards are filled & finished with jointing compound, joint paper tape suitable for Gypboards (as recommended by Indian Gypsum or equivalent make). Finally a layer of 12mm thickness of Base coat plaster (fire resistance) is applied with Expanded Metal 18 gauge in centre for reinforcement followed by 2 coats of Drywall top coat (fire resistance) at the face of plaster to give smooth seamless finish.

4. METAL STUD PARTITION (DOUBLE LAYER)

Providing & fixing 132mm thk. Metal Stud partition with 2 hrs. Fire resistance which includes two layer of tapered edge 15.0mm thick Fire line board screw fixed with drywall screw of 25mm for first layer & 45mm for second layer at 300mm centres to either side of 70mm studs (0.55mm thick having one flange of 34mm & another flange of 36mm made of G.I. steel) placed at 610mm centre to centre in 72 floor & ceiling channel) 0.55mm thick having equal flanges of 32mm made of G.I steel) with joint staggered on each layer to avoid leakage through joints. Finally, the square and tapered edges of the boards are to be jointed &

finished so as to have a flush look, which includes filling & finishing with jointing compound. Joint paper tape and two coats of Drywall Top Coat suitable for Gypboard (as per recommended practices of India Gypsum or equivalent)

GYPSUM AND POP WORKS

1. G.I. screws will be used for fixing of Plaster of Paris / Gypsum Sheets.

2. All the false ceiling, partition work & Gypsum sheet cladding work shall be as per Gypsum India or an equivalent prescribed norms and their specifications.

3. All Gypboard shall be of India Gypsum Company or equivalent make as per IS 2542: Part 2: Sec 1 to 10. It shall be fixed to the G. I. frame work and ply, jointed and finished with jointing compound, paper tape and finished with two layers of approved primer all as per Manufacturers Specifications ready to receive paint.

4. The Plaster of Paris used for the punning on the walls shall be the best quality as per IS 2333: 1992. All punning work shall be executed in perfect line and level and of smooth & even finish.

5. Rate of Plaster of Paris punning towels shall include necessary hacking of internal existing Neroo plaster.

6. The work will have to be executed at any height and lift will not form the criterion for any extra amount.

7. All the rates quoted shall be inclusive of the required scaffolding.

Density – Nominal in dry state – 807.10 Kg/m3.

Standard – Confirming to IS 2542 – 1981 & IS 2095 – 1982.

Non-combustible as per BS 476: Part 4: 1970.

Non ignitable class 'P' as per BS 476: Part 5: 1968.

Fire propagation index 1 = 4.06 as per BS 476: Part 7: 1971.
Surface spread of flame class – 1 as per BS 476: Part 7: 1971.

Fire resistant evaluation as per BS 476: Part 87 ISO: 834 and IS3 3809.

Resistance to knocking and scuffing – greater than that of cement plaster work.

Gypsum wall cladding mainly comprises of fixing 12 mm tick the gypsum panels directly on wall or partitions by using PVC plugs and self-drilling screws or bonding tape.

No form of channel support or wall plaster is required for these wall cladding. They can be directly fixed on the wall or partitions using 3 inch screws.

Once the wall cladding panels are installed, the joints are finished with Gypsum powder to give a seamless finish.

WOOD WORK, CARPENTRY AND JOINERY

These specifications are for work to be done, items to be supplied and materials to be used inthe works as shown and defined on the drawings and described all under supervision and to the entire satisfaction of the interior designer.

The workmanship is to be best available and of a very high standard, use must be made ofspecialist tradesmen in all types of work and necessary allowance must be made for the samein the rates quoted.

The materials and items to be provided by the contractor shall be the best of their respective kinds as specified by the Architect and in accordance with the samples approved, where materials or products are specified in these specifications and or / or Bill of Quantities by the name of the manufacture or the brand name, trade name or catalogue references, the contractor will require to obtain prior approval of the interior designer for using substitutematerial or product. The contractor shall produce all invoices, vouchers or receipted accounts for any materials if called upon to do so by the interior designer.

Samples of all materials are to be submitted to the Architect for his approval before the contractor orders or delivers in bulk in the site. Samples together with their packing are to beprovided by the Contractor free of charge and approval samples will be retained by the Architect for comparison with

the materials, which will be delivered to the site.

Should any materials be rejected by the Architect, they will be removed from the site at the contractor's expense. Also the contractor will be required to submit specimen finishes of colors, fabrics, etc. for approval of Architect before proceeding with the works. Should it be necessaryto prepare shop drawings, then four copies of such drawings shall be submitted for approvalof the Architect who will retain two copies, all the contractor’s expenses.

Timber generally is to be the best of its kind, well and properly seasoned, of natural growth, free from work holes, large loose or dead knots or other defects and sawn die square and notsuffer from warping, splitting or other defects through improper handling.

The hardwood is to be C.P. Teak or other similar joinery hardwood, weighing not less than 45lbs. Per cubic foot with moisture not more than 20%.

Teak is to be the best quality from Dandeli free from soft heart, worm and bee holes andweighing not less than 50 lbs. Per cubic foot with maximum moisture contents of 12%. Teak veneers and flitches shall match each other throughout and where possible, shall match existing flitches in the building

The particle board shall be of high density, equal or superior quality to the laid in the I.S. 3478and as approved by the Architect.

The blockboard shall be of Mysore. Anchor of P.G. Brand one of the following I.S. Specifications or such approved adhesives shall be used :

I.S. 851 – 1957: Synthetic Resin adhesive for construction works in wood.

I.S. 848 – 1957: Cold setting case in glue for wood.

Where glued joinery and carpentry work is likely to come into contact with moisture, the glue shall be waterproof. The use of animal's glues will not be permitted.

Flush doors of hollow framed core insulated construction shall be constructed with 4" wide stiles, top and bottom rail, on 4" wide horizontal intermediate rail and two 4" wide diagonal braces, filled in solid with approved rigid type polyurethane foam slab insulation. Where described as with glazed panel the doors shall be constructed with one 3" wide and one wide stile, 4" top and bottom rail, one 4" wide horizontal intermediate rail and 2" wide diagonal braces: filled in as described before.

Flush doors of hollow framed core construction shall be constructed with 3" wide stiles and top stiles. 5" wide bottom rail, two 6" wide horizontal intermediate rails with beehive core of 1" wide filling pieces at 4" centers both ways and blocked out as necessary for lock and hinges. All horizontal members shall have ¼ dia vent borings.

All doors shall consist of selected hardware properly jointed together and they shall be covered on both sides with 3/16" teak veneered plywood or as specified. Each door is to be lipped all round with ½" teak twice rebated edging tongued to the stiles and rails and mitered. The doors are to be the full thickness as specified. The lippings on the meeting stiles of folding doors shall be increased to take the rebate as specified.

Frames to doors, windows, etc. shall be of hardwood or teak as specified to the required sizes with all necessary moulding with mortise and tenone joint, lead and teak pins and secured in position as specified.

Shelves generally shall be constructed of plywood with edging of 1" teak.

All timber members, whether they are part of the original structure or new, should be treated with anti-termite coat and one coat of solignum.

Timber is to be cut to the required sizes and length as soon as practicable after the works are begun and stored under cover so that the air will circulate freely around it. Joinery is to be prepared immediately after the finalization of the contract, framed up (but not bounded) and stored until required for fixing in position, when it is to be bonded and wedged up. Any portion that warps or develop shakes or other defects are to be replaced before wedging up. The whole work is to be framed and finished in a proper workman like manner, in accordance with the detailed drawings, and fitted with all necessary metal ties, straps, bolts, screws, etc.

Turning bonded joints are to be cross-tongued with teak tongues and where over ½" thick, tobe double cross tongued. Joiner's work generally is to be finished with fine sand papered surfaces unless otherwise specified.

Templates, boxes and moulds shall be accurately set out and rigidly constructed so as to remain accurate during the time they are in use.

Grounds are to be clean sawn, free from large knots, splayed as required and plugged and fixed to walls, etc at 1' – 6" centers unless otherwise specified.

Wood plugs are to be cut on the twist. Patent wall plugs or plastic fillings may be used in lieu of wood

plugs with the prior approval of the Architect.

All unexpected surfaces of timber, e.g. false ceilings, backing fillets, backs of doorframes,cupboard framing, grounds, etc. are to be treated with two coats of approved timber preservative before fixing or bedding.

The service stations, bar counters, shelving, etc. shall be generally constructed of plywood asdescribed and specified properly housed, grooved tongued, glued, blocked and screwed together and entirely to the satisfaction of the interior designer.

The banquettes, chairs, tables, Etc. shall be generally constructed of teak foam rubber andfabric as described and specified, properly housed, grooves tenoned, tongued, glued, blocked and screwed together in the manner of good quality furniture and entirely to thesatisfaction of the Architect. A prototype sample of all custom made pieces must be prepared and submitted the Architect for his approval before proceeding with the work in quantity.

Hardware & Metal:

The hardware throughout shall be of approved manufacture and supply, well made and equal in every respect to the approved samples to be deposited with the Architect. For the purpose of approval of samples, the contractor may be required to produce and provide tothe Architect, samples from many different sources and should allow in his rates for the same.

Fittings generally shall have satin chrome or anodized finish unless otherwise stated and shallbe suitable for their intended purpose of use.

Screws are to match the finish of the article to be fixed and to be round or flat headed orcounter sunk

as required.

The bronze and brass surfaces shall be covered with thick grease or other suitable protective material, renew as necessary and subsequently clean off and clear away on completion.

Aluminium and stainless steel shall be of approved manufacture and suitable for its particular application generally, the surfaces of all aluminium shall have an anodized finish and the quality and finish both shall comply with the samples approved by the Architect.

All steel, brass, bronze, aluminium and stainless steel articles shall be submitted for test for strength, if so, required by the Architect, at the contractor's expense.

All brazing and welds are to be executed in a clean and smooth manner, rubbed down andleft in the flat test and tidiest way particularly where exposed.

Chromium plating shall be in accordance with B.S 1224 or as per approved specifications for "normal conditions" and shall be on a base material of copper or brass.

Glazing: All glass to be approved manufacture complying with is: 3548 – 1966 or as per approved quality and sample to be of the quality specified and free from bubbles, smoke wanes, air holes and other defects. The compound for glazing to metal is to be a special non- hardening compound manufactured for the purpose and of a brand and quality approved by the Architect.

In Cutting glass: Proper allowance shall be made for expansion. Each square of glazing to be in whole sheet. On completion, clean all glass inside and out, replace all cracked, scratched or broken panes and leave in good condition to the satisfaction of the Architect.

Paint & Polishing: All material required for the works shall be of specified and approved manufacture, delivered to the site in the manufacture's containers with the seals etc. unbroken and clearly marked with the manufacturer's name or trade – mark with a description of thecontents and color. All materials are to be stored on the site of the works.

Spray painting with approved machines will be permitted only if prior written approval has been obtained from the Architect. No spraying will be permitted in the case of priming coats nor where the soiling of adjacent surface if likely to occur. The nozzle and pressure to be sooperated as to give an even coating throughout to the satisfaction of the Architect. The paint used for spraying is to comply generally with the specification concerned which is to be specifically prepared by the manufacturer for spraying. Thinning of paint made for brushing will not be allowed.

Wood preservation shall be solignum or other equal and approved impregnating wood preservative, and all concealed woodwork shall be so treated.

All brushes, tools, pots, kettles, etc used in carrying out the work shall be clean and free fromforeign matter and are to be thoroughly cleaned out before being used with a different type of class of material.

All iron or steel surfaces shall be thoroughly scrapped and rubbed down with wire brushes and shall be entirely free from rust, mill scale, etc. before applying the priming cost.

Surfaces of new woodwork, which are to be painted, are to be rubbed down, knotted andstopped to the approval of the Architect.

Surfaces of previously painted woodwork which are to be repainted shall be cleaned with soap and water, detergent solution or approval solvent to remove dirt, grease, etc. whilst wetthe surface shall be flatted down with a suitable abrasive and then rinsed down and allowed to dry. Minor areas of defective paint shall be removed by scrapping back to a firm edge and the exposed surface touched in with primer as described and stopped with putty. Where woodwork has been previously painted or polished and is to be newly polished, the same shall be prepared with scrapping, burning off or rubbing down.

Surfaces of previously painted metal which are to be repainted shall be cleaned down and flatted down as described in surfaces of preciously painted woodwork. Minor areas of defective paint and any rust and loose scale shall be removed completely by chipping, scrapping and wire brushing back to the bare metal and touched in with primer as described.

PARTITION WORKS

Ply partition-wood work

Unless otherwise specified, all timber for frames and shutters for doors, windows, ventilators, etc. shall be of approved quality with permissible defects for "First Grade" of timbers as per IS 1003 of latest edition. The planed surface shall be smooth and free from blemishes and dis-colorations.

- All Woodwork that is not visible after finishes such as partition framework, panellingframework etc., shall be out of well-Seasoned 1st Quality old Burma Teak wood or well-seasoned 1st quality CP teak free from defects.

- All woodwork that is visible after finishes shall be Seasoned 1st Quality old Burma Teakwood or B.T.C. free from knots or any defects. All wood sizes given in the B.O.Q. areout - of sizes.

- All plywood shall either be of Commercial plywood approved by IS Code or Marine plywood (as specified in the dwgs or BOQ) of 'Nocte', 'Green, Donear or, equivalent as per Architect's approval.

- All Marine plywood shall be as per IS 710: 1976.

- All the toilet doors, ply packing under the wooden flooring, storages in the pantry etc., shall be made in Marine plywood of 'Nocte', 'Green, Donear or, equivalent as per Architect's approval and the rest of the items shall be constructed Commercial plywood of 'Nocte', 'Green, Donear or, equivalent as per Architect's approval.

- Typically, the verticals/ tops/ drawer fascias of storages, tables and such other items shall be made in 19mm thick plywood, backing in 8mm thick plywood, drawer's sides and base in 12mm

thick plywood, cladding on internal framework using 6 or 8mm plywood (as specified), shutters in 19mm thick block board (small shutters) or composed framed shutters (large shutters) as described in the 'framework' section. Some drawer's fascia wherever mentioned shall be in old Burma teakwood section of 19mm thickness.

- All woodwork exposed or otherwise i.e. teakwood and plywood shall suitably treated for Pest/Termite control using 'Termiseal' or 'Woodguard' (colourless) and all respective rates shall be inclusive of costs incurred towards such treatment.

- All flat surfaces are to be in high-density particleboard or equal superior quality to that laid down in IS 3478 equivalent material approved by the Architect. The particles of the particular board shall be bounded with phenol formaldehyde (BMR quality) (Nova teak super or Anchor board IPM)

- Flush doors shall be solid core of approved make.

- Block board shall be equal or superior to that laid down in I.S. 1959-1960 or an approved sample.

- I.S. 851 - 1957 - Synthetic resin adhesive for construction work in wood.
- I.S. 849 - 1957 - Cold setting case in glue for wood

- All joints will be standard, mortised and tenon, dovetail, dowel, cross-halved, mitered, tongued and grooved and rebated. Nailed or glued butt joints will not be permitted. All joints shall be smeared with white lead.

- Hidden surfaces of door frames and similar items shall be finished with two coats of redoxide paint to all hidden surfaces of frame in contact with masonry / concrete.

- All medium density fiber board (MDF) (if to be used) shall be of "Nuwood", Marbok" make or equivalent.

- The work will have to be executed at any height and lift will not form the criterion for any extra amount.

- This specification is of a general type only and must be used in conjunction with the drawings of the particular item being made. Anything shown on the drawings of the particular item but not in the specification must be complied with, and vice versa.

INTERNAL FRAMEWORK

- **For 65mm thick ply partition and basic plywood panelling** the internal framework shall be of 50mm x 50mm at a consistent spacing of 600mm in a square grid. The C.P Teak Wood members must be notched and screwed adequately to give rigidity to the entire framework and finally cladded with 8mm thick commercial plywood.

- **For 50mm thick flushed door,** the internal framework shall be of old C.P. teakwood of size 38mm x 50mm at approx. 300mm c/c. The C.P Teak Wood members must be notched and screwed adequately to give rigidity to the entire framework and finallycladded with 6mm thick commercial plywood.

- **For 75mm thick flushed door,** the internal framework shall be of old C.P. teakwood of size 50mm x 50mm at approx. 300mm c/c. The C.P Teak Wood members must be notched and screwed adequately to give rigidity to the entire framework and finallycladded with 8mm thick commercial plywood.

- **For 50mm thick sliding shutter of a storage,** the internal framework shall be of old C.P. teakwood of size 38mm x 50mm at approx. 450mm c/c. The C.P Teak Wood members must be notched and screwed adequately to give rigidity to the entire framework and finally cladded with 6mm thick commercial plywood.

- **The Fascia for switchboards** shall be constructed with an internal framework of a grid using 19mm thick plywood such that the required shape is achieved. Finally 6mm plywood shall be boxed around this framework to complete the fascia ready to takeveneer.

Veneer finish

- All exposed surfaces of plywood/ block board shall be finished with veneer sheet orpaint or polish as specified in the schedule of quantities.
- Veneer wherever specified shall be of 3.5 mm thickness and of matching lots for independent sections wherever required and as directed by the Architects. It shall be of 'Anchor' make or 'Equivalent' to be approved by the Architect.
- All Veneer shall be out of one piece upto sizes not exceeding 8'-0" x 4'-0" unless otherwisedirected by the Architects.
- Veneer finish items shall be finished with approved French polish on all the surfaces, both external and internal except surfaces like skirting, wainscoting, table tops & all storage tops which are approx. 900mm high which shall be finished with approved colour stained matt water based PU coat of ICA or inchem or equivalent make using approved coloured stainers of the same company.
- All the ply/ block board/ veneer edges of items finished with Veneer shall be well secured with an old Burma teakwood lipping patti of the required size as per Architect'sapproval.
- Rates for veneering and exposed woodwork shall be inclusive of finishes such as French Polish, Lustre Paint, Melamine Polish or Duco Paint unless otherwise indicated in item description.

MDF Partition

Providing and fixing completely finished solid ply/MDF partition with an internal framework of MS sections as per drawing (Partition P2) at a spacing of 600 - 650 mm centre to centre in a grid. The framework shall be covered on both sides by 10mm marine plywood/MDF by means of adhesives and screws. The framework must take support wherever desired from the floor & ceiling only & the floor must not be punctured at any spot (unless otherwise approved beforehand by the architect). All internal MS frame members to be coated with anti-rust primerand given a coat of enamel paint along with all the inner surface of the plywood must be treated with anti-termite treatment as well as with wood preservative. All exposed ply/mdf to ply/mdf joints shall be neat & well finished and completed with duco paint/luster paint as indicated by the Architect as per shade approved Item to include

incorporating a door along with necessary hardware within the partition wherever necessary as per drawing and finishing as per design Item to include spray coating all the surfaces with approved anti termite solution including providing 10 year guarantee for the same as directed by the Architect or Architect

/ PMC in Charge.

Partly solid partly glazed Partition

Providing and fixing partly solid partly glazed partition in MS framework with an internal framework of MS sections as per drawing (Partition P3) at a spacing of 600 - 650 mm centre tocentre in a grid. The framework shall be covered on both sides by 10mm marine plywood/MDF by means of adhesives and screws. The framework must take support wherever desired from the floor & ceiling only & the floor must not be punctured at any spot (unless otherwise approved beforehand by the architect). All internal MS frame members to be coated with anti-rust primer and given a coat of enamel paint along with all the inner surface of the plywood must be treated with ant termite treatment as well as with wood preservative. All exposed ply/mdf to ply/mdf joints cladding with 3 mm veneer with melamine polish as pershade approved by the Architect. Item to include incorporating a door along with necessary hardware within the partition wherever necessary as per drawing and finishing as per design. Item to include spray coating all the surfaces with approved anti termite solution including providing 10 year guarantee for the same as directed by the Architect or Architect / PMC inCharge.

Toughened Glass Partition

Providing & fixing 12 mm thk toughened glass partition with a framework of MS sections as persize given in the drawing along with a low height storage to be made with a bench/ledge on one side as per drawing. (Partition P1). Shop drawings to be approved by the Architects before installation of the glass partitions with all hardware type and its sizes and placement to ensure the partition is sturdy. Item to include all necessary hardware as per design. Item to also include doors as part of the partition as shown in the drawing to be paid measured by area. The finishof the partition/door shall be paid as per relevant item.

Material:

The profiles are manufactured from MS section, which gives wall sufficient rigidness and corrosion resistance. The surface of the profiles is finished with natural anodisation or powdercoated. Toughened Glass are fixed in the modules with a special transparent silicon sealingwhich helps the transition from glass to MS sections invisible. Also, the bottom edge of the glasspane is filled with sealing, separating it from the MS and preventing the sealing from falling out.

DOORS & PARTITIONS

- All floor springs shall be heavy duty two way of 'Everite', ozone or equivalent make (unless Dorma make specified) with brass plate covers, which shall be approved by theArchitect.
- All patch fittings; floor spring, locks etc to be used in the glass partitions and glass doorsshall be Dorma make and shall be matt brass finish.
- All dorma make specified patches, floor springs, door closers shall be as per the weightand other specification of the item as required, by the manufacturer to recommend thecorrect fitting for the said item.
- Items like spider glazing for the CFC, Sliding folding partitions (on the 2nd floor betweenthe 2 big conference rooms shall be totally as per Dorma make specification as persuggestive dwgs attached in the document.
- All mortise locks & handles shall be of " Golden " make or equivalent.

- Concealed Door Closers shall be 'Everite make or 'Equivalent' to be approved by theArchitect.
- All hinges used for the old doors shall be of parliamentary type and heavy duty withbrass finish of flora, magnum or equivalent make.
- All hinges used for the new doors shall be heavy duty with brass finish of flora, magnum or equivalent make.
- All handles for the old doors shall be about 150mm tall, heavy duty, brass finish anddecorative type as per Architect's approval.
- All handles for new doors with frames shall have heavy-duty brass finish mortice handle with a keyhole at the bottom. The Tubular locks shall be used for the toilet doors and shall be brass finish. The make for these handles shall be enox, leme or equivalent make.
- All the doors on floor springs (both glass and solid) shall have brass-finished push/ pull plates as per the dwgs as handles.
- All locks shall be of solo, vijayan or equivalent make.
- All the tower bolts shall be as per the specified length and shall be flora, magnum orequivalent make.

STRUCTURAL STEEL WORKS

- All steel works shall comply with the Indian Standard Code IS 226-1975.
- The steel work shall be erected unpainted, but all dirt, grease, rust and mill-scale shall be removed.
- All joints shall be fully welded with the electric arc process. All visible joints shall beplanned with a grinder.
- The size and number of cleats, dowels, holdfasts, bolts, etc., shall be as per Architect / Consultants instructions.
- All exposed steel work shall be brushed finish unless otherwise specified.

FINISHES WORK

PLASTER OF PARIS

- The Plaster of Paris used for the punning on the walls shall be the best quality as per IS 2333: 1992. All punning work shall be executed in perfect line and level and of smooth& even finish.

- Rate of Plaster of Paris punning towels shall include necessary hacking of internal existing Neroo plaster.

- The work will have to be executed at any height and lift will not form the criterion forany extra amount.

- All the rates quoted shall be inclusive of the required scaffolding.

PAINTING WORKS

Timber (if specified to be painted): All internal timbers and plywood shall be coated all overwith one coat of 2nd quality oil paint, or 1 coat of clear and black "Termiseal" mix. Exposed timber and plywood surfaces that are directed to be painted shall be given 1 coat of woodprimer, followed by 1 coat of ready-mix enamel putty, followed by 1 undercoat, another coatof putty rubbed down with emery paper and water and 2 finishing coats of "Goodlass Nerolac" or "Berger" 1st quality enamel oil paint, diluted as required with thinner (not turpentine) sprayed or hand-brushed to required shade as per instructions.

Internal Walls (POP finish)---if to be lustre painted: All the internal walls surfaces shall be scrapped down thoroughly with Emery paper (180) and wiped clean followed by a coat of Asian paints wall Primer (E1) and then a coat of Asian paints Acrylic Wall Putty (E0). The surfaceshall be again scrapped down thoroughly with Emery paper (180) and wiped clean followedby a coat of Asian paints wall Primer (E1) followed by another round of scraping down of surface with Emery paper (320) and wiped clean followed by 2 coats of Asian paints Interior wall finish lustre (LF) of approved colour shade.

External Walls (Sand faced plaster finish): Shall be cleaned and painted with 2 coats of acrylic emulsion Apex paint or equivalent cement paint to the shade chosen by the Architect/Consultant if specified

Steel Work: Shall be rubbed down thoroughly and coated with one coat of approved zinc-chromate, anti-rust metal primer, and if exposed followed by 1 coat of ready-mix enamel puttyfollowed by 1 undercoat and second coat of putty rubbed down with emery paper and waterand 2 finishing coats of specified coats of enamel paint using thinner as required, hand brushed or sprayed.

Internal Walls (POP finish)---surface preparation if to be texture painted: All the internal walls surfaces shall be scrapped down thoroughly with Emery paper (180) and wiped clean followed by a coat of Asian paints wall Primer (E1) and then a coat of Asian paints Acrylic Wall Putty (E0).The surface shall be again scrapped down thoroughly with Emery paper (180) and wiped clean followed by a coat of Asian paints wall Primer (E1) followed by another round of scraping downof surface with Emery paper (320) and thus preparing the surface for receiving the texture paint.

General procedure for Lustre Finish, Acrylic Emulsion and Enamel Painting:

- Sand papering and cleaning the surface properly.
- Filling the minor cracks/holes with plaster of Paris.
- Applying one coat of cement primer mixed with 15% of doubled boiled linseed oil.
- Sand papering and applying lambi/putty twice.
- Applying second time cement primer to the full surface.
- Sand papering and applying third time touch-up lambi/putty.
- Sand papering the putty works and painting with three coats of required paint afterproviding touch-up with lambi/putty in every coat.

General procedure for Water Cut Enamel Paint (4 coats – if required)

- Sand papering the surface and applying one coat of wood pink primer or flat oil plant.
- Applying lambi/putty to the full surface twice.

- Water cutting the surface by waterproof paper and applying a coat of enamel paint to the full surface.
- Water cutting the surface by waterproof paper and applying a coat of enamel paint to the full surface.
- Sand papering the putty works and applying second coat of enamel paint.
- Water cutting by waterproof paper and applying third coat of enamel paint.
- Final water papering, minor touch-up and applying fourth and final coat enamel paintusing good quality thinner in place of turpentine.

General procedure for Texture Finish or Stucco Paint

- Sand papering, cleaning the surface properly
- Filling the cracks/holes with plaster of Paris
- Applying one coat of double boiled linseed oil with mixed cement primer.
- Providing a coat of lambi/putty to the full surface
- Sand papering the putty works and applying second coat of cement primer
- Sand papering the surface and making 'texture finish' using roller or by hand as required.(Using Zinc moist + enamel paint + whiting)
- Then painting with two coats of luster paint

General procedure for Duco Paint

- Sand papering filling cracks/holes with M/Seal crack filler
- Applying a coat of 'Duco' oil primer
- Levelling with one coat of lambi/putty to the full surface
- Water cutting the putty works and spray one coat of N.C. grey surface
- Providing two times N.C. putty to the full surface
- Water cutting the surface, applying second time surface or white N.C. paint
- Water cutting the surface applying touch-up lambi/putty wherever required and then painting with three coats of Duco paint.

General procedure for Design Type Painting

- Shading/Stippling/Marbling by either brush, sea sponge, rag rolling or artists brush asrequired.
- Applying minimum two coats of lacquer (sprayed) at 'Duco' I.C.A. make or 'Krillo' - Asian Paints make.
- Rubbing/Buffing with Rubbing Compound of 'Waxpol' or 'I.C.A.' make.
- Final cleaning with 'Liquid Polish' of I.C.A. make.

General measures to be taken:

All material required for the works shall be of specified and approved manufacturer, deliveredto the site in the manufacture's containers with the seals, etc., unbroken and clearly marked with the manufacture's name or trade mark with a description of the contents and colour. All materials are to be stored on the site of work.

Spray painting with approved machines will be permitted only if written approval has been obtained from the Employer/ Architect prior to painting. No spraying will be permitted in the case of priming coats where the soiling of adjacent surfaces is likely to occur. The nozzle and pressure to be so operated as

to give an even coating throughout to the satisfaction of the employer/ Architect. The paint used for sprayings is to comely generally with the specifications concerned and is to be specially prepared by the manufacturer for spraying. Thinning of paintmade for brushing will not be allowed.

Wood preservative shall be so lignum or other equal approved impregnating wood preservative and all concealed woodwork shall be treated with wood preservative.

All brushes, pots tools, kettles, etc. used in carrying out the work shall be clean and from foreignmatter and are to thoroughly cleaned out before being used with a different type of class.

All iron and steel surface shall be thoroughly scraped and rubbed with wire brushes and shall be entirely free from rust, mill scale, etc. before applying the priming coat.

Surface of new woodwork, which are to be painted, are to be rubbed down, clean down to the approval of the Architect.

Surface are previously painted wood work which are to be painted are to be cleaned downwith soap and water detergent solution or approved solvent to remove dirt, grease, etc. Whilstwet the surface shall be flattened down with a suitable abrasive and then rinsed down andallowed to dry. Minor areas of defective paint shall be removed completely by chipping, scrapping back to a firm edge and the exposed surface touched in with the primer as described and stopped with putty. Where woodwork has been previously painted or polished and is to be newly polished, scrapping, burning off or rubbing down, should be carried outproperly.

Surfaces of previously painted metal which shall be painted are to be clean down and flattened down as described in surfaces of any rust and loose scale shall be removed completely by chipping, scrapping and wire brushing back to the bare metal touched in with 2 coats of primer as described/ specified/ directed by the Architect Consultant.

Mode of Measurement

- Painting works of plain surfaces measured as usual i.e. Length x Width = Area
- If any delicate or intricate areas with designs, grooves, curves, moulding etc., are involved, the mode of measurements for such works shall be indicated by the 'Contractor' on the basis of the actual conditions obtaining at site and approval by the Architects, prior to taking up such works in hand.

- Glass doors/windows with mouldings and sash bars to be painted both sides in singleshade will be measured on one side only and multiplied by 2.25 times i.e. length xbreadth x 2.5 times. No extra measurements for moulding, window jamb thickness etc. Also no deductions for glass openings etc.

- Ordinary windows painted on both sides shall be measured on one side only (wall to wallincluding jambs) and multiplied by 1.5 times i.e. length x breadth x 1.5 times no deduction for glass panes.

- M.S. grills shall be measured on one side and multiplied by 2 times i.e. length x breadth x2 times.

- All non-painted or polished surfaces shall be thoroughly cleaned without scratches or any kind of damage before handing over and nothing extra shall be payable for cleaningof these items like, windowpanes, flooring, partitions etc.

- All junctions between polished surfaces and paint surfaces shall be neatly line cut in a very crisp and perfect manner such that no junctions look smudged or crooked.

1. Materials manufactured by the following manufacturers shall be used:

a) Cement Primer : Asian Paints, Duco or equivalent.

b) Enamel Paint for lambi/putty : Asian Paints, Duco or equivalent.

c) Enamel paint for finishing : Asian Paints, Duco or equivalent.

d) Flat Oil Paint : Asian Paints, Duco or equivalent.

e) Luster Paint : Asian Paints, Duco or equivalent.

f) Linseed Oil : 1st Quality Man of War brand of M/s. A.N. Irani & Co., (not Chotta Japan brand of sameCompany).

g) Duco Paint : I.C.A, Asian or equivalent.

h) Oil Primer or Surfacer : I.C.A, Asian or equivalent.

i) N.C. Putty : N.C. Putty of Esdee make, Oil Putty of AddisionPaint.

j) N.C. Putty : Asian Paints.

k)VR texture finish : VR Concrete Solutions

l) Lime based texture paint : OIKOS

1.9.1

1.9.2 POLISHING WORKS

1. All exposed t.w. and veneer and all internally visible t.w. and plywood shall be through thoroughly sand-papered and cleaned, and melamine polished.
2. Staining, preparation, filing and finishing coats shall be done strictly as per manufacturers recommendation (example Asian Paints I. Ltd.) Sample of stainand finish shall be submitted to the Architect/Consultant for prior approval.
3. ***Linseed Oil***

Procedure

a) Scraping all the surfaces filling all the cracks / holes.
b) Applying 5-6 coats of linseed oil along with turpentine using a muslin cloth with slight pressure, so that the oil gets filled into the grains.
c) The proportion of linseed oil to turpentine varies from 80:20 to 60:40, 40:60, 20:80and so on with every next coat of oil.
d) The final finish on top shall be of matt applied by brush

4. French Polish

For French Polish the base material shall be shellac dissolved in methylated spirit. The timber shall be well sanded and prepared and the grains to be filled with a grain filler. Staining if prescribed must be done before application of the polish.The equipment consists of the polishing rubber which is to be a wad of cotton wool and a cover of a soft linen or cotton fabric. This rubber must never be soaked into the polish with the cover removed. Polish is to be applied uniformly over the surfacewith a slow figure-of-eight motion until the timber is coated with a thin layer ofpolish. A series of thin even coats to be applied allowing only for a few minutes fordrying in between application. This layer on achievement of an even surface is then spirited off with methylated spirit to remove the rubber marks and to achieve a smooth finish.

Procedure

a) Sanding of the raw surface of wood / ply / Veneer: Sand the wood/ply/Veneer surface with 80 number sandpaper (of roughest grit). In case of veneered surface, use 120 or 150 no sand paper). Wipe clean the sanded surface witha clean cloth.

b) Do note that:
- More finished the raw veneer/wood, higher the sandpaper numberchosen.
- Sanding to be done in the direction of the grains.
- The sanding shall be done till a smooth and even finish surface for polish is ready.

c) Colouring of the surface: Prepare a dry mixture of colored powders to achieve the desired coloured finish. The dry mixture consist of:
- A whiting powder (microphile or chalk powder as it is known in Karnataka.)
- One or more relevant colour powders (mahogany. black, raw sienna, burnt sienna etc) as per Architect's approval.
- All the powders shall be hand mixed.
- Apply the mixture evenly onto the desired surface using a dampcloth and get the colour of the polish approved by the Architectat this stage.
- In case if natural colour of the wood is to be retained, then the 1st coat of polish should be directly applied over the sanded wooden surface as specified by the Architect.
- Rub the surface gently with a clean cloth to remove excess colour.Care is to be taken that the powder is applied uniformly over thesurface. This surface is left to be dried for some time before thepolish is applied.

d) 1st coat of polish:
- Sand the surface with 220 grit sandpaper; this is to remove excess coloured powder so that the grains are distinctly seen. The powdershall adhere to the

grains only. Wipe the surface with a dry cloth.

- Dip a cloth in the polish and apply the polish over the wooden surface evenly along the direction of the grains.
- Let the polish dry.
- Composition of French polish:

1. Spirit.
2. Lac
3. Chandrush
4. Rumi mastagi

e) Test for authenticity of spirit: Dip a finger into the spirit solution and blow air over the finger; the solution should evaporate leaving no white coloured residue behind.

f) 2nd coat polish:

- Sand the surface with 220 grit sandpaper and clean the surface using a neat cloth
- Filling of the dents, cracks fissures in the wooden surface can be done at this stage.

Do note that:

- For the interiors, the dents etc should be filled with a mixture of wax and coloured powder.('Kaccha' wax is to be used to fill ply and 'pucca' wax is to be used to fill veneer and wood).
- For the exteriors, pucca lambi (a mixture of whiting, coloured powder and French polish) is used to fill the dents etc.
- Joints between plys and veneer can also be filled in using puccalambi.

g) Repeatedly apply the 2nd coat of the French polish until all the polish ingredients are properly impregnated into the wood surface.

h) Colour rendering changes is if required by the Architect shall be made at this stage only.

i) 3rd and final coat:

- Sand the surface using 220 grit paper and again wipe it with clean cloth.
- Apply the final coat of French polish repeatedly until the surface gets an even sheen and all the grains are filled with polish ingredients.

j) Wax buffing:

For Wax Polish the base material contains silicon and dryers. A good silicon wax is used and not a cream or spray. Before the wax is applied, the timber is sealed first with another finish Ronseal.A light coat of sealer is applied by brush or cloth directly to the unfilled timber surface, working it in well and finishing evenly in the direction of the grains. It should be allowed to dry completely and then sanded lightly with fine abrasive paper. A heavy coat of wax is applied next, working in well and it is finished by stroking in the grains before leaving for hardening. This surface is then rubbed up with a soft brush but only after it is left to harden for several hours. The grain is then buffed with a soft cloth.

- Apply wax (shin-o-shine-white polish) with the help of a cloth and then rub the surface evenly with steel wool.
- Rub the surface again with steel wool for buffing to ensure that the surface is not left sticky or greasy.
- ***If the surface has to be PU finished, PU can be applied instead of the wax at this stage. This shall be done as per ICA or equivalent***

make company specifications only. However if the wood colour desired is 'natural' and PU is required, then the French polish is avoided, instead a sealer is applied (preferably using a machine) over which PU is applied.

k) Melamine Polish:

For Melamine Polish the base material consists of Polyurethene. Polyurethene gives touch surface that resists chipping, scratching and boiling water.Clean off all grease and dirt with an abrasive and white spirit. It is advised that it is not done inhumid conditions. Apply the same coat, of preferably a clear hard glaze with acloth pad. It should be allowed to dry for a minimum of 6 hours and then againcoated. Subsequent coats should be rubbed down with fine glass paper or medium grade steel wool. A matt finish is then achieved, if specified, by giving afinal coat of clear Ronseal Matt coat.

1.8.2 Finishes for Doors and Windows

1. All material required for the works shall be of specified and approved manufacturer, delivered to the site in the manufacturer's container with the seals etc., intact and clearly marked with the manufacturer's name or trademark with a description of the contents and colour. All materials to be stored on -site.
2. Spray painting with approved machines will be permitted only if written approval has been obtained from the Architects prior to the painting. No spraying would bepermitted in the case of priming coats where the soiling of adjacent surfaces is likely to occur. The nozzle and pressure to be adjusted so as to give an even coat uniformlyto the satisfaction of the Architects. The paints used for spraying to conform to the specifications and is to be specially prepared by the manufacturer for spraying purposes. Thinning of paint will not be permitted.
3. Solignum or any other equivalent and approved impregnating wood preservative should be used for protection to concealed woodwork. All brushes, tools, pots, etc., used in carrying out the work shall be clean and free from foreignmatter and should be thoroughly cleaned before being used with a different typeand class of material.
4. All iron and steel surfaces shall be thoroughly scraped and rubbed with wire brushes and shall be made entirely free of rust, mill scale etc., before applying the priming coat. Surfaces of new woodwork which are to be painted are to be rubbeddown and cleaned to the approval of the Architects. Surfaces of previously painted wood work that are to be repainted should be cleaned down with soap and water detergent solution or approved solvent to remove dirt, grease etc. The wet surface should then be evened out with an appropriate abrasive and then rinsed down and allowed to dry. Minor areas of defective paint shall be removed by scraping back to an even edge and this surface to be then touched up with the primer and an application of putty. Surfaces of previously painted metal surfaces to be repaintedshall be cleaned, evened out, any rust, loose scales to be removed by chipping, scraping and wire brushing and the exposed base metal to be touched up with primer.
5. **Timber (if specified to be painted):** All internal timbers and plywood shall be coated all over with one coat of 2nd quality oil paint, or 1 coat of clear and black "Termiseal"mix. Exposed timber and plywood surfaces that are directed to be painted shall be given 1 coat of wood primer, followed by 1 coat of ready-mix enamel putty, followed by 1 undercoat, another coat of putty rubbed down with emery paper and water and 2 finishing coats of "Goodlass Nerolac" or "Berger" 1st quality enamel oil paint, diluted as required with thinner (not turpentine) sprayed or hand-brushedto required shade as per instructions.

GLASS & MIRROR

- Glass shall be "I.G." Brand, made by Indo -Asahi or Modi or Saint Gobain Float. The glass shall adhere to IS 14900:2000

- Glass shall be even thickness as specified without any defects like bubbles, aberrations waves, patches etc.

- All glass to be used with patch fittings shall be toughened clear glass with 12mm thickness.

- All 'Mirrors' shall be of imported plate glass (6 mm thick) with imported 'mirroring' of Asahi,Modi, Saint Gobain or equivalent make. The mirror testing shall be as per IS 3438:1994.

- All necessary gaskets, buffers, silicon, epdm etc. required to seal the gaps in glass work shall be included as part of the applicable item and nothing extra shall be payable onthis account.

- All glass to be used in wooden frames, as tall partition shall be s shall be toughened or non-toughened (as specified) clear glass with 10mm thickness.

- Glass edges shall be fine-finished or polished before fixing.

- Large glass panels shall be beaded in rubber gasket before installation.

- Glass above 1/4" (6mm) thickness shall be imported plate glass.
- A configuration of 6mm glass with a 12mm air gap and another layer of 6mm glass shallbe used as hermetically sealed glass.

- A configuration of 2 nos. 6mm glass on either side with 2 nos. 0.38mm thick PVB layers shall be used as PVB laminated glass.

- The work will have to be executed at any height and lift will not form the criterion forany extra amount.

- The mirror fixing wherever specified shall be done by using 3M tapes with a backing plysuch that no bolts or framework is visible. The bonding of the mirror should be done with a high-density polyurethane double-coated foam tape. The tape should be of 1.6 mm thick natural coloured with foam density of 290 kg/m3, which should give a minimum Normal Tensile strength of 275 kPa with aluminium T blocks when tested as per the ASTM D 897, and should hold 1000 g on an area of 0.5 sq.in for a minimum duration of 10000minutes at ambient conditions and upto the temperature of 66 deg C, when tested as per ASTM D 3654.The width and area of the Mirror Mounting Tape should be calculated as per the manufacturer's recommended methods of static load calculation considering the mirror dimensions & weight. The tape should be applied all around the periphery of the mirror as per 3M make specifications. The manufacturer's test report onthe tape performance needs to be submitted with other documents.

DOORS & WINDOWS RESTORATION WORKS

1. SCRAPPING

Surface are previously painted wood work which are to be painted are to be cleaned downwith soap and water detergent solution or approved solvent to remove dirt, grease, etc. Whilst wet the surface shall be flattened down with a suitable abrasive and then rinsed down and allowed to dry. Minor areas of defective paint shall be removed completely by chipping, scrapping back to a firm edge and the exposed surface touched in with the primer as described and stopped with putty. Where woodwork has been previously painted or polished and is to be newly polished, scrapping, burning off or rubbing down, should be carried outproperly.

Surfaces of previously painted metal which shall be painted are to be clean down and flattened down as described in surfaces of any rust and loose scale shall be removed completely by chipping, scrapping and wire brushing back to the bare metal touched in with 2 coats of primer as described/ specified/ directed by the Architect Consultant.

Manual Cleaning

This shall be done using wire brush for scrapping, chisel/hammer for chipping, abrasive cloth/block for rubbing etc.

2. GI DOOR GI

FRAMES:

The frame should be provided with:

- 3 Nos. of M.S. powder coated 4" Butt hinges of 2mm thickness welded to the mainframe
- 6 Nos. of 1.2mm thick CRCA electroplated stiffeners should be welded to frame
- 6 Nos. of 8" M.S. hold fasts with split end tail welded to stiffener plates one no. al dropreceiver
- Each frame should be provided with 25x50mm tie rod at bottom
- All welded places should be treated with protective coat of zinc rich primer
- The entire frame should be provided with a coat of etch prime
- The frame section should be cut to length and metre joined with corner brackets madeof CRCA electroplated

Specifications:

- Door Frame Fabrication Thickness: 1.2mm
- Steel Base: IS 513
- Galvanized steel with zinc: 120 gms/sq. mtr.
- The overall size of the section should be 80x50mm
- High precision: +/-0.05-0.1mm

GI SHUTTERS:

Door Type: - bSteel Fire Rated Door

Criteria: - Stability & Integrity with Infill Insulation Material

Rating: - 120 mins

Shutter Thickness: - *49 mm*

Testing Standards: - BS 476 Part 20 - 22, IS 3614 Part 2

Test Laboratory: - CBRI Roorkee, India

Detail Description*:*

1 Steel frame Profile Design - NDRF 154 x 77
2 Frame manufactured with 1.5mm Galvanised Steel 3 Shutter Thickness - 49mm
4 Shutter Honey Comb / Wool Insulation Infill treated with VIPER FRS 881 LH 5 Shutter manufactured with 1.0mm Galvanised Steel

6 Tested with Vision Panel for 120 minutes rating

Recommended Finish Frame & Shutter:

1 Powder Coating in desired RAL Shade Code
2 Polyurethane Coating in desired RAL Shade Code3 Selective Wood Grain Finishes available

3. WOODEN DOORTIMBER

Timber shall be fully matured, well-seasoned 1st quality BTC Teak for structural items and either 1st quality CP Teak or well-seasoned Burma Teak for non-structural woodwork such as doors and windows etc. unless otherwise specified for the particular job (the Contractor shall furnish from a recognized timber merchant a certificate as to its seasoned condition and the date of its cutting into scantlings) free from all knots, shakes, cracks, dry and wet rots or defects of anyother kind. Only the heart wood of a sound tree, from which the sap has been entirely removed; sap wood or the wood that is found to be soft or of a spongy nature at any portion

of the scantling under consideration will be rejected and only which is uniform in substance, straight in fibre and of uniform hardness shall be used on the works. The colour should beuniform throughout.

The Consultant or his representative may inspect all logs and scantlings previous to use and reject any which he considers defective in the requirements of the specification. The Consultant shall have the power to reject at any stage any work which may be found defective in quality or workmanship and he shall not be debarred from rejecting wrought timber by reason of his having previously passed the same in the log or other un-worked state.Rejected timber and woodwork shall be removed from the site of the work within 24 hours of rejection at the Contractor's expense.

No wood work shall be placed in position, covered in the ground or walls, unless and until ithas been approved by the Consultant his representative; otherwise, it is to be removed or payment proportionately deducted, at the discretion of the Consultant. The Contractor shall, therefore, give due notice to Consultant or his representative for inspection. The preliminary passing by the

Consultants\Clients representative will be done in systematic manner with the blue chalk or light stamp supplied by the Contractor.

WOOD WORK, CARPENTRY AND JOINERY

The whole of the timber used to be of best 1st quality CP Teak or Burma Teak first quality orsecond hand Burma Teak (for non-structural members) of the dimensions and forms shown inthe drawing or as described by the Consultants. The wood to be in every case, of the best description, full grown, sound, free from large and loose or dead knots twists, shakers, suncracks, flaws or other defects and to be of hard wood and well-seasoned.

The tolerance permissible in teak wood shall be as follows:

i) Sap wood to the extent of 20%
ii) ii) Warp to the extent of 10mm in 3 metre length.
iii) iii) Live knots of 2 knots per metre the diameter of each knot not exceeding 20mm.

Any wood found to be not up to the above standards is liable to be rejected by the Consultants/Architect / PMC The Consultants decision in this regard will be final and binding.

All mortise and mitre joints tenons, scarf's etc. to be made and fitted accurately in a workman like manner in accordance with working Drawings or directions and to the satisfaction of the Consultants. All joints shall be properly glued with an approved first quality glue. If, after the wood work shall have been erected any undue shrinkage or bad workmanship show themselves, the Contractor shall forthwith amend the same without any extra change.

The rate of wood work to include all sawing, planning, joining, framing labour and material forraising and fixing and all workmanship also the fitting, fixing and supply of all straps, bolts, nuts, nails, spikes, screws etc. necessary for the framing and fixing. All holes for fixing bolts shall beaccurately centered and drilled to the exact size of the shank diameter and countersunk whenrequired.

All timber resting on or embedded in masonry to be well tarred with boiling coal tar.

The measurement of all wood work to be for actual visible portion and no allowance will bemade for tenons overlaps etc.

All exposed faces of wood work shall be sand papered once before erection for approval of the Consultant. No colour or other preservatives shall be applied without prior approval of theConsultants.

The whole of the wood work shall be first treated with two coats of anti-termite wood Preservative chemicals of an approved make and the contractor shall strictly observe the manufacturer's instructions for using the material. All the wood shall thereafter be applied witha primary cost of approved first quality wood primer paint. The application of primary shall not be done within 24 hours of the application of the second cost of anti-termite treatment. The wood work shall be made perfectly clean

and smooth before painting. Framed joints must be coated with the wood preservative and the primer before being put together.

The Contractor shall provide to store the timber during construction. Timber that has deteriorated on account of exposure to damp is liable to be rejected.

The rates entered in the Bill of Quantities must be held to include the cost of haulage to thework site, housing and protecting from weather, risks of every kind and all expenses connectedwith the preparation and use in the work. The cost of primer and wood preservative as specified is to be included in the cost of wood work to which it is applied.

TIMBER TREATMENT

All structural timber members, should be treated with anti-termite coat and one coat of solignum.

For old BTC structural members (apply by brush)

- Apply 1 layer of turpentine oil – let the sample dry
- Apply 2nd layer: 1/3 linseed oil and 2/3 turpentine oil mixed and let sample dry
- Apply 3rd layer: 2/3 linseed oil and 1/3 turpentine oil and let sample dry
- Apply 4th layer: full linseed oil and let sample dry.

INDIAN STANDARD CODE FOR USE OF TIMBER

Sr. No.	**Item**	**IS CODE no.**
1.	Timber seasoning	1141
2.	Key for identification of commercial timber	4970
3.	Permissible moisture content for timber	287
4.	Permissible moisture content for timber products	11215
5.	Method of measurement and evaluation of defects in timber	3364
6.	Structural timber	2408
7.	Testing method for specimen	1708 (Part 1 to 18)

PAINTING & POLISHING OF DOOR AND WINDOW FRAMES

External doors and windows on all floors, in the corridors and lobby need to be consolidated, using teak wood infills where necessary and to the specified designs of brass hardware. The application of a clear propriety preservative is recommended, such as clarified beeswax

dissolved in pure turpentine oil, finally rubbed down by a soft cloth. Microcrystalline waxesmay be used, at a suggested loading of 25 cc of wax per litre of preservative.

External doors and windows should also be consolidated using teak wood inserts where necessary, with a view to using second hand teak that has been properly seasoned. Exterior timber members exposed would be either French polished and coated with 3 coats of clearPU coating or with primer and 3 coats of specified enamel paint of brand approved by Architect.

GENERAL CONDITIONS

1. **Rates:** Unless otherwise provided in the description of various items of work, the rates tendered by the contractor shall be for completed items of work covering all materials, labour carriage, royalties, fees, rents, sales tax, octroi, wastage, tools, plant, equipment, transport, temporary constructions, overhead charges and profits as well as general liabilities, obligation and risks, arising out of the conditions of contract and carrying out of the work in part(s) or under/ across/along pipes cables ,drains etc. complete and shall apply to all heights, depths, lead and lifts. No extra charges, whatsoever, consequent on any misunderstanding or otherwise shall be allowed.

   However, in case of building works extra payment for items of concrete work, RCC work, Brick work and Stone work only above different floor levels shall be made at the rates for such items only as are provided in the Delhi Schedule of Rates for operation of these rates the floor level shall be the top of RCC slab in main room and not at the top of any sunk or depressed floor slabs.

2 **No revision in rates due to change/closure of sources of materials:** Collection of materials at the site of work for proper execution of the work as per specifications shall include all leads and lifts. The rates of various items of work shall hold good irrespective of the quarry or source from which materials are brought so long as these conform to the specifications. Closure or change of any particular quarry or source shall not entitle the contractor to claim any revision in rates.

3. Some restrictions may be imposed by the police authorities etc. on the working and/ or movement of labour, materials etc. The contractor shall be bound to follow all such restrictions/ instructions and no claim of payment on this account whatsoever shall be entertained.

4. **Compensation for damage by rains, floods or other natural calamities:** No compensation for any damage caused to the work or materials by rains, floods or other natural calamities shall be paid to the contractor. The contractor shall have to make good all such damages at his own cost as per the directions of the Engineer-in-charge failing which the damages shall be made good by the Engineer-in-charge at the risk and cost of the contractor.

5. **Work on Sundays and holidays**: If the contractor executes any work on Sunday or holiday in the absence of the Engineer-in-Charge or his authorized representative and without having previously given him sufficient notice in writing that such work was about to be executed, he shall take up and reconstruct any work so executed at his own cost and expenses if ordered to do so by the Engineer-in-Charge in writing under his hand.

6. **Work not done in ordinary working hours**: If the contractor executes any work, not in ordinary working hours, in the absence of the Engineer-in-charge or his authorized representative and without having previously given him sufficient notice in writing that such work was about to be executed, he shall take up and reconstruct any work so executed at his own cost and expenses, if ordered to do so by the Engineer-in-charge in writing under his hand.

7. **Clearance of site**: The contractor shall clear the site of work simultaneously as the work proceeds failing which the same shall be got cleared by the Engineer-in-charge at the risk and cost of the contractor by giving him one-day notice.

8. **Disposal of materials of offensive nature**: All night soil, filth or other materials of an offensive nature taken out of any trench, sewer, drain, cesspool or other place shall not be deposited on the surface of any street, road or where it is likely to be a nuisance or passed into

any sewer or drain, but shall at once be removed by the contractor from the site to suitable dumping ground.

9. **Facilities to other contractors**: The contractor shall in accordance with the requirements of the Engineer-in-charge, afford to provide all reasonable facilities to other contractors engaged contemporaneously on separate contracts in connection with the works and for departmental labour and labour of any other properly authorized agency which may be employed at the site on execution of any work not included in this contract or of any contract which the N.D.M.C may enter into in connection with or ancillary to the work.

10. **Work in different parts to be executed simultaneously**: The contractor shall progress in the different parts of the work simultaneously as far as possible so that minimum breakage and repairs are involved. The entire work shall be handed over in a satisfactory finished state.

11. **Conditions regarding taking over completed portion of work**: During the progress of the work, completed portions of the work may be put to use by the Engineer-in-charge and the contractor shall remain fully responsible for maintenance of the work till the entire work covered by the contract is satisfactorily completed and a certificate of completion given by the Engineer-in-charge. Maintenance of the work during the defect liability period shall be governed by the relevant clauses of conditions of contract.

12. **Possession of site**: The contractor shall not be permitted to enter on (other than for inspection purposes) or take possession of the site until instructed to do so by the Engineer-in-charge in writing. The portion of the site to be occupied by the contractor shall be defined and/or marked on the site plan and the contractor shall on no account be allowed to extend his operations beyond these areas. In respect of any land allotted to the contractor for purposes of or in connection with the contract, such use or occupation shall not confer any right of tenancy of the land to the contractor and the contractor shall vacate the land on demand by the Engineer-in-charge.

13. **Occupation of private land**: The contractor shall neither, except with the consent of the occupiers thereof, form temporary roads nor cart any earth or materials or place any excavated or other materials and T & P upon private land and any damage done to any property whatever contiguous to the work or otherwise shall be at the sole risk and cost of the contractor. The contractor shall also pay for all damages caused by or incidental to the work in whatever manner occasioned and shall indemnify the N.D.M.C from any liability in respect thereof, and the amount of any claim made upon it in consequence of such damages by the contractor, which it may have to pay, shall be deducted by the Engineer-in-charge from any money due to or may become due to the contractor.

14. The contractor shall not occupy or obstruct by his operations more than one half of the width of any road or street at any one time. However, in unavoidable conditions the contractor shall obtain the consent of the Engineer-in-charge in writing before closing any road to vehicular traffic and the foot walks shall be kept clear at all times. The contractor shall at his own expense and charges, provide and maintain in good working condition all fencing, boarding, strutting, diversions, barricades, cautionary signs, signals, speed limit boards, red and green flags and red light at night with sufficient number of chowkidars and other safety measures while the work is in progress or blocking or cutting roads and laying pipe lines or where ever otherwise necessary and all enclosures for materials or T & P on works, for protection of public and proper guidance of traffic. The signs set up shall be of approved design and of reflector type if so desired. Temporary warning lamps installed at all barricades during the hours of darkness shall be kept lit at all times. The contractor shall also provide suitable passage ways over the trenches for access to various buildings, roads and service lanes etc.

In case the contractor fails to comply with the aforesaid arrangements, the same shall be made by the Engineer-in-charge at the risk and cost of the contractor.

15. The contractor shall store materials, whether brought by the contractor or supplied by the N.D.M.C., keep the T & P, install water & power system, electrical and mechanical equipment and construct all temporary structures etc. on the site only at places approved by the Engineer-in-charge. Should such places be required by the Engineer-in-charge for any other purposes, the contractor shall clear the places within such time as may be instructed by the Engineer-in-charge. In case of default, the same shall be got cleared by the Engineer-in-charge at the risk and cost of the contractor.

16. Temporary access to the site: The contractor shall provide on-site temporary access to the site and shall alter, adapt and maintain the same as required from time to time and shall take up and clear them away as and when no longer required and as and when ordered by the Engineer-in-charge and make good all damages done to the site.
17. The contractor shall be bound to bear the expenses of defence of every suite, action or other proceedings at law that may be brought by any person for injury sustained or damages to any property, whatsoever, which may arise out of or in consequence of the construction and maintenance of works owing to neglect of the proper precautions and to pay any damages and costs which may be awarded in such suite, action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by such person. He shall also indemnify and keep indemnified the N.D.M.C against all damages and costs consequent upon such claims arising from any such injuries or damages to person(s) or property.

18. All other provisions remaining unchanged, the contractor shall be allowed to pitch tents only as per the instructions of the Engineer-in-charge in place of huts (now not allowed) of walls and roofs of prescribed specifications for labour and other alike structures, temporary or otherwise including sanitary arrangements, as per the provisions of Model Rules and Fair Wage Clause.
19. **Income tax deductions:** Income tax, as applicable under the Income Tax Rules framed from time to time by the Govt. of India, at the prescribed rates shall be recovered from each bill of the contractor.

19 A. **GST Tax deductions**: GST applicable under Govt. of India at the prescribed rates shall be recovered from each bill of the contractor.

19 B. **Cess @ 1%** of the cost of construction/ work incurred by an employer for the purpose of Building and other Construction workers (Regulation of Employment and conditions of service) Act 1996 shall be deducted at source from the Bills of the Contractor/firms (if Applicable).

19 C. The contractor has to submit a certificate along with copies of returns submitted to the Department of GST that up to date returns have been filed by him/ them.

19 D "The goods, including for works contract, shall be supplied by bidder or its authorized distributor in Delhi and against a sale invoice issued from Delhi. The delivery of goods shall also be made from Delhi. The bidder dealer or its authorized distributor, as the case may be, who supplies the goods should be registered with the GST Department and carry a valid Tax Identification Number issued by it. The bidder shall, however, be responsible for compliance with all conditions, warranties/ guarantees, irrespective of the fact that the goods are supplied by him directly or through its authorized distributor. Further, the quoted bid price in the tender shall be inclusive of all taxes and duties. The Pre-authorized agencies shall also ensure the following:

Delivery of good is made against a sale invoice issued from Delhi. The Dealer supplying good should be registered with the GST Department and carry a valid Tax Identification Number issued by it.

20 Treasure, trove, fossils, etc.: All fossils, coins, articles of value or antiquity, any structures and other remains or things of geological and archaeological interest discovered on the site shall be absolute property of the N.D.M.C and the contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing, shall

immediately upon discovery thereof and before removal acquaint the Engineer-in-charge with such discovery and carry out the Engineer-in-charge's directions as to the disposal of the same.

21 Arrangements for electric connection: The contractor shall make his own arrangements for obtained electric connection, if required, and make necessary payments directly to the department concerned.

22. **Cutting of C.I. Pipes:** The damaged portion of the cracked C.I. pipes, if issued from the N.D.M.C stores, shall be cut at a point 15 cm. beyond the visible extremity of the crack and cracked portion received from the stores plus 15 cm shall be treated as C.I. scrap. No claim for cutting of C.I. pipes, carriage of cracked portion from the stores and returning back the scrap to the stores shall be entertained.

23. The costly parts such as spindles of valves etc. shall be removed by the contractor from the valves and kept in his safe custody and the same shall be re-fixed before completion of work or as and when desired by the Engineer-in-charge. No claim on this account whatsoever shall be entertained.

24. The contractor shall submit, if desired, samples, drawings, equipment characteristics and capacity data etc. of equipment, accessories, devices etc. that he proposes to use in the installations (if any) to the Engineer-in-charge for approval.

25. Provision of appliances at site: The contractor shall provide and maintain at his own cost appliances at site in good working condition required for conducting tests at site such as balance, set of standard sieves and dial type thermometer etc. complete as per requirements of the Engineer-in-charge in order to enable the Engineer-in-charge or his representative to conduct field tests etc. to ensure that the quality of work is in accordance with the prescribed specifications.

26. Potholes and depressions shall be repaired at least one day prior to surfacing of the road.

27. The contractor shall remove all bitumen spots on kerbs and channels and all heaps of wasted mix from gully gratings, bell mouths and other interception arrangements at the end of day's work failing which the same shall be got removed by the Engineer-in-charge at the risk and cost of the contractor.

28. Conditions for building and allied works:

(a) Whenever recessed fittings are required to be provided, the contractor shall keep necessary recesses in building work during its execution itself failing which the contractor shall make all such recesses, grooves etc. and make good the damages at his own cost unless otherwise specified in the schedule of quantities.

(b) The Engineer-in-Charge shall require, where he may deem so necessary, to provide grooves of approved pattern between various surfaces such as timber/ plaster, concrete or exposed concrete/ brick work, ceilings/ wall, skirting/plaster, between contractor's rates for various items are deemed to include the cost of making such grooves.

(c) For concrete and RCC work, no extra payment shall be made for leaving recesses, holes and other openings for services and finishing them to correct sizes and making sunk positions or troughs for carrying pipes or fixing other fittings, marking RCC members of different shapes and thick nesses as per drawings, embedding hooks, suspenders, dowels, clamps holts, pipe sleeves etc. as directed, leaving slits, grooves, rebates and drip moulds in required positions, providing holes for embedding railings, protecting fresh concrete against damage by rain, making brackets of required shapes, laying concrete to different slopes, cambers and curves, allowing other authorizes agencies (if any) to work simultaneously for completing their part of the work and

resetting minor displacements in form work or reinforcement after other agencies have completed their part of the work.

(d) The structural and architectural drawings (if any) shall be properly correlated at all time before executing any work Architectural requirements shall be fully satisfied in those items where specific mention is made 'Architect's Drawings', 'Architect's Design', 'Architect's Approval', etc. In addition, for finishing items samples shall be prepared for prior approval before starting the work on these items.

29. The aforesaid conditions shall be read and construed as forming integral part of contract.

Engineer-in-Charge
Executive Engineer (SPECIAL PROJECT)

ADDITIONAL CONDITIONS

1. The contractor shall get himself registered as per section – 7 of the building and other construction workers (Regulation of Employment and Conditions of Service) Act, 1996 and all the workers employed on the work shall be registered as beneficiary as per section – 12 of the said act before release of payment.
2. The contractor shall properly maintain Register of Beneficiaries, Health Register, Register of Wages / Muster Roll and Report of Accident as per various forms under the Delhi Building and Other Construction Workers (Regulation of Employment and conditions of service) Rules, 2002.
3. Advance payment in no case shall be more than **20%** of the tendered amount in construction work. If the bill not submitted by the agency within stipulated time period after receiving the advance payment, then **15% PA** simple interest shall be levied for the default period.
4. In all the precast units to be used in the work i.e C.C Interlocking Pavers, Kerb stones & Slabs etc., Ordinary Portland Cement (OPC) conforming to IS:269-2015 (part - I) shall be used.
5. The contractors should have valid labour license under Sec-12(1) of the contract labour (regulation and abolition) Act 1970.
6. Contractors shall have to provide the P.F. Nos. and E.S.I Account Nos. of Casual/ Contract workers. Up-to-date proof of payment through ECS or NEFT to the labour employed at the said work must be produced before preparing passing and dispersing each bill of work.
7. All building rubbish and dismantled unserviceable material shall be disposed off at recycling plant of MCD for construction and demolition work at Delhi. Proof of disposal of malba at said plant shall be produced before preparing each bill.
8. Contractor will deploy required Labours (Skilled or unskilled) on wages as per Clause 19 as amended from time to time and accordingly make payment of E.P.F. & E.S.I and claim for reimbursement for the same from Engineer-in-Charge. On actual basis subject to for maximum strength as per DAR applicable.
9. Engineer-in-Charge may be ensured that the lowest bidder furnishes either copy of registration or proof of applying for obtaining registration with EPFO and ESIC contractor for such tender called for out sourced services. No payment shall be made to contractor/ agency till copy of registration with EPFO and ESIC is submitted by the contractors from the date of issue of letter of acceptance.
10. Junior Engineer-in-Charge of work shall certify and establish that all labours deployed in work have been paid all wages through ECS/NEFT/ ON LINE/ by payee Cheque by the agency/ contractor.
11. In Running Bill payments, the provisional rates shall be payable for the Deviated Quantities, Extra items, and Deduction items subject to final approval of rates from Competent Authority.
12. The Contractor have to submit an Undertaking while applying of grant of extension of time, that **"I/we will not claim any damages on account of additional expenses incurred and losses suffered on Staff, Overheads, Establishment including T&P etc., whether the extension of time shall be granted without levy or with levy of compensation".**
13. Necessary recoveries shall be made from the contractor running bill as per Govt. Notification, Orders issued time to time.

14. Reimbursement of any tax shall be made as per the guide line of Govt. of India issued from time to time.

15. Third party quality assurance and auditing is to be carried out from the empaneled agencies as approved by the Competent Authority.

Contractor

Executive Engineer (Special Project)

SPECIAL CONDITIONS

1 The materials to be used for installation are clearly mentioned in the Schedule of quantities. Any material make required apart from the mentioned makes in SOQ shall be used from the approved list attached in NIT. If any material to be used is not mentioned in above both mentioned details, prior approval of Engineer-in-charge shall be must.

2 All material brought at site in bags or containers / drums must be permanent marked, signed with date by authorized agent of contractor or contractor himself, J.E-in-Charge, A.E-in-Charge of work, Engineer-in-Charge of the work.

3 It should be ensured by agency that labours deputed by the agency should not deface the permanent marked portion by agency, J.E, A.E & E.E.

4 Material & Empty Drums and Bags must be in safe joint custody of agency and the department at all times. No recovery of empty drums and bags should be made from the agency.

5 The original vouchers/ invoices of purchase of material with detailed description regarding lot and batch number and date of manufacturing and packing by the manufacturer and duly signed by agency must be submitted with EE-in-charge and attested copies of same to J.E & A.E-in-charge of the work.

6 The bidder shall be ready for providing site and factory visit in order to ascertain the capability before opening of bids and to check the status of manufacturing of items during the execution.

7 Operation and maintenance during defect liability period of one year shall be responsibility of the agency and nothing extra on this account shall be paid to the agency / Contractor.

8 Dismantled material received from site will be issued to agencies as per the rate given below:
   a) Hard rock / stone @ **Rs. 1100/- cum**
   b) Old bricks @ **Rs. 2500/- per 1000 Nos.**
   c) MS Steel @ **Rs. 22/- Kg**

9 Specialized works as defined in Section 3.1.3 of CPWD manual 2019, Annexure 6 shall be executed through specialized agencies.

10 The Ready mixed concrete of approved brand/ make shall be provided by the contractor at site without any extra charges.

11 Agency should provide office space for NDMC field staff without any additional cost as per approved plan.

12 In partial modification of clause – 17 of the conditions of the contract for work. 10% security deposit of the water proofing shall be released in **10 years guarantee period** span with releasing **10% of security deposit every year** from the date of completion i.e. guarantee on water proofing work. The security deposit shall be released after the water proofing treatment is found satisfactory and the decision of Engineer-in-charge in this regard shall be final and binding.

13 **GUARANTEE:** The contractor shall furnish a guarantee bond on the prescribed Performa on non-judicial stamp paper of Rs. 100/- for the successful functioning of water proofing treatment for a period of ten years from the date of completion.

Executive Engineer (SPL. PROJ)

SPECIAL CONDITIONS FOR USE OF RECYLED PRODUCT OF C &D WASTE

1. It is mandatory to use manufactured aggregate (recycled concrete aggregate/ recycled aggregate) and recycled products as per items in schedule of quantities of this work.

2. Manufactured aggregate (recycled concrete aggregate/recycled aggregate) and recycled products shall be procured by the contractor from any of the recycling plant of presently functional at Burari, Shastri Park and Mundka or any other recycling plant in NCR, as per directions of engineer-in-charge.

3. No extra payment shall be made to the contractor for the cartage of the manufactured aggregate (recycled aggregate) and recycled products from recycling plant to the site of work.

4. Manufacture aggregate (recycled concrete aggregate/ recycled aggregate) and recycled products shall be procured by the contractor specifically for the execution of the items of the work. Proper receipt/ acknowledgement, mentioning, Agreement no, Name of work, Department and date of Procurement shall be submitted by the contractor along with each and every bill.

5. Test certificate for the conformity of the manufactured aggregate (recycled concrete aggregate/ recycled aggregate) and recycled products with relevant IS code/ CPWD Specifications shall be obtained by the contractor from the recycling plant from where the material would be procured and the same should be submitted to the Engineer-in-charge for further quality tests etc. by Engineer-in-charge. The contractor shall be responsible for conformity of the quality of material as per IS Codes/ CPWD Specifications.

6. Contactor shall dispose of all building rubbish received from the site of work to **C & D Waste Recycling Plant at Burari or as approved by Engineer-in-Charge.** The cost of recycling of building rubbish/ charges deposited by the Contractor at the recycling plant will be reimbursed to the agency after submission the receipt of the same with name of work, agreement number and name of agency clearly mentioned on the receipt.

Executive Engineer (SPL. PROJ)

SPECIAL CONDITION OF N.G.T.

1. The Contractor shall not store/ dump construction material or debris on metaled road.

2. The contractor shall get prior approval from Engineer-in-Charge for the area where the construction material or debris can be stored beyond the metaled road. This area shall not cause any obstruction to the free flow of traffic/ inconvenience to the pedestrians. It should be ensured by the contractor that no accident occurs on account of such permissible storage.

3. The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/ area using CGI sheets or plastic and/ or other similar material to ensure that no construction material dust fly outside the plot area.

4. The contractor shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/ or are carrying construction material like cement, sand and other allied material are fully covered. The contractor shall take every necessary precaution that the vehicles are properly cleaned and dust free to ensure that during carriage to their destination, the dust, sand or any other particles are not released in air/ contaminate air.

5. The contractor shall provide mask to every worker working on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.

6. The contractor shall provide all medical help, investigation and treatment to the workers involved in the construction of building and carry of construction material and debris relatable to dust emission.

7. The contractor shall ensure that C & D waste is transported to the C & D waste site only and due record shall be maintained by the contractor.

8. The Contractor shall compulsory use the wet jet in grinding and stone cutting.

9. The contractor shall comply all the preventive and protective environmental steps as stated in the MoEF guidelines, 2010.

10. The contractor shall carry out on-Road-Inspection for black smoke generating machines. The Contractor shall use cleaner fuel.

11. The Contractor shall ensure that all DG sets comply emission norms notified by MoEF.

12. The Contractor shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20 kmph. Speed bumps shall be used to ensure speed reduction. In cases where speed reduction cannot effectively reduce fugitive dust, the contractor shall divert traffic to nearby paved areas.

13. The Contractor shall ensure that the construction material is covered by tarpaulin. The contractor shall take all other precaution to ensure that no dust particles are permitted to pollute air quality as a result of such storage.

14. No concrete or construction or repairing works will be done at least within one-meter radius of the truck of trees.

15. There shall be no concretization of the tree within one meter of their circumference.

16. Wherever because of the width of the road/ pavement division it is not possible to provide one meter around the trees than it is liberty to the field officers to permit lesser dimension commensurate with space available at site in the special circumstances only but if shall be ensured that tree have sufficient area for receiving the water and air to its roots.

Executive Engineer (SPL. PROJ)

SPECIAL CONDITION FOR READY MIXED CONCERETE

1 The contractor will submit material test certificate of manufacturer and GSTIN No. of manufacture of original bills of respective items for specific work to Engineer-in-charge.

2 The contractor will submit certificate with supporting document regarding complete set up of testing laboratory with testing equipment and tools etc. as per ASTM/ DIN/ BIS/ NABL or as per manufacture's specification applicable for conducting necessary and mandatory test.

3 The contractor will submit regarding test certificate of manufacturer, that full tests were conducted during production of respective item as per relevant code if applicable.

4 For RMC – lot wise original bill/ tax invoice of receptive RMC branded producer as per list approved from whom they procure RMC for specific work to Engineer-in-charge.

5 The agency has to submit all GST Registration no. of dealers/ manufactures/Suppliers of raw material in sequence chain method and relevant transaction nos.

Executive Engineer (SPL. PROJ)

SPECIAL CONDITIONS FOR CEMENT

1) The contractor shall procure 43 grade **Ordinary Portland cement** conforming to IS 269/2015 as required in the work, form reputed manufacturers of cement as per 'List of Preferred Makes of Materials for Civil Works' as approved by Engineer-in-charge.

The tenderers may also submit a list of names of cement manufacturers which they propose to use in the work. The Engineer-in-charge reserves right to accept or reject name(s) cement manufacturer(s) which the tenderer process to use in the work. No change in the tenderer rates will be accepted if the tender accepting authority does not accept the list of cement manufactures, given by the tenderer, fully or partially.

The supply of cement shall be taken in 50Kg. bags bearing manufacturer's name and ISI marking. Samples of cement arranged by the contractor shall be taken by the Engineer-in-Charge and got tested in accordance with provisions of relevant BIS codes. In case the test results indicate that the cement arranged by the contractor does not conform to the relevant BIS codes, the same shall stand rejected, and it shall be removed from the site by the contractor at his own cost within a week's time of written order from the Engineer-in-charge to do so.

2) The cement shall be brought at site in bulk supply of approximately 10 ton or as decided by the Engineer-in-charge. The cement godown of the capacity to store a minimum of 500 bags of cement or as decided by the Engineer-in-charge shall be constructed by the contractor at site of work for which no extra payment shall be made.

3) Double lock provision shall be made to the door of the cement godown. The keys of one lock shall remain with the Engineer-in-Charge or his authorized representative and the keys of the other lock shall remain with the contractor. The contractor shall be responsible for the watch and ward and safety of the cement godown. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-Charge at any time.

~~4)~~ The cement provided by the contractor with the Manufacture's Certificate and shall be got tested by the Engineer-in-Charge (if required) and used on the work as per direction of Engineer in Charge. The contractor shall supply free of charge the cement required for testing including its transportation cost to testing laboratories. All expenditure to be incurred for testing of samples e.g. packaging, sealing, transportation, loading, unloading etc. including testing charges shall be borne by the contractor.

5) The actual issue and consumption of cement on work shall be regulated and proper accounts maintained as provided in Clause 10 of the contract. The theoretical consumption of cement shall be worked out as per procedure prescribed in Clause 38 of the contract and shall be governed by conditions laid therein. In case the cement consumption is less than theoretical consumption including permissible variation, recovery at the rate so prescribed shall be made. In case of excess consumption, no adjustment need to made.

6) The cement brought to the site and the cement remaining unused after completion of the work shall not be removed from site without the written permission of the Engineer-in-Charge.

7) The damaged cement shall be removed from the site immediately by the contractor on receipt of a notice in writing from the Engineer-in-Charge. If he does not do so within 3 days of receipt of such notice, the Engineer-in-Charge shall get it removed at the cost of the contractor.
Chief Engineer may change the brand of Cement depending upon availability in local market, if needed. Instructions in this respect can be issued by them at regular intervals. The name of manufacturers should be finalized after taking into consideration the suggestions of contractors during pre-bid meeting, if any.

Executive Engineer (SPL. PROJ)

SPECIAL CONDITIONS FOR STEEL

1) The contractor shall procure IS marked TMT bars of various grades from the Steel Manufactures such as SAIL, RINL, TATA, JSW, JSPL, THERMOCON, SRMB, RIPL(GK-TMT) or any other Primary Producer of Steel as per IS: 1786-2008.

2) For reinforced cement concrete or pre-stressed concrete works, the reinforcement bars shall consist of the following grades conforming to IS:1786: 2008 (Indian Standard specification for high strength deformed steel bars and wires for concrete reinforcement): Fe 415, Fe 415D, Fe 415S, Fe 500D, Fe 500S and Fe 550D.

3) The contractor shall obtain manufacture's certificate stating the process of manufacture, chemical composition and test sheet giving result of each mechanical test applicable to the material purchased and submit it to the Engineer in charge. Each test certificate shall indicate the number of the cast to which it applies, corresponding to the number or identification mark to be found on the material.

4) The Engineer in charge or his authorized officer shall get each consignment tested for both chemical composition and physical properties (including bend and re-bend test) as specified in IS:1786 from NABL accredited laboratory or any Government Laboratory.

5) Samples shall also be taken and got tested by the Engineer-in-Charge as per the provisions in this regard in relevant BIS codes. In case the test results indicate that sample of steel does not conform to BIS codes, the same shall stand rejected and shall be removed from the site of work by the contractor at his own risk and cost within a week's time from written orders from the Engineer-in-Charge to do so and no payment whatsoever in this regard shall be made by the Department.

6) The steel reinforcement shall be brought to the site in bulk from manufacturers along with test certificate of each lot supply of 10 tonnes or more or as decided by the Engineer-in-Charge.

7) The steel reinforcement shall be stored by the contractor at site of work in such a way as to prevent distortion & corrosion and nothing extra shall be paid on this account. Bars of different sizes and lengths shall be stored separately to facilitate easy counting and checking.

8) For checking nominal mass, tensile strength, bend test, re-bend test etc. specimen of sufficient length shall be cut from each size of the bar at random at frequency not less than that specified below:

Size of bar	**For consignment below 100 tonnes**	**For consignment above 100 tonnes**
Under 10mm dia bars	One sample for each 25 tonnes or part thereof	One sample for each 40 tonnes or part thereof
10mm to 16 mm dia bars	One sample for each 35 tonnes or part there of	One sample for each 45 tonnes or part thereof
Over 16mm dia bars	One sample for each 45 tonnes or part there of	One sample for each 50 tonnes or part thereof

9) The contractor shall supply free of charge the steel required for testing including its transportation to testing laboratories. The cost of tests shall be borne by the contractor.

10) The actual issue and consumption of steel on work shall be regulated and proper accounts maintained as provided in clause 10 of the contract. The theoretical consumption of steel shall be worked out as per procedure prescribed in clause 38 of the contract and shall be governed by conditions laid therein. In case the consumption is less than theoretical consumption including permissible variations recovery at the rate so prescribed shall be made. In case of excess consumption, no adjustment need to be made.

11) The steel brought to site and the steel remaining unused shall not be removed from site without the written permission of the Engineer-in-Charge.

12) The contractor shall furnish to the department all the purchase invoices for Steel for every consignment.

13) The contractor should use factory made round type cover blocks for all RCC works to avoid displacement of bars in any directions and to ensure proper cover

Executive Engineer (SPL. PROJ)

LIST OF PREFERRED MAKES OF MATERIALS FOR CIVIL WORKS

Brands names of materials (Refer materials which are applicable for the scope of work) and finishes for use in work are listed below. This list is indicative but not exhaustive. However, approved and equivalent materials and finishes of any other specialized firms may be used subject to approval of the alternate brand by the Engineer-in-charge (See also condition of contract).

S. No.	Materials	Preferred Make
1.	ACP	ALSTONE, VIRGO, ALSTRONG, ALDEKO, REYNOARCH
2.	ACRYLIC/PLASTIC EMULSION	RANGOLI ACRYLIC EMULSION OF BERGER MAKE, BEAUTY GOLD OF KANSAI -NEROLAC MAKE, APCOLITE ACRYLIC EMULSION OF ASIAN PAINT
3.	ACRYLIC EXTERIOR PAINT	SONWCRYL XT OR SNOWCEM PAINT, WEATHERCOAT SMOOTH OF BERGER PAINTS, WEATHER SHIELD OF ICI PAINTS, APEX OF ASIAN PAINT
4.	ADHESIVE	PIDILITE, SIKA, THERMOSHIELD, DUNLOP, VAMORGANIC, ALDEKO, MAKPHALT, ALSTONE
5.	ALLUMINIUM DOOR / WINDOW/ FITTINGS	CLASSIC, ISI MARKED, ETERNIA
6.	BITUMEN	INDIAN OIL, HINDUSTAN PETROLEUM
7.	BALL VALVES	ZOLOTO, IBP, ARCO
8.	CERAMIC TILES	JOHNSON, SOMANY, KAJARIA, BELL CERAMICS, NITCO, VITERO, JOHNSON
9.	C.P. BRASS FITTINGS/ BATH FITTINGS	JAGUAR(CONTINENTAL), KINGSTON(ELTA), PLATO, SHAKTI, CONTINENTAL
10.	C.I. DOUBLE FLANGED SLUICE VALVES	KIRLOSKAR, IVC, BURN
11.	C.I. MANHOLES COVERS	B.C., RIF
12.	CPVC PIPE	SUPREME, PRINCE, FINOLEX, ASHIRVAD
13.	CC PAVERS/ CHEQURED/ PRECAST CONCRETE TILES	HINDUSTAN, DALAL, TERRAFERMA, SUSHMA. NITCO-(ROCKARD), BHARAT-(NILSAN) REGENCY
14.	CEMENT	ACC, ULTRATECH, J.K. SUPER, SHREE CEMENT, AMBUJA, JAYPEE CEMENT, CENTURY CEMENT, BIRLA, UTTAM, VIKRAM, & J.K. CEMENT
15.	DECORATIVE LAMINATE	MARINO, CENTURY, GREENLAM, ALSTONE
16.	D.I. PIPES AND FITTINGS	TATA, JINDAL, ELECTROSTEEL
17.	FALSE CEILING/ GRID SYSTEM/ BAFFEL/ GRG/ MINERAL FIBER CEILING TILES	ARMSTRONG, ANAKON, DIAMOND CEILING, GYPROC (SAINT GOBAIN), USG BORAL.
18.	FLUSH DOOR	ARCHID PLY, JAIN DOOR PVT. LTD., SWASTIK, LAXMI WOOD, ALSTONE
19.	GLASS/ FLOAT GLASS	MODI FLOAT, SAINT GOBAIN, ASAHI INDIA
20.	G.I. PIPES	TATA, JINDAL (HISSAR)
21.	G.I. FITTINGS (MALLEABLE CAST IRON)	UNIK, ICS OR ANY OTHER ISI MARKED
22.	GUNMETAL VALVES	LEADER, SANT, ZOLOTO
23.	HYDRAULIC DOOR CLOSER/ FLOOR SPRING	HARDWYN, GODREJ, YALE
24.	LA(CI) PIPES	RIF, NECO
25.	LAMINATES	FORMICA, GREENLAM, BAKELITE HYLAM, VIRGO, ALSTONE
26.	LOCKS/LATCH	GODREJ, HARRISON, PLAZA, GOLDEN, YALE, KICH
27.	MIRROR	ATUL, MODIGUARD, SAINT GOBAIN
28.	NON METALIC SURFACE HARDNER	MC DERITOP F.H.
29.	NUTS, BOLTS AND	KUNDAN, PRIYA, ATUL

	SCREWS, STEEL	
30.	OIL BOUND WASHABLE DISTEMPER	BERGER MAKE, KANSAI-NEROLAC MAKE, TRACTOR BRAND WASHABLE, ASIAN PAINTS, MAXILITE OF ICE-
31.	PLASTIC EMULSION PAINT	ASIAN, BERGER, ICI, DULUX
32.	PRELAMINATED PARTICLE BOARD	CENTURY PLY, KITLAM, ECOBOARD, MERINO, NOVOPAN
33.	PRECAST C.C. COVER DRAIN/ MANHOLE	KKMG, NIMCO, HINDUSTAN, TERRAFERMA, ACME
34.	PVC WATER STORAGE TANK	SINTEX, POLYWELL, SHEETAL, LOTUS, SPL
35.	POLY CABONATE SHEET	GE PLASTIC POLYGAL
36.	POLY-SULPHIDE/ SILICON SEALENT	PIDILITE, TUFFSEAL, CHOKSEY CHEMICALS, FOSROC
37.	PRECOATED GALVANIZED IRON PROFILE SHEET/ TUBE	TATA, JINDAL ESSAR STEEL, JYOTI
38.	R.C.C. PIPES (NP-2)	PRAGATI, LAKSHMI, SOOD & SOOD, JAIN SPUN PIPES, INDIAN HUME PIPE CO. SPUN PIPE CO., SEMENTIA, JAIN & CO.
39.	RMC	ACC, ULTRATECH, LAFARGE, RMC INDIA, NDCON, V.K. RMC
40.	STRUCTURAL STEEL SECTIONS	TATA, SAIL, RINL, JINDAL STEEL AND POWER LTD. and JSW STEEL LTD., APOLLO, JYOTI
41.	STAINLESS STEEL SECTIONS	NILKANTH, NIRALI, CORBA, PRAYAG
42.	STAINLESS STEEL SINKS	NILKANTH, NIRALI, CORBA
43.	S.S. STAIRCASE RAILING	JINDAL STAINLESS STEEL LTD., ICICH INDUSTERIES, ESSAL
44.	SOIL, WASTE & VENT PIPES & FITTINGS (CENTRIFUGAL CAST IRON)	NECO, RIF, BIC, SKF, RPMF (Only ISI/BIS marked product of any of above brand may be accepted)
45.	STONEWARE PIPE & GULLY TRAPS	PERFECT, PARRY, Any ISI marked
46.	SMC STORAGE PANEL TANK	SINTEX, BINANI, DEVI POLYMERS
47.	SYNTHETIC ENAMEL PAINT	BERGER, NEROLAC, ASIAN, ICI, DULUX
48.	TILE ADHESIVE/ BLOCK ADHESIVE	CICO, PIDILITE, BULWORK, REYNO, BASE X
49.	UPVC WINDOW/ DOOR	FENESTA, REHAU, POLYWOOD, OKOTECH, ALSTONE
50.	UPVC HARDWARES	KINLONG, GEZE, EBCO, DNV GLOBAL, ROTO, DORMA
51.	VITRIFIED TILES	GRANITO, KAJARIA, JOHNSON (MARBONITE), VITERO, VERMORA
52.	VITREOUS CHINA SANITARY WARE (W.C./ WASH BASIN)	HINDWARE, CERA, PARRYWARE
53.	WHITE CEMENT	J.K. WHITE.
54.	WATER PROOFING COMPOUND	TAPCRETE, CICO, ACCOPROOF, IMPERMO, SIKA, FOSROC, MC BAUCHEMI, REYNO
55.	WATER-PROOF CEMENT PAINT	SNOWCEM, ASIAN, BERGER
56.	WATER PROOFING MEMBRANE-APP (ATACTIC POLYPROPYLENE POLYMER)	SIKA INDIA, IWL INDIA LTD., PIDILITE, SHALIMAR SEAL AND TAR PRODUCTS (P) LTD., BENGAL BITUMEN
57.	WPC WATERPROOF BOARD	ALSTONE

58.	WPC DOOR FRAME	ALSTONE, ECOSTE, HARDYPLAST
59.	WPC DECORATIVE JALI	ALSTONE, ECOSTE, HARDYPLAST
60.	WALL PUTTY	BASE X, JK CEMENT .

Executive Engineer (Special Project)

ELECTRIC WORK

SPECIAL CONDITIONS

1. The entire Site where the work has to be executed, must be visited by the contractor before quoting the rates.
2. The work shall be carried out strictly in accordance with CPWD works manual/ specification and also confirm to requirement of Indian Electricity Rules in force as amended up to date.

3. The works executed by the Contractor shall at all times be open for inspection of Engineer in Charge or his authorized representative at his works/factory.
4. The contractor shall arrange all tools, ladders, scaffolding etc. including their cartage to and fro within quoted rates. Nothing will be paid extra on this account.
5. The works executed by the contractor shall be under his charge/custody until they are completely handed over to the department after recording completion of the work.

6. No compensation for any damage caused to the works or materials by rain, flood or other natural calamities shall be paid to the contractor. It is the responsibility of the contractor to keep all the materials under lock and key and to provide security for that. The contractor has to bear the complete cost to repair/replace the damaged work/material.

7. All the materials to be provided & fixed for the work will be first checked by the Engineer-in-charge.
8. All the material/T&P required will be arranged by the contractor himself.
9. Necessary precaution required for the man-power shall have to be taken by the contractor himself.
10. NDMC shall not be responsible in case of any mis-happening during execution of work.
11. Any work not mentioned in the schedule of work and which is essentially required for the completion of the work, has to be completed by the contractor within the quoted amount.

Nothing extra will be paid for such works.

12. Any damage done to the building during the execution of electrical works shall be made good immediately by the electrical contractor to the satisfaction of Engineer-in-Charge at his own cost. Any expenditure done by the department in this connection shall be recoverable from the contractor and decision of Engineer-in-charge about recovery shall be final.
13. During the execution of work, all related civil work has to be done by the contractor at their own end.
14. No advance shall be paid against material and payment shall be made as per Terms & Conditions or after entire completion of works.
15. The work shall be carried out according to approved drawings however the department reserves the right to change the layout as per requirements at site.
16. Good workmanship is an essential requirement for compliance with the rules and specifications.
17. The entire installation shall be at the risk and responsibility of the contractor until these are tested and handed over to NDMC.
18. Notwithstanding the schedule of quantity, all items of inter-related work considered necessary to make installation complete and operative deemed to be included shall be provided by the contractor at no extra cost.
19. The materials to be supplied by the NDMC have to be lifted/shifted from NDMC store to sites by the contractor at his own arrangement. Noting extra will be paid for the same.

20. All the required material/ equipments etc shall be procured/ installed by the contractor only after the approval of engineer in-charge from the attached list of makes.
21. Use of electricity involved in the work, the same will be provided by the department for testing purpose.
22. The defect liability period will be for one year after commissioning/handed over of the work, hence Bank guarantee in lieu of performance guarantee shall remain stand for defect liability period. The security deposit and Bank guarantee shall be released after satisfactory completion of Guarantee Period. The security deposit shall be deducted from the first running / final bill, however it will be ascertained that 7.5% of bill amount must be reserved in the form of P.G. and S.D.
23. All the statutory clearance if required from the Government Offices shall be obtained by the bidder.
24. Mode of payment:

a) 75% of the cost of material brought at site in good condition on pro-rata basis & as assessed by Engineer-in-charge.
b) 15 % of the contract amount after completion of installation in all respect.
c) Balance 10% of the contract amount after testing, commissioning, trial run and handing over to deptt. for beneficial use.

25. Completeness of tender:

All sundry equipment, fittings, unit assemblies, accessories, hardware items, foundation, bolts, termination lugs for electrical connections, and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work shall be deemed to have been included in the tender irrespectively of the fact whether such items are specifically mentioned in the tender documents or not.

For item/equipment requiring initial inspection at manufacture's works the contractor will intimate the date of testing of equipments at the manufacturer's works before dispatch. The department also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make the arrangements for the same. The successful tenderer shall give sufficient advance notice regarding the dates proposed for such tests/inspection to the department and facilitate the same. The travelling, lodging charges and necessary arrangement etc. required for the inspection shall be on the part of tenderer. The separate storage accommodation shall be provided by the department. Watch and ward of the stores and their safe custody shall be the responsibility of the contractor till the final taking over of the installation by the department.

Executive Engineer (E)

Construction Division-III

SPECIAL CONDITION

GENERAL

The Special Conditions of Contract are an extension of and are to be read in conjunction with the General Conditions of Contract

2.0 SCOPE OF WORK

Following is the scope of work included in this Tender:

Inetrnal & External Electrification works including installation of HT Panels, Transformers, LT Panel, Bus Duct, BBT, Lighting fixtures, cables and Cable Trays etc (As per enclosed BOQ & Specs.)

Conduiting and Wiring for Lighting and Power Sockets complete with accessories and fitting as required

Installtion of Transformers, HT/ LT Panel and sub panels etc complete with accessories and fitting as required.

Installation of lighting fixtures and Switch sockets (Normal/Modular)

Installation of Bus duct, BBT & cable tray complete with accessories and fitting as required.

Installation, testing and commissioning of the entire installations to the satisfaction of Consultant and Local Authorities.

Applying, Liaison & obtaining NOC for the installations from Local Authorities (If any) including all expenses required for the purpose.

Maintaining the installation minimum for a period of 1 year from the date of commissioning/ virtual completion, whichever is later, and imparting training to the workers/staff of the complex as asked for, Maintaining the installations as per IS requirement and exercising Test drills as asked for by the client/Local Authorities.

3.0 INSTALLATION SCHEMATIC

The installation shall confirm to as per latest NBC 2016, IS and IEC nad Main Single Line Diagram. Tender drawings attached along with Tender Papers.

Since the Agency, executing the job is responsible for obtaining the NOC from the Local Service Authorities, deviation, if any, with respect to the scheme and drawings attached may be brought out clearly in the Tender Paper while quoting for the job.

4.0 Time - Essence Of Contract

The time allowed for carrying out the Work as entered in the tender shall be strictly observed by the Contractor and shall be deemed to be of the essence of the Contract and shall be reckoned from the date of issue of LOI + 10 days Mobilization time. The Work shall proceed with due diligence up to Final Completion. The Contractor shall prepare a Construction Programme with time schedule keeping in view the completion period stipulated for specific portions of the Work and also the overall completion time and submit same for the approval of the Project Manager and the Owner’s Representative. The Contractor shall comply with the time schedule as approved by the Project Manager and the Owner’s Representative. In the event of the Contractor failing to comply with the overall and individual milestones contained in the time schedules, he shall be liable to pay liquidated damages as provided for in this Contract.

INSPECTION AND TESTING OF MATERIALS

The Contractor shall, if so required, produce manufacturers' test certificates for any particular batch of materials supplied by him. The tests carried out shall be as per relevant Indian Standards and shall be carried out at Government approved test facility specified by the Project Manager. NO PAYMENT SHALL BE MADE WITHOUT TEST CERTIFICATE OF THE ITEM. For checking setting out

and testing materials at the Site the Contractor shall provide the following minimum testing equipment:

Clip-on Ammeter and voltmeter

1000 V Meggar and 5 KV Meggar

Steel tapes of various lengths

Spirit Level

Hydraulic Crimping Tool

Earth Testing Meggar

Pipe bending Tool, thread cutting die, bench vice etc.

Cable jointing kit

The Contractor shall provide at least four permanent benchmark at site which shall be preserved till the completion of works. These are essential for laying of cables at correct levels.

All such equipment shall be calibrated at specified frequency for accuracy at a Testing Facility approved by the Project Manager and calibration certificates will be submitted to the Project

DRAWINGS

Contract / Tender Drawings duly signed by the Architect / Consultants are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the direction of the Project Manager and with the prior approval of the Project Manager

Architectural drawings shall take precedence over Electrical drawings, which in turn shall take precedence over services drawings in regard to all dimensions.

The Contractor shall verify all dimensions at the Site and bring to the notice of the Project Manager discrepancies if any; the Project Manger's decision in this respect shall be final.

SHOP DRAWINGS

The Contractor shall submit, during the currency of the project, to the Project Manager four (4) copies of all shop drawings for Architect/Consultant approval. Shop drawings shall be submitted generally for the following :-

Showing any changes in layout in the Electrical drawings.

Equipment layout, piping and wiring diagram.

Manufacturer or Contractor's fabrication drawings for any materials or equipment supplied by him.

All the shop drawings shall be prepared on computer through AutoCAD software. Within 7 days after the issue of award of the contract and initial set of working drawings, the contractor shall furnish to the Project Manager, for the approval of the Architect / Consultant, four sets of detailed shop drawings of all equipment and materials as required by the Architect / Project Manager.

Each item of equipment / material proposed shall be a standard catalogue product of an established manufacturer strictly from the List of Approved Makes and Manufacturers listed in the attached tender documents.

Shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any materials to allow Architect / Consultant ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved programmed.

Manufacturers drawings, catalogues, pamphlets, equipment characteristics data, performance charts and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contractor.

Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any deviation in piping, wiring or any other part of the mechanical, electrical or architectural layouts; he shall inform the Project Manager well in advance and no delays resulting from such re-design shall be admissible. He shall also submit all related information as may be required for such redesign to the Architect / Project Manager.

Where the work of the contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Project Manager, the contractor shall prepare composite working drawings and sections at 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 work of other trades, he shall make all the necessary changes without extra cost to the Owner / Project Manager.

Within four weeks of approval of all the relevant shop drawings, the contractor shall submit four copies of a comprehensive variation in quantity statement, and itemized price list of recommended (by manufacturers) imported and local spare parts and tools covering all equipment and materials in this contract. The Project Manager shall make recommendation to Owner for acceptance of anticipated variation in contract amounts and also advise the Owner to initiate action for procurement of spare parts and tools at the completion of project.

COMPLETION DRAWINGS & STANDARD MEASUREMENT BOOK (SMB)

On completion of the work, the contractor shall submit three (3) complete sets of the site produced drawings and marked up prints of ‘AS BUILT’ drawings verified and approved by the Architect to the Project Manager. These drawings shall include and show all the changes / deviations made from the working drawings during the course of construction and also the other details as called for by the project

manger. During the execution of the Works a set of drawings shall be retained in the Contractor's site offices for the exclusive purpose of recording changes made to the Work as the construction proceeds. The drawings shall be prepared on computer through AutoCAD Software and provided to the Project Manager on CD.

Along with the completion drawings the Contractor shall also prepare and submit to the Project Manager the Standard Measurement Book (SMB) in the form of a bound book and a soft copy of the same. SMB shall incorporate the standard measurements of the item as per the completion / as built drawings in modules finalized in consultation with the Project Manager.

7.0 CONTRACT DRAWINGS

Drawings forming part of the Contract are listed below. Further supplementary drawings furnished by the Project Manager from time to time shall also be deemed to form part of the Contract.

8.0 TESTING OF INSTALLATIONS

The Contractor shall perform all such tests as may be necessary and required by the Project Manager to ensure quality of the executed works and by local authorities to meet Municipal and other bye-laws, regulations in force. The Contractor shall provide all labour, equipment, and materials etc., required for the performance of the tests.

9.0 SITE INFORMATION

All information, levels and dimensions given in the tender drawings relating to Site conditions are given in good faith; the Contractor shall, however, make his own independent inquiries and verify the same. Any claims for extras on account of any deviations or incorrectness of above referred information, levels etc., shall be considered as in admissible. The Contractor shall obtain all information relating to local regulations, by-laws and all regulations applicable to the work or applicable profession. Any claims in this regard shall be inadmissible.

10.0 SITE INSTRUCTION FILE

The Contractor shall maintain a Site order book / instruction file at the Site office. All instructions received from the Project Manager relating to the Work shall be retained in the file.

12.0. PHOTOGRAPHS

Besides submitting progress charts, reports, etc., the Contractor shall submit progress Photographs as directed by Project Manager, in triplicate along with negatives.

13.0. PROFESSIONAL INTEGRITY AND TEAM SPIRIT:

It is the intent of the Owner and the Project Manager that this Project will be executed in a spirit of teamwork and full professional integrity. The Contractor shall fully co-operate with all agencies concerned to fulfill this objective. Special conditions of contract

14.0 QUALITY ASSURANCE AND CONTROL PROGRAMME:

The Contractor shall establish an effective quality control system at the Site and implement the same through an independent team consisting of the Contractor's Representative and qualified and experienced engineers and technical personnel to enforce quality control on all items of the Work and the Project at all stages.

15.0 CONTRACT DRAWINGS

Drawings forming part of the Contract are listed in page 189. Further supplementary Drawings furnished by the Project Manager from time to time shall also be deemed to form part of the Contract.

16.0 ENTRY TO THE SITE

The Project Manager, at his discretion has the right to issue passes to control the admission of the Contractor, his agents, employees and work people to the Site of the Work or any part there of. Passes shall be returned at any time on demand by the Project Manager.

17.0 FIRE PRECAUTIONS

The Contractor shall take all precautions and preventive measures against fire hazards at the Site and shall assume full responsibility for the same.

18.0 DRILLING, CUTTING OF WATER PROOFING MEMBRANEETC

All cutting and drilling of walls or other elements of the building for the proper entry / installation of inserts, boxes, equipment etc., shall be carried out using electrically operated tools only. Manual drilling, cutting, chiseling, etc shall not be permitted. No structural member shall be cut or chased without the written permission of the Project Manager. Cutting and drilling of structural members shall be carried out using vibration free diamond wire sawing and diamond drilling only with prior permission from the Project Manger. The costs for procurement and using such equipment are deemed to be included in the Contract and no extra costs will be paid.

No walls terraces shall be cut for making and opening after waterproofing has been done without written approval of Project Manager/ Architects. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/ cutting is made fully waterproof as per specifications and details of waterproofing approved by Architects.

19.0 ASSOCIATED CIVIL WORKS / STORES

All civil works required for the storage of materials or the installation of equipments and any other requirement for the contractor’s functioning shall be the responsibility of the contractor at his own risk & cost.

CONTRACTOR’S RATES

Rates quoted in this tender shall be inclusive of cost of materials, labour, supervision, erection, tools, plant, scaffolding, service connections, transport to site, all taxes, Octroi and levies, breakage, wastage and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.

Rates quoted are for all heights and depths and in all positions, leads & lifts etc. as may be required for this work.

All rates quoted are inclusive or cutting holes and chases in walls and floors and making good the same with cement mortar/concrete/ water proofing of appropriate mix and strength as directed by Project Manager. Contractor shall provide holes, sleeves, recesses in the concrete and masonry work as the work proceeds.

The Contractor shall furnish the Architects with vouchers & test certificates to prove that the materials are as specified and to indicate that the rates at which the materials are purchased in order to work out the rate analysis of non-tendered items, which he may be called upon to carry out.

SITE CLEARANCE AND CLEANUP

The contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.

After the fixtures, equipment and appliances have been installed and commissioned, contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discoloration leaving the same in a ready to use condition.

On completion of all works, contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done at Contractor’s risk and cost.

1. LT PANEL TECHNICAL SPECIFICATIONS

MEDIUM VOLTAGE SWITCHBOARD PANELS

SCOPE

The vendor scope shall be design, manufacturing, supply, supervision for testing and commissioning of LT Panels as per IS 8623-1 for Power & Motor Control Center for Voltages up to 1000 V.

STANDARDS

The equipment's covered under this specification shall conform to the latest revisions of relevant Indian and International Standards some of which are listed below.

IS 5	:	Colors for ready-mixed paints and enamels.
IS 375 / 1963	:	Making & arrangement for switchgear, Busbars, main connections & auxiliary wiring
IS 694	:	PVC insulated cables for working voltages up to & including 1100V
IS 13779	:	A.C. Static Electricity Meters
IS 1248	:	Electrical Indicating instruments
IS 1567 / 1960	:	Metal clad switches (Current rating not exceeding 100A)
IS 1951 / 1916	:	Polyvinyl chloride sleeve for electric purposes
IS 2147 / IS 12063	:	Degree of protection provided by enclosures for low voltage switchgear and control gear.
IEC 60947 / IS 13947 (Pa 2)		A.C. Circuit Breakers
IS 8828	:	Miniature Circuit Breakers
IS 12640	:	Residual Current Operated Circuit Breakers
IS 2448 / 1962	:	Adhesive insulating tapes
IS 2551	:	Danger Notice Plates
IS 2705	:	Current Transformers
IS 2208 / 1962	:	HRC Cartridge fuses links up to 650 Volts
IEC 60947 / IS 139 (Part-4, Sec-1)	:	Contactors & motors starter for voltages not exceeding 1000 V AC or 1200 V DC
IS 13947 (Part-5, Sec-	:	Control Circuit Devices and Switching Elements

1)		
IS 13947 (Part-1 & 5)	:	Indicators

IEC 60947 / IS 13947 (Pa 3)	:	Switch Disconnectors Fuse, Changeover Switches
IS 3043	:	Code of practice for earthing
IS 3072	:	Installation and Maintenance of switchgear
IS 3231/ IS 8686	:	Electrical relays for power system protection
IS 4237	:	General requirements for switchgear & control gear for voltages not exceeding 1000 V
IS 6875	:	Switches and push-buttons
IS 10118	:	Code of practice for selection, installation and maintenance of switchgear and control gear
IS 8623 (Part–1)	:	Specification for factory built assemblies of switchgear and control gear for voltages up to & including 1000 V AC

General

Medium voltage power control centers (generally termed as switchboard panels) shall be in sheet steel clad cubicle pattern, free floor standing type, totally enclosed, compartmentalized design. This specification shall cover three types of panels, viz a draw out design incorporating air circuit breakers, one incorporating air circuit breaker as incoming and combination fuse switch as out- goings, non-draw out design shall be in standard full size or three-fourth or half size panels incorporating air circuit breakers shall either be in single tier or in two tier arrangement depending upon the rating of the breaker. The panels shall be of extensible type with provision of bus bar extensions.

Construction

Switch board panels or power control centers of free standing type shall have a bus bar chamber at the top and the cable compartment at the bottom depending upon the specific requirements of the job. The space between the bus chamber and cable compartment shall be suitably compartmentalized to accommodate either air circuit breakers or switch fuse feeders of various ratings. The cable terminations shall be carried out on the rear side of the panels for which adequate space and clamping arrangements shall be provided. Where panels have to be installed with very little access space at the rear, the cable terminations shall be carried out in suitable cable alleys provided on the front of the panel. All the live parts shall be properly

shrouded with Bakelite barriers. Arrangements and marking of bus bars, main connections and wiring shall be in accordance with IS: 5578 - 1985 and IS: 11353 - 1985 .

The structure of the panel shall be robust and provided with adequate bracing to withstand the operation of the equipment and stresses due to system short circuit. The panels shall be fabricated out of best quality heavy gauge 2.0 mm thick CRCA. The panel shall be machine pressed with punched openings for meters, indicating lamps etc.

Dimensions

All power control centers shall have dimensions not more than that given on the layout drawings. Panels arranged side by side shall have the same height and depth. The height of the panel should be limited to 2400mm. All the operating levers, handles etc. of the heights unit shall not be at a height more than 1.7 mtr. For all incoming cables a removable gland plate will be provided in the panel and a minimum distance of 300mm will be provided between the gland plate and the nearest terminal for proper dressing and termination of the cable. All the components of a module will be mounted on a component plate using the machine screws and taped holes (excepting the components mounted on the door). These component plates should be fixed with bolts for easy replacement. Standardization will be adopted while making these plates so that the component plates of the same size modules can be changed from one module to another. In case of panel of lengths more than 4 meters the fabrication of any single section will be limited to a maximum length of 3 mtr. for the purpose of shipping and shifting at the site. These sections will be assembled at the location of installation with the help of nuts and bolts. While making these sections consideration will be given to the place of sectionlisation and select the location where the minimum electrical connections are transferred from one section to another. All the hardware used in the assembly will be electroplated for protection and neat appearance.

Bus Bars

The bus bars shall be suitable for 4 wires, 415 volts, 50 Hz, system. The bus bar shall be made of high conductivity grade electrolytic copper and at the time of joining of two copper buses tinning will be done on the copper strips ends to a length equal to the lap length of the joint plus one each. The bus bars shall have uniform cross section throughout. The bus bars shall be capable of carrying the rated current at 415 volts continuously. The bus bar will run in a separate busbar chamber using bus insulators made of non deteriorating, vermin proof, non hygroscopic materials such as epoxy fiber, reinforced polyester or moulding compound. The interval between the two insulators will be designed after considering:

Strength and safe load rating of the insulator,

The vibrating force generated during a fault,

A Factor of safety of 1.8

A set of insulators at both ends of the bus.

The bus size calculations must be approved by the consultants. The bus bars shall be designed to withstand a temperature rise of 45° above the ambient. To limit the temperature rise in the bus bar chamber a set of louvers can be provided at strategic places considering the air circulation. The louvers provided will have a brass wire mesh covering from inside with more than 100 openings per sq. inch. The overall temperature of bus bar shall not exceed 85°C. A current density of 0.8 Amp / Sq.mm for aluminium and 1.3 Amp/ Sq. mm for copper shall not be exceeded for bus bars.

All the bus bars shall be insulated with PVC heat shrinking sleeves suitably throughout (except at joints) the length. The Electro galvanized high tensile steel nuts, bolts, plain or spring washers of suitable size will be used in connecting the various section of the bus bar. A minimum of 1.6 times the width of bus bar will be the lapping length of each joint.

Earthing

The panels shall be provided with an aluminium earth strip running through out the length of the switchboard. Suitable earthling eyes/bolts shall be provided on the main earthing bus to connect the

same to the earth grid at the site. Sufficient number of star washers shall be provided at the joints to achieve earth continuity between the panels and the sheet metal parts.

Mountings

Panels incorporating switch-fuse units shall have suitable compartments of standard width. Each compartment shall incorporate a heavy duty load break switch-fuse and HRC fuses. Suitable cable termination arrangement shall be provided for switch-fuse unit feeders. Equipment shall be provided with proper fastening arrangements to ensure vibration free operation. Proper designation as given on the respective drawings shall be provided for every equipment.

Circuit breakers shall be mounted such that they are accessible from the front of the panel. More than two circuit breakers shall not be incorporated in a vertical section. The breaker compartment shall be divided into two parts, one for the breaker and the other for incorporating associated control gear. The necessary instrumentation shall be provided on the door of the compartment. Protection relays and KWH meters shall be fixed on the rear side of the panels.

Interlocking

The panels shall be provided with the following interlocking arrangement.

The door of the switch-fuse compartments is so interlocked with the switch drive or handle that the door can be opened only if the switch is in `OFF' position. De-interlocking arrangement shall also be provided for occasional inspection.

It shall not be possible for the breaker to be withdrawn when in `ON' position.

It shall not be possible for the breakers to be switched on unless it is either in fully inserted positions or for testing purposes in fully isolated position.

The breaker shall be capable of being raked in to `testing' `isolated' and `maintenance' positions and kept locked in any of these positions.

A safety latch to ensure that the movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle shall be provided.

Protection & Instrumentation

Protection and instrumentation shall be as per standard specifications.

Wiring

All the interconnecting between the incoming, bus and the outgoing of 100 A and above rating shall be done by insulated Aluminium/copper strips of suitable sizes. Switch-fuse and equipment below 100 A rating shall be wired with insulated copper conductors. The wiring for instrumentation protection and control equipment shall be carried out with insulated flexible copper conductors. The power interconnecting shall be carried out by means of pressure clamps, special washers, etc. The wiring shall be terminated by using crimping sockets. Wiring shall be laid out neatly in bunches which are firmly fastened to the steel members of the panel. When the wiring is crossing from fixed parts to moving parts such as door etc. the wires will be run in PVC sleeve of suitable size. Under no

circumstances the wiring should be under any kind of stress. All the potential circuits shall be protected by fuses mounted near the tap-off point from the main connections.

Terminals

All the control, instrumentation and protection wiring shall be provided with printed PVC ferrules at both ends. For terminating control cables on to the equipment in the panels suitable terminal blocks shall be provided. The terminal shall also be numbered for easy identification and maintenance.

Surface treatment

All sheet metal accessories and components of power control centers and switchboard panels shall be thoroughly cleaned, degreased, derusted, rinsed and hot-dip phosphatised before drying and doing red oxide primer. After this, it shall be spray finished with a primer, oven dried and spray painted with finish paint, 2 coats wet on wet. Then it shall be baked in oven to achieve a uniform, smooth and tough film. The painting shall be with synthetic enamel stoving grade to a final overall dry film thickness of 50/60 microns

Enclosure

The panel enclosure shall be totally dust and vermin proof and shall be suitable for indoor installation. All the cubicles will have front located, outward opening lockable doors having hidden hinges and a bolted back cover both using no deteriorating neoprene/rubber gasket. Enclosure design shall be in accordance with degree of protection IP 54 as per IS 13947-1993.

Name plate

The panel as well as the feeder compartment doors shall be provided with name plate giving the switchboard/feeder descriptions as indicated on the drawings.

Testing

The power control centers shall be tested at factory after assembling of all components and completion of all inter- connections and wiring. Tests shall be conducted in accordance with the requirements of BS:3659 and 3185/IS: 8623-1993.

Insulation Test

Insulation of the main circuit, that is, the insulation resistance of each pole to the earth and that between the poles shall be measured.

Insulation resistance to earth of all secondary wiring should be tested with 1000 volt meggar.

Insulation test shall be carried out both before and after high voltage test.

High Voltage Test

A high voltage test with 2.5 KV for one minute shall be applied between the poles and earth. Test shall be carried out on each pole in turn with the remaining poles earthed, all units raked in position and the breakers closed. Original test certificate shall be submitted along with panel.

Storing, Erection and Commissioning

The panels shall be stored in a well ventilated, dry place, suitable Polyethylene covers shall be provided for necessary protection against moisture.

Erection

Switch boards shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturer. The foundation shall be flat and level. Suitable grouting holes shall be provided in the foundation. Suitable MS base channel shall be embedded in foundation on which the panel can be directly installed. The switch boards shall be properly aligned and bolted to the foundation by atleast four bolts. Cables shall be terminated on the bottom plate or top plate as the case may be, by using brass compression glands. The individual cables shall then be led through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. The switchboard earth bus shall be connected to the local earth grid.

Pre-commission Tests

Panels shall be commissioned only after the successful completion of the following tests. The tests shall be carried in the presence of Architect's / Consultants representative.

All main and auxiliary bus bar connections shall be checked and tightened.

All wiring termination and bus bar joints shall be checked and tightened.

Wiring shall be checked to ensure that it is according to the drawing.

All wiring shall be tested for insulation resistance by a 1000 volts meggar.

Phase rotation tests shall be conducted

Suitable injection tests shall be applied to all the measuring instruments to establish the correctness and accuracy of calibration and working order.

All relays and protective devices shall be tested for correctness of settings and operation by introducing a current generator and an ammeter in the circuit.

MEDIUM VOLTAGE AIR CIRCUIT BREAKER

General

Air circuit breakers shall be incorporated in power control center and motor control centers wherever specified. ACB shall conform to IEC 60947 PART I &II AND IS 13947 PART I & II in all respects. ACBs shall be suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply.

The breaker shall comply with the Isolation function requirement of IEC 60947 section 7.12 and marked as Suitable for Isolation / disconnection function to ensure safety of operating personnel.

The breaker shall provide CLASS – II front facia. All circuit breakers can be reverse fed without reduction in performance.

Type and construction

Air circuit breakers shall be of moulded case design with trip free operating mechanism. Air Circuit breakers shall be with drawable type with horizontal drawout carriage. The ACBs shall be strong and robust in construction with suitable arrangement for anchoring when in fully engaged or fully drawn out positions. The carriage or cradle on which the breaker is mounted shall be of robust design made of fabricated steel, supported on rollers. Cradle shall also comprise of main and secondary separable contacts and all drawout mechanisms in a completely fig welded assembly. There shall be no dependence upon the panel board frame for any critical alignment. The withdrawal arrangement shall be such as to allow smooth and easy movement.

All ACBs accessories shall be front fitted type. All the releases like U/v, Shunt and Closing coils shall be rated for Continous operation.

All 4 pole ACBs shall be capable of setting neutral protection to N or N/2 to ensure precise neutral protection.

In case 3Pole ACB are offered based on application, it shall still be possible to protect the neutral by providing an external CT.

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. The contact tips and arc chutes shall be suitable for ready replacement. Self aligning isolating contacts with automatic shutters to screen the live parts shall be provided. The design of the breaker shall be such that all the components are easily accessible to inspection, maintenance and replacement.

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 shall be "handle 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, in to the disconnected position. A flush mounted manual trip shall be provided on the front of the panel. The breaker shall also be provided with a hand reset automatic trip indicator. All breakers will have switching ON and OFF time of less than 4 cycles.

There shall be mechanical indication on the front panel for “Ready to Close” situation for the ACB by checking all interlockings. ACB shall be convertible from manual to electrical at site.

Interlocking and safety arrangement

Air circuit breakers shall be provided with the following safety and interlocking arrangements:

It shall not be possible for breaker to be withdrawn when in `ON" position.

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.

The breaker shall be capable of being raked in to `testing' isolated and maintenance positions and kept locked in any of these positions.

A safety latch to ensure that the movement of the breaker, as it is withdrawn is checked before it is completely out of the cubicle.

The operating mechanism shall provide for raking the breaker in to connected, test and disconnected positions without opening the compartment door.

Mechanical interlocks will be provided between the operation of different breakers with the help of individually unique and matched castle key-locks (if specifically asked for).

Protections

ACB should be provided with Thermal Magnetic, or micro processor based releases as mentioned in the specifications or Bill of Material.

(i) Micro Processor based Release.

The microprocessor releases unit shall be provided on circuit breaker for Long time (Over Load), Short time (Short Circuit) and earth fault protection all with adjustable setting and adjustable time delay by dial. Releases shall also have instantaneous protection, true RMS sensing with EMC/EMI Compatibility.

The micro-processor release should be self-powered type without any auxiliary power supply during normal operation of the breaker.

The circuit breaker control unit shall measure the true r.m.s value of the current.

Thermal Memory: When the breaker shall re close after tripping on overload, then the thermal stress caused by the overload if not dissipated completely, shall get stored in the memory of releases and this thermal memory shall ensure reduced tripping time in case of subsequent overloads and earth fault. Realistic hot/cold curves shall take into account the integrated heating effects to offer closer protection to the system. Breaker shall have facility of zone selective interlocking as a standard without need of an external power supply.

Thermal Magnetic Trip Unit

Breaking capacity should be minimum 65KA upto 3200A. Breaker shall be of category B & Ultimate braking capacity Icu should be equal to service breaking capacity Ics.

The over current relay shall be of thermal type.

It shall be bimetal based and be integrated as part of the circuit breaker.

The over current relay shall be connected with epoxy coated CT.

The over current relay shall have a wide adjustment range (50 –100%) to allow flexibility of the setting on site.

The short circuit release should have the following characteristics:

It should be direct acting type. Instead of sensing through a CT it should sense the current directly.

It should be possible to have phase wise indication of fault operation for short circuit release.

There should be a provision of resetting the release after every short circuit fault to have antipumping feature.

Earth fault release should have the following characteristics

Current setting should be available from 02.In to 0.6In

Time delay from instanteneous to 1 second should be possible with various steps in between.

MOULDED CASE CIRCUIT BREAKERS

General

Moulded case circuit breakers shall be incorporated in the switch board wherever specified. MCCB shall conform to the latest IEC 60947-Part 1&2 & IS 13947:1993 in all respects.

They shall be of Category A with a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu).

Rated insulation voltage shall be 750V AC (50/60 Hz).

MCCB shall be suitable either for single phase AC 230 Volts or three phase 415 volts. Suitable discrimination shall be provided between upstream and down stream breakers in the range of 10-20 milli seconds.

The circuit breaker shall comply with the isolation function requirement of IEC 60947-2 section

7.1.2 to marked as suitable for isolation/disconnection to facilitate safety of operating personnel while the breaker is in use.

MCCBs shall be available in fixed or plug in / with drawable version as well as in 3P & 4P version. A safety trip shall provide advanced opening to prevent connection and disconnection of a closed circuit breaker.

The MCCB shall provide class II insulation between the front and internal power circuit. It should be suitable for reverse fed.

All MCCBs required as per BOQ shall have Ics=100% Icu, with following minimum service breaking capacity requirements.

Construction

The MCCB cover and case shall be made of high strength heat-resistant and flame retardant thermosetting insulating material, operating handle shall be quick make/quick break. The operating handle shall have suitable `ON' `OFF' and `TRIPPED' mechanical indicators notable from outside. Three phase MCCBS shall have a common operating handle for simultaneous operation and tripping of all the three phases.

MCCB shall be equipped with a “push to trip” button in front to test operation and the opening of poles. MCCB should provide instantaneous protection feature in event of high value short circuit current independent of thermal magnetic or electronic trip unit.

Contact

Contact tips shall be made of suitable arc resistant, sintered alloy for long electrical life. Terminals shall be of liberal design with adequate clearances.

Accessories

MCCB shall be provided with the following accessories, if specified in schedule of quantities.

Under voltage trip

Shunt trip

Alarm switch

Auxiliary switches

All the accessories shall be rated for continuous operation. These Auxiliaries shall be common for the similar type and range of MCCBs

It should be possible to equip MCCBs with a motor mechanism for electrically controlled operation.

Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

Handle interlock to prevent unnecessary manipulations of the breaker.

Door interlock to prevent the door being opened when the breaker is in ON position.

Defeat-interlocking device to open the door even if the breaker is in ON position.

The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable short circuit pick-up. Where earth fault protection is indicated they shall be integral and have adjustability from 20% to 100% of rated current with adjustable time delays.

The trip command shall override all other commands. The MCCB shall employ maintenance free double break contract system to minimise the let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables (with test certificates) and let-through energy curves. Line and Load connections shall be interchangeable.

Testing

Original test certificate of the MCCB as per IEC 60947-1 &2 or IS13947 shall be furnished.

Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

SWITCH FUSE UNITS AND MEASURING INSTRUMENTS

General

Switch-fuse units shall be incorporated in the switchboard panels wherever specified. The switches will conform to the requirements of IEC 947.1 and IEC 947-3 & IS 13947 part 1 and part 3. Switch- fuse unit shall be suitable for 415 Volts, 3 phase, 4 wire, 50 HZ, AC supply.

Construction & Operation

The unit housing shall be of robust/Modular construction designed to withstand arduous conditions encountered in the electrical system. Sheet materials used for switch-fuse enclosure shall be given a rigorous rust proofing treatment before it is fabricated and painted. Unit shall preferably have double break per phase in order to isolate fuse links when the switch is in OFF position.

The switch operating mechanism will ensure rapid opening and closing (operator independant) and will conform to §2-12 of IEC 947-3. The closing of all poles, including the neutral, will be simultaneously as required by IEC 947-3.

To ensure positive contact indication as described in IEC 947-3 § 7-2-7

The operating handle will only indicate the O (OFF) position if the main contacts are actually separated. They will be achieved by design of the operating mechanism.

The switches will be designed to be locked on the OFF position by padlock (with locking in the ON position possible)

Fuses should be isolated from both sides. Construction should prevent the possibility of live outgoing when incoming is live but there is no fuse mounted on the switch.

These auxiliary contacts will be common with all of the range.

The auxiliary contacts can easily be mounted on site without taking out any part like side plate etc. and disturbing the mechanism.

The electrical endurance will be that of category A. It will correspond to an AC23 operational category without a current derating at 415V ac for ratings up to 630A.

Fuse should be stationery during the switch operation.

Phase barriers for all switches should be available as standard. Terminal shield up to 63A should be available as standard. For higher ratings provision for fitment should be available.

Length of operating shaft should be adjustable continuously. This feature should come as a standard. The switches should be able to take Aluminum termination.

Fuses

The units shall contain fuse base and carriers for accommodating HRC units. HRC fuse units of specified rating.

In case it is required it should be possible to convert a switch from BS type fuse holder to DIN type fuse holder and vice versa at site.

Operating mechanism

The operating mechanism of the unit shall be crisp and positive in action with quick-make, quick- break silver plated contacts. The operating handle shall be suitable for rotary operation unless otherwise specified. Position of the handle such as 'ON `OFF' shall be clearly indicated. Operating handle shall be of retractable type.

Contact system should have self wiping feature. Separate arcing and current carrying zone to be provided for better thermal performance throughout the life of the switch

Contact system should be designed in such a way that during high short circuit fault current the contact pressure increases and switch can withstand the fault. In no circumstances there shall be any repulsion between the contacts during short circuit.

Shrouding

All the live parts inside the switch-fuse units shall be shrouded to prevent any accidental contact.

Terminals

All the terminals shall be liberally designed. All the units above 100 A shall be provided with integral cable socket.

Interlocking

All switch-fuse units shall be provided with suitable interlock such that the door of the switch board panels shall not open unless the switch is in 'OFF' position. Provision for padlocking the switch in 'OFF' position shall be also provided.

Testing

Routine and type test shall be conducted as per IS: 13947. The original test certificate shall be furnished.

Pre-commissioning tests at the site as per standard specification shall be conducted before commissioning

METERING, INSTRUMENTATION AND PROTECTION

General

The specifications hereinafter laid down shall cover all the meters, instrumentation 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 and drawings.

Instrument Transformers

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 1 KV. Current transformers shall have rated primary current, rated burden and class of accuracy as specified in the schedule. However, the rated secondary current shall be 5 A. unless otherwise specified. The acceptable minimum class of various applications shall be as given below :

For energy Measuring: Class 0.5

Protection : Class 10 p.

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 35 MVA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identification of poles. Current transformers shall be provided with earthing terminals for earthing chassis frame work and fixed part of the metal casing (if any). Each CT shall be provided with rating plate indicating the following :

Name and make

Serial Number

Transformation ratio

Rated burden

Rated voltage

Accuracy class

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CTs 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.

Potential transformers

Potential transformers shall be provided if specifically called for. Potential transformers shall comply with the requirements of IS: 3156 (Part-I, II & III) in all respects.

Measuring Instruments

General

Direct reading electrical instruments shall be in conformity with IS: 1248. The accuracy of direct reading shall be 1.0 for voltmeters and 1.5 for ammeters. Other types of instruments shall have accuracy of 1.5. The errors due to variations in temperature shall be limited to a minimum. The meters shall be suitable for continuous operation between -100C & + 50°C. All meters shall be of flush mounting type with 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. Instrument 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.

Ammeters

Ammeters shall be of moving-iron type. The moving part assembly shall be with jewel bearings. 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 5 A secondary of instrument transformation.

Voltmeters

Voltmeter shall be of moving iron type. The range for 400 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.

Wattmeter, Frequency meters, power factor meters

Wattmeter : Wattmeter shall be of three phase, Electro-dynamic type, suitable for use with current and potential transformers associated with the particular panel. Wattmeter shall be provided with a maximum demand indicator.

Power factor meters :Polyphase power factor meters shall be of Electro-dynamic type with current and potential coils suitable for operation with current transformers and potential transformers associated with the particular panel. The scale shall be calibrated for 50% lag - 100% - 50% lead readings. Phase angle accuracy shall be + 40.

Energy meters and reactive power meters :Trivector meters shall be two element, integrating type kilowatt-hour, KVA, Kilovolt - ampere - hour reactive meters. The meters shall conform to IEC - 170 in all respects. Energy meters, KVA and KVARH meters shall be provided with integrating registers. The registers shall be able to record energy consumption of 500 Hours

corresponding to maximum current at the rated voltage and unity power factor. These meters shall be suitable for operation with current and potential transformers associated with the particular panel.

Trivector meter shall be digital type,

Relays

General

Protection relays shall be provided wherever required to trip and isolate the particular section under fault. All the relays shall be adjusted and coordinated for proper range of the particular circuit or equipment. Relays shall be provided with flag type indicators to indicate the cause of tripping. The flag indicators shall remain in position until they are reset by hand reset.

Relays shall be designed to make or break the normal circuit current with which they are associated. The relay contacts shall be of silver or platinum alloy. The contacts shall be designed to withstand repeated operation without damage. The relays shall be of draw-out type to facilitate testing and maintenance. The draw-out case shall be dust tight with a finish suitable for tropical country. The relays shall be capable of disconnecting faulty section of network or faulty equipment without causing interruption or disturbance to the remaining sections. The analysis of setting shall be made considering relay errors, pick-up and overshoot errors and shall be submitted to the Engineer/Architect for approval.

Over current relays

Over current relays shall be induction type with inverse definite minimum time lag characteristics. The over current relays shall be provided with adjustable current and time settings. The setting for current shall be 50-200% in step of 25%. The IDMT over current relays shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 amperes.

Earth fault relay

Earth fault relay shall have current setting of 10% to 40% in steps of 10%, otherwise, the earth fault relays shall conform to specification laid down for over current relays.

Under Voltage Relays

Under voltage relays shall be induction type and shall have inverse limit operation characteristic, with pick up voltage range of 50 - 90% of the rated voltage.

Testing

Instrument transformers shall be tested at factory as per IS:2705& IS:3156. The test shall incorporate the following :

type tests

Routine tests

Original test certificates in triplicate shall be provided.

Meters shall be tested as per IS: 1248. The tests shall include both type tests and routine tests. Original test certificate in triplicate shall be furnished.

a) Suitable injection tests shall be applied to the secondary circuit of every instrument to establish the correctness of calibration and working order.

b) All relays and protective devices shall be tested to establish correctness of setting and operation by introducing a current generator and an ammeter in the circuit.

2. DIESEL GENERATOR SET

GENERAL

The diesel generator set shall consist of AC alternator of required capacity coupled to a suitable capacity diesel engine with all accessories and controls such as starting devices, lubricating arrangements, speed control, cooling arrangement, exhausting arrangement, automatic control devices, protection gear, instrumentation etc. as required and specified hereinafter.

DESCRIPTIONS AND SCOPE OF SUPPLY:-

Supply, Installation, Testing and commissioning of 2 Nos.750 kVA DG Sets.

The work involves supply installations, testing and commissioning of DG sets complete in all respects as per specification & BOQ.

The work will involve on turnkey basis designing and construction of foundation by contractor including fixing of fuel piping, exhaust gas system and the connected civil engineering works involved during the erection.

Arrangement of all manpower including material and facilities required for installation and commissioning of DG Set shall have to be arranged by the contractor/supplier including unloading of DG Set and placement at site.

The complete DG Set shall conform to ISO 8528 and when fully installed and commissioned shall be completely functional and deliver rated output as per ISO-8528 at ISO reference condition. The “Guaranteed Parameters” of the engine as per Schedule-I duly filled in shall be submitted as part of the offer.

The DG Set shall be capable of continuous working under following ambient condition:-

A Altitude Not exceeding 1000 meters above sea level B Maximum temperature of air 50 degree C at air intake

C	Average relative humidity	98%

The DG Set shall include –

Diesel Engine

Silencer unit in the exhaust circuit

Fuel tank with fuel piping

Governor

Alternator

Engine Instrument Panel

Power Cable

CONCOMITANT ACCESSORIES:-

The set shall be accompanied by following accessories whose cost shall be included in the basic price of the unit.

Acoustic enclosure if ask in Schedule of quantity /BOQ

Auto-main failure panel (AMF) unit complete If ask in Schedule of quantity/BOQ

OPTIONAL ACCESSORIES IF ASK IN SCHEDULE OF QTY /BOQ:-

Contractor must also quote separately for supply and laying of PVC/XLPE insulated. PVC Sheathed, armoured power cable with aluminium conductors per meter length conforming to IS 1554 (PT.I) 1976/IS 7098 Part-I

Contractor must quote separately for supply, installation and commissioning of Switchgear and control panel. The rate quoted shall be in per no. basis.

Recommended spares for 2 years. The rates shall be quoted per DG set basis.

Recommended tools. The rates shall be quoted per DG set basis.

Any other accessories, which in the opinion of the tenderer, can contribute to better performance, should be explained in the offer and price should be quoted separately.

THE TOTAL VALUE OF THE OFFER WILL BE CALCULATED BASED ON –

The cost of basic machine

The cost of the concomitant accessories according to tender specification.

Cost of any other offered accessory treated as concomitant accessory in addition to other factors, like applicable duties and taxes, insurance freight, installation and commissioning, training etc.

ALTERNATOR

This specification covers the design and manufacture of 3 phases, 50 Hz, 415 V, synchronous generators suitable for coupling to Diesel Engines.

Scope

Alternator shall be brush less type conforming to IEC 60034 with 1.0% voltage regulation under all load conditions shall be of self-exciting, self-regulating type in SPDP enclosure and suitable for 415 volt, 3 phase 4 wire 50 HZ. AC system with neutral point. It shall be directly coupled with engine by means of flexible coupling. The alternator shall be provided with Automatic Voltage Regulator (AVR).

Voltage Regulation: ± 1.0 % of rated voltage from no load to full load

Enclosure; IP-23

insulation; Class “H”

Permissible over load: 10% for one hour in 12 hours of duration.

Codes and Standards

Unless they are in variance with the clause of this Specification, the synchronous generators and their components shall comply with the latest edition of the applicable standards listed below:

BS-2613: The electrical performance or rotating electrical machinery. IEC-34-1: Rotating electrical machines.

IS-4722: Specification for rotating electrical machines. BS-4999/: All applicable parts of BS-499/200 5000

IEEE-115: Test procedure for synchronous machines. VDE-0530: Rotating electrical machines.

Performance Requirement

Operating Condition

Generator shall be suitable for operating in maximum ambient temperature of 45°C, an altitude not exceeding 1000 meters above mean sea level and P.F. of 0.8. The power output shall be valid for above. The generator shall operate satisfactorily under sudden load rejection (up to full load). For sudden load application, vendor shall indicate the limits in percentage of rated load.

Voltage Adjustment Range

The generator terminal voltage shall be adjustable with a continuously variable trimmer potentiometer. The adjustment range shall be 5% of the nominal voltage with a possible extension to 10% as optional if required.

Transient Voltage Performance

The dip or rise in voltage during load variations shall be dependent only on the leakage voltage drop of the machine which shall therefore be kept to a minimum.

In case of sudden application of full load at rated power factor, the voltage drop shall not exceed 20% depending on speed and size of generator. The rated voltage shall be restored within 0, 3-0, 8 Sec. depending on the size of the machine. Generators shall be equipped for surge currents when relatively large squirrel cage motors are switched on directly.

This may be achieved by over-dimensioning the machine and a special winding design. Under extreme conditions special design work shall be carried out on the magnetic circuit.

Voltage Stability

At power factors 0.1 inductive to 1 the voltage stability shall be approximately ñ 1% between no load and full load. The voltage regulator shall be dimensioned so that the voltage regulation of ñ 1% is maintained even in case of load independent speed variation by 3%.

The voltage regulator shall have sufficient power reserve to compensate for the differing exciter requirements between cold and hot alternator and exciter.

Waveform

Harmonic Content, Distortion Factor

The geometric dimensions of the magnetic system shall be designed in such a way that the harmonic content of the voltage shall be less than 2% from phase to phase for a load variation from no load to rated load and power factor variation from 0.1 (lag) to 1 and at linear symmetrical loading.

Deviation from sine wave

The maximum permissible deviation from sine wave shall be 5%

Telephone Harmonic Factor

This shall not exceed the values given in IEC 34-1.

Unbalanced Load

The generator shall be capable of withstanding without injury, the effects of a continuous current unbalance corresponding to a negative phase sequence current of 20% of the rated current, provided that the KVA rating is not exceeded, and the maximum current does not exceed 105% of rated current in any phase.

Frequency Limits

The generator shall be suitable for continuous operation at rated load for a frequency variation of ñ 3% of rated value. In addition, vendor shall furnish the short time under frequency operating limits and the permissible volts per Hertz (V/Hz) limits (if required).

Overloads

The generator shall be capable of withstanding without injury. The effects of a 10% overload for one hour or 50% overload for 30 secs.

Short circuit withstand capability.

The generator shall be capable of withstanding without damage a sustained short circuit current of 3 IN for a period of three second. This shall be achieved either through an auxiliary winding in the stator or through a permanent magnet generator.

Parallel Operation

Generator sets shall be suitable for parallel operation with other generating sets, among themselves or outside supply at operating voltage and under load conditions up to rated value. Details of existing units and for outside supply shall be furnished by the Employer.

Construction Requirements:

Frame

The frame shall be of steel plate welded construction. It shall be compact, of light weight and with sufficient mechanical rigidity.

Stator Core

The stator core shall be composed of high quality laminated silicon steel plates to reduce heat loss and improve electromagnetic efficiency. In addition, cooling air ducts shall be provided at optimum intervals to ensure uniform temperature distribution within the stator winding.

Stator Winding

The stator winding shall use thermosetting resin rich mica insulation conforming to Class 'H'. The winding shall be mechanically strong against vibration, shall resist heat build-up and shall repel both moisture and chemical attack.

3 nos. resistance type embedded temperature detectors (RTD) suitably distributed in stator windings shall be provided. Lead wire from these shall be brought to a terminal strip or terminal box, if required.

Rotor

Rotor shall be manufactured from forged alloy steel having very high mechanical and superior magnetic properties.

Field Winding

Rotor coils shall be continuously wound type and shall be manufactured from copper, having high conductivity and creep resistance. Field winding shall have Class "H" insulation with excellent electrical and mechanical properties. The insulation shall electrically form a compact mass capable of withstanding all the mechanical forces during operation. The field windings shall be

capable of operating at a field voltage of 140% of rated load field voltage for at least one minute starting from stabilized temperatures at rated conditions.

Bearings

Bearings shall be antifriction bearings, relubricable, with grease regulation, for 40000 operating hours.

Temperature Limits

The generator winding shall be of Class "H" insulation with temperature limitation for Class "H" insulation. In case temperature limitation for Class "F or B" is required generator should be oversized. The maximum temperature of different parts of the generator shall be limited as per BS/IEC/IS standards.

Direction of Rotation

The direction of rotation of the rotor of the machine shall be compatible with that of the prime mover. A clear indication of the direction of rotation shall be given on either end of the machine.

Terminal Box

Terminal box shall be fabricated out of cold-rolled sheet steel and shall be complete with access cover. Line cubicle shall have provision for termination of cable/bus duct as specified in the data sheet.

Space Heaters

Suitably rated heaters shall be installed with in the enclosure. Location and maximum surface temperatures of the heaters shall be such that no damage can be caused to any insulation. Heaters shall be suitable for operation on single phase 240 V AC supply unless otherwise specified.

EXCITER AND ACCESSORIES

General Description & Design Particulars

The rated current of the main exciter shall be at least 120% of machine excitation current at its rated output. The rated voltage shall be at least 110 % of the full load machine excitation voltage.

CT Parameters for AVR

The current transformer required to feed the AVR from the generator terminal shall be suitably selected depending on system requirement.

Auto-Voltage Regulator

Automatic solid state voltage regulator (AVR) shall be provided with the following characteristics:

1% voltage accuracy from no-load to full load at steady state. Response time of less than 25 milliseconds.

Voltage change limited to about 15% for full load step change with recovery to ñ 5% within 0,3 - 0,8 sec. (depending on size of alternator) and with not more than two overshoots.

Brushless Excitation Scheme

General

Brushless excitation scheme shall consist of an AC exciter rotary rectifier and varistor, all mounted on the same shaft as the generator. Rotating AC exciter shall have stationary field circuit powered by an auxiliary winding in the stator.

AC voltage generated in the AC exciter shall be rectified by the rotary rectifier assembly and fed to the main field circuit. During faults, when the generator is isolated from the system, field suppression shall be automatically done by contractor mounted in switchboard.

The rotor winding of the AC exciter, the rectifier assembly, main field winding of the generator and other accessories on rotor part shall be rigidly fastened to the shaft and the connection with different items shall be anti-loosening type.

AC Exciter

The AC exciter shall be three-phase synchronous generator with a rotary armature type structure. Its stator shall be constructed so that the magnetic pole is bolted to the magnet frame. The magnetic poles shall be made of laminated, punched sheet steel. When the stator of the principal synchronous generator is moved, the AC exciter in its entirety shall be designed to slip snugly into the bore of the former.

Rotary Rectifier

The rotary rectifier set shall consist of silicon rectifiers and varistor. Rotor circuit shall be designed to take care of rectification of AC voltage.

All components shall be mounted considering the effects of the centrifugal forces. The element built into the rotary rectifier shall offer very high reliability, long life and trouble free operation requiring practically no maintenance.

ENGINE:

8.1. Rated Power Output

The Diesel Generating set shall be capable of delivering continuous power as per ISO-8528 at ISO reference conditions.

Diesel Engine

General

The diesel engine shall be of suitable capacity and rating as per ISO-8528. The engine will be 4 stroke cycle, Radiator cooled, cold starting, turbo charged, Electric battery start, directly coupled to alternator, mounted on a common base frame through flexible coupling. The engine shall be required to operate on commercially available diesel fuel in India. The engine shall be suitable for 10% overload for one hour in every 12 hours continuous running. Diesel engine shall be of heavy duty robust construction suitable for either intermittent duty or continuous duty.

Accessories

The diesel engine shall be complete with accessories and protective devices including following:-

Heavy duty dry type air filters with vacuum indicator.

Air to Air Charge air cooler for turbo charged after cooled engine.

Expansion bellows (Stainless steel)

Suitable Radiator

Electronic type governor with servo-motor and oil pump shall be provided. The setting of speed of the engine should be manual by hand or by remote control operation.

Lubricating arrangement shall be of force feed type with gear oil pump, oil service tank, oil filters and high oil pressure relief valve, etc. Lubricating oil cooler shall be provided.

Fuel injection system shall have a Fuel injection pump for cylinder with fuel oil filter and service tank of required capacity.

Dry type, air suction pipe, exhaust pipe with silencer, thermal insulation etc.

Fly wheel with suitable coupling and guard.

Suitable `Stop' device to stop the engine in case any of the controlled variables exceed and upper or lower limit (temperature of cooling water and lub. oil and pressure of lub. oil).

Engine speed control unit.

Exhaust gas Turbo charger and after cooler.

Lube oil sump.

Thermostats with by pass facilities.

Lube oil heaters (if required).

Corrosion resistor/chemical dozer/corrosion inhibitor

Fuel pre-filter and water separator.

Torsional vibration damper if required.

Self-starter for electric start system with battery operated electric motor of adequate capacity. Starting system batteries should be suitable capacity to cater for minimum 3 consecutive starts

Battery charging alternator

Engine control panel (Engine Instrumentation) comprising of following:-

Lubricating Oil pressure gauge:

Battery Volt Meter

High & Low Coolant temperature gauge.

Battery Charging Ammeter

Electronic hour meter.

RPM indicator.

ON/OFF REMOTE start key.

Lub. oil temperature gauge

Suitable sensing device to transmit `Stop'

Audio-visual signal to indicate `Abnormal' conditions of the controlled variables described above with reset push buttons.

Oil service tank with all accessories such as level indicator, manhole, valved inlet and outlet, air vent, drain plug, mounting pedestals etc.

Safety Equipment for engine:-

Over speed tripping cum indication

Low lube oil pressure trip cum indication.

High & Low coolant temp. trip cum indication

High lube. Oil temp. stop

Engine Speed Governor

Engine shall be supplied with inbuilt electronic governor to maintain engine speeds within the rated speed under varying load conditions.

Battery Charger:-

The battery charger of reputed make shall be provided. The battery charger shall be complete with the following indications and features;

Battery charge/discharge current

Boost charge/trickle charge selector

o) On/Off switch

Fault indication

Protection Auto cut off feature to safeguard batteries from overcharging.

The input voltage to battery charger may vary between 180 volts to 240 volts, Therefore, the battery charger should be capable of charging the battery to desired voltage level within the above input voltage range.

The battery charger shall have a selector switch by which the rate of charging the batteries can be selected.

The battery charger shall be provided with trickle/boost mode to keep battery fully charged.

9 BATTERIES:

“Heavy duty suitable capacity maintenance free lead acid battery of Amron/Standard Furukawa/ Exide make with its leads. The battery shall be size to give not less than ten consecutive starts of the engine of 0 degree centigrade to 50 degree centigrade.”

BASE AND MOUNTINGS

Base

Engine and alternator shall be mounted, coupled and aligned on a common channel iron fabricated Base Frame with pre-drilled holes. An oil and water drain block shall be provided on the base rail.

Anti vibration Mountings

The mountings of the DG set shall be liberally designed and shall be of reputed make.

FUEL TANK

Fuel tank capacity shall be sufficient for daily 8 hours continuous running of DG set. Fuel tank of sheet metal fabricated from 14 SWG M.S. Sheet steel suitable for continuous operation complete with drain valve, air vent, inlet and outlet connection. Fuel tank will be placed inside the enclosure in base. The above capacities are the minimum.

ACOUSTIC ENCLOSURE (IF ASKED IN SCHEDULE OF QUANTITIES/ BOQ):-

The Diesel Generating set shall be housed inside a high quality acoustic enclosure made of 14 gauge folded CRCA sheet. It shall be of modular construction manufactured using CNC Turret punch press and rigid in form. The enclosure shall be modular in construction with the provision to assemble and dismantle easily at site.

The weatherproof corrosion resistant metal components should be NINE TANK pre-treated before powder coating (inside as well outside) The weather proof corrosion resistant enclosure shall undergo various stages of surface treatment like degreasing, pickling, phosphating and passivation followed by a finish of polyester powder coating which gives the surface long lasting aesthetic looks. Only zinc plated or stainless steel fasteners shall be used in the construction of the enclosure.

High quality insulation material (rock wool/mineral wool) of 96 Kg/ cum as per IS: 8183-1993 shall be used liberally in order to achieve desired noise level. This shall be covered with

fiber glass fire resistive cloth and perforated powder coated sheet of 0.6mm thickness. High quality gasket for doors shall be used.

Air inlet/exhaust acoustic louvers for efficient air circulation shall be provided with attenuators to control sound at air entry and exit from the containers. Additional large capacity fan shall be incorporated for effective cooling so that the temperature inside the enclosure shall not exceed the ambient temperature by 5°C

Heavy duty residential type silencer shall be provided within the enclosure to control the exhaust noise.

Other features to be provided:

Full access to the engine for maintenance through large lockable doors with single key handles.

Neutral and body earthing terminals accessible from outside

Separate tray for battery

Provision of external drain plugs for Lub oil / Fuel Oil / Water

Emergency stop button from outside

Provision for illumination inside enclosure

High enclosure temperature safety.

The doors shall be gasketed with high quality EPDN gaskets to prevent leakage of sound

The door handles shall be lockable type.

Specially designed attenuators shall be provided to control sound at air entry and exit points.

Adequate ventilation shall be provided to meet total air requirement. If required, a blower is provided to meet total air requirement.

Temperature of enclosure shall not exceed beyond 5 - 7º DC of ambient temperature.

Noise Level shall be less than 75 dB (A) at 1 mtr. distance.

Door hinges shall be made of anti-corrosive special alloy.

Viewing window shall be fitted with toughened glass instead of acrylic sheet.

EMISSION RELATED PARAMETERS:-

Emission of the exhaust gas should be in accordance with Central Pollution Control Board norms as applicable at the time of supply.

TECHNICAL LITERATURE:-

One copy of the printed illustrative catalogue showing features of the machine and its elements must be enclosed with each copy of the bid.

Tenderer shall submit the following technical literatures and drawing along with each of the generating set.

Three copies of maintenance and operation instruction manual.

Three copies of dimensional and detailed drawing of DG set and anti-vibration arrangement drawings for generating sets.

Three copies of schematic wiring diagrams and wiring layout

Three copies of wiring between control panel to DG sets.

Three copies of spare part catalogue giving part list no. of each component with exploded view and assembly drawing.

Three copies of dimensioned drawing showing overall size of the generating set and switch board.

Trouble shooting guide.

SPARES:-

Two lists of recommended perishable and non-perishable spares required for normal maintenance to cover complete range of mechanical, hydraulic and electrical equipments including controls on double shift working basis should be furnished and quoted separately. The quantities should relate to, in case of non-perishable spares, to two years normal maintenance, and in case of perishable spares to the duration of its shelf life or two years whichever is less. Shelf life should be indicated with the quotation for spares.

TOOLS:-

Set of tools required for each diesel engine, alternator, and acoustic enclosure for different sizes, bolts, nuts. A list of such tools required for each of the equipment shall be given indicating the make of tools (rates shall be quoted separately).

SPECIAL FEATURES:-

Special features if any, incorporated into the plant, shall be indicated separately by the tenderer, clearly indicating the advantages of the features.

DEVIATIONS:-

The tenderer should specify clearly any deviations from the tender specification.

DECLARATION OF PERFORMANCE PARAMETERS:-

S. No.	Detail of test	Declaration
1	DG set continuous power rating as per ISO 8528 at ISO reference condition	------ KW at 1.0 power factor
2	DG set continuous power rating as per ISO 8528 at ambient condition	------ KW at 1.0 power factor
3	ISO Specific Fuel Consumption of DG set	------ liter/KWH
4	Specific Fuel Consumption of DG set at ambient condition	------ liter/KWH

The contractor shall furnish calculation for calculating declared rating. The calculation shall be as per ISO 8528.

The contractor shall furnish calculation for calculating declared Specific Fuel Consumption. The calculation shall be as given in ISO 3046.

INSPECTIONS & TESTING:

INSPECTION OF EQUIPMENT & TESTING AT MANUFACTURER'S WORKS

The Employer will depute authorized representatives for witnessing the testing of Diesel Generator Set at Manufacturer's works on receipt of the inspection call from the Contractor/Supplier.

The following performance tests shall be carried out in each DG set and it shall be witnessed by Employer representative at contractor’s premises:-

The full load test shall be carried out on prevailed ambient condition available at the place of test. The DG set shall be gradually loaded from no load to 25% of rated power, 75% of rated power and then 100% of rated power. For each such partial rating, after stabilization of load, DG set shall run for that rating at least for ½ hour.

Fuel consumption test of Diesel Generator Set:

The Diesel Generator set shall run at full rated load (in KW) continuously for one hour. This shall be followed by 1-hour fuel consumption test as described.

"The alternator shall be loaded with rated load in KW. The fuel consumed during the test shall be measured in grams and the generated electrical unit shall be measured in KWH. The ratio of both shall be calculated and compared with declared value."

The tenderer shall provide free of cost all consumable items like diesel, mobile oil,grease, water electricity, cotton waste etc. for testing of DG set at firm premises. Operation of all safety devices and overall operations of electrical systems are to be tested at firm's premises for satisfactory performance.

Manufacturer must have suitable facilities at their works for carrying out various performance tests on the plant. The tenderer should clearly confirm that all the facilities exist and shall be made available to the inspecting authority.

Performance of DG Set

Voltage regulation : +2% Rheostat shall provide for +5% voltage

adjustment.

Voltage wave form : Wave from deviation shall not be greater than

10% or within NEMA MG 1-22.43.

Telephone influence : As per NEMA requirement (fewer factors than 50).

Electro-magnetic : Attenuation shall exceed the requirement Interference level for AM/FM Radio and Television Equipment

22.0 Testing

Diesel Generator set

The following test shall be conducted on alternator and DG set.

Factory test

The factory tests shall incorporate the following:

Type tests

Routine tests

High voltage test

Short circuit current test

Instantaneous short-circuit withstand test

Insulation resistance test

These tests shall be conducted as per the requirements of BS 2613 or IS 4222 and the original test certificates shall be furnished.

SITE TEST AFTER INSTALLATION:-

The Diesel Generator set shall run at maximum available load up to the rated load as per prevailed ambient condition at site for 8 hours. During this test, operation of all safety devices and overall operation of electrical system are to be tested at site. This test will be witnessed by the Representative of the Contractor.

The employer will provide free of cost all consumable items like diesel, mobile oil, grease, water, electricity, cotton waste etc. for testing the DG set.

Site tests

After the erection and wiring and earthing of DG set, the following tests shall be conducted.

Insulation resistance of the generator.

Speed, No. load voltage and full load voltage regulation

Frequency at no load, half load and full load.

Full load test for 6 Hrs. at rated voltage, speed and frequency.

The readings shall be observed with calibrated meters. Only one meter shall be used for the test, the readings shall be properly tabulated submitted in triplicate.

Testing of controls

All the safety controls and protective devices of the DG set shall be tested for correct calibration and operation. The results of the tests shall be tabulated and submitted in triplicate.

TRAINING:-

Technical experts of the manufacturer during commissioning of plant will fully and adequately train operators/maintenance staff nominated by the Employer.

FOUNDATION AND RELATED DRAWINGS:-

For each plant, the supplier shall furnish to each consignee direct 3 copies of foundation drawings and related diagrams giving machine weight, overall dimensions, foundation details, electrical load and circuitry, within 4 weeks of the receipt of Advance Acceptance of Tender for approval before commencing the foundation work, installation and commissioning of the plant. Foundation and other related work to be completed before DG set reaches the site.

ERECTION, COMMISSIONING AND PROVING TESTS:-

The contractor or his agent would be required to carry out a joint check at the consignee's end, along with the consignee, before unpacking is done, to avoid subsequent complaints regarding

short shipment/transit damages. It is necessary that this joint inspection be done immediately on receipt of the plant by consignee to avoid commissioning delays due to shortages/transit damages. The authorised assembler representative must be present during joint inspection and they should certify that items supplied are from OEM, based on visual or any other suitable check as applicable. The OEM certificate of engine and alternator including manufacturers test certificate MUST be supplied along with the D. G. Set. The date of manufacture of the engine and alternator must be within ONE year of the date of supply.

Installation of plant including foundation and other related civil engineering works shall be done by the contractor. The contractor shall arrange commissioning of the plant in the presence of Employer Staff.

The contractor or his agent will commission the plant within 5 days from the date of its erection.

The plant performance shall be demonstrated by the contractor or his agent after successful installation and commissioning at the employer’s works for a period of two 8 hrs. Shifts.

3.0 CABLE TRAYS, FITTINGS & ACCESSORIES

Applicable Standards:-

-IS-1255-1963(Revised to date) = C.O.P. for laying.

-IS-226-	-do-	Structural steel
-IS-2074-	-do-	Zinc-oxide-primer
-IS-2633-	-do-	Testing of zinc coating
-IS-2629-	-do-	Hot dip galvanizing iron

Hot Dip Galvanized Cable tray

Cable trays should have undergone rigorous rust proofing process before galvanizing, which should comprise of alkaline, degreasing and descaling in diluted sulfuric acid and a recognized phosphate process. All nuts, bolts, washers & hardware etc. shall be hot-dip galvanized. Galvanizing shall be uniform, smooth and free from any spots. The zinc deposit shall not be less than 610 Grams. Per Sq. meter of surface area and also the thickness of zinc along the surface shall not be less than 75 microns.

However, the amount of zinc deposit on the threaded portions of the bolts, nuts etc., shall not be less than 300 Grams (Per Sq. m. of surface area). The zinc deposit on the washers shall not be less than 340 Grams (per Sq. m. of surface area).

MS Powder coated

MS powder coated cable trays should have undergone rigorous rust proofing process, which should comprise of alkaline, degreasing and descaling in diluted sulfuric acid and a recognized phosphate process. The sheet work shall then be given two coats of oxide primer before final approved shade of

powder coating. Cable trays shall be powder coated of colour as approved by Engineer-in-Charge and shall conform to IS - 2074 amended to date. Thickness of powder coating shall not be less than 70 microns.

Minimum size of main channel for ladder type trays and rung should be as under:-

---------- Size of Tray

Size of Main Channel Size of Rung

---

750 mm to 1500 mm 25 x 75 x 25 x 2.5 mm 20 X 50 X 20 X 2 @ 250 C/C

TABLE FOR ANGLES FOR CABLE TRAY SUPPORT AND HANGERS

Size of Cable Tray	Size of Angle	Spacing	Hangers
1200 to 1500 mm	50 x 50 x 5 mm	@ 1500 mm	10mm dia rod
900 to 1000 mm	40 x 40 x 5 mm	@ 1500 mm	10mm dia rod
750 to 600 mm	40 x 40 x 5 mm	@ 1800 mm	10mm dia rod
150 to 450 mm	40 x 40 x 3 mm	@ 1800 mm	10mm dia rod

In case of MS supports Contractor shall carry out 2 coat of primer and two coat of synthetic enamel paint (Spray paint or powder coating as specified& approved) of approved shade on all steel structures. Sizes of angles for cable tray supports and hangers shall be as per table given above or as specified in BOQ:

Cable Tray Mounting:

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out as per following and to be approved by Engineer in charge (refer typical cable tray fixing details)

Hangers shall be of minimum10 mm Dia Steel Round Bar or as specified in BOQ. Maximum loading on a horizontal support arm to be 120 Kg per meter of cable tray run.

Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding/bolting to the vertical supports.

Spacing between horizontal support arms of vertical tray runs must be specified & as required.

STORAGE AND HANDLING OF CABLES

All cables shall be inspected upon receipt at site and checked for any damage during transit. Cable drums shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in the ground causing rot and damage to the cable drums.

During storage periodical rolling of drums once in 3 months through 90o shall be done. Rolling shall be done in the direction of the arrow marked on the drum.

It should be ensured that both ends of the cable are properly sealed to prevent ingress/absorption of moisture by the insulation.

Protection from rain and sun shall be ensured. Sufficient ventilation between cable drums, should be ensured during storage.

The drums shall always be rested on the flanges and not on the flat sides.

Damaged battens of drums etc. should be replaced, if necessary.

When cable drums have to be moved over short distances, they should be rolled in the direction of the arrow, marked on the drum.

For transportation over long distances, the drum should be mounted on cable drum wheels strong enough to carry the weight of the drum and pulled by means of ropes. Alternatively, they may be mounted on a trailer or on a suitable mechanical transport.

When unloading cable drums from vehicles, a crane shall preferably be used. Otherwise the drum shall be rolled down carefully on a suitable ramp or rails, where necessary.

While transferring cable from one drum to another, the barrel of the new drum shall have a diameter not less than that of the original drum.

The cables shall not be bent sharp to a small radius. The minimum safe bending radius for all types of XLPE cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius should be adopted. At joints and terminations, the bending radius of individual cores of a multi core cable shall not be less than 15 times its overall diameter.

Cable with kinks and straightened kinks or with similar apparent defects like defective armouring etc. shall be rejected.

Cables from the stores shall be supplied by the contractor as per the site requirement in pieces cut in the stores.

INSTALLATION

GENERAL

The cable installation including necessary termination shall be carried out in accordance with the specifications given herein. For details not covered in these specifications, I.S. 1255 shall be followed.

No straight through joint shall be permitted in the system. The cables shall be supplied as per cable schedule submitted by the contractor & approved by Project Manager.

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for LT cables and 15 times the overall diameter for HT cables. Cables shall be laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, LT cables shall be laid above HT cables. Where more than one cable is laid side by side, cable marker tags of approved type inscribed with cable identification details shall be permanently attached to cables at entry points to the building, at specified intervals for cables laid direct in grounds and in locations like manholes, pull pits etc.

In Masonry Trenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches to be provided by Project Manager. Cables shall be laid on galvanized angle iron supports fabricated from minimum 38mm x 38mm x 6mm galvanized angle iron supports grouted in trench walls at intervals not exceeding 600 mm. If required, cables shall be arranged in tier formation inside the trench. Suitable clamps, hooks and saddles shall be used for securing the cables in position and dressing properly so that the clear spacing between the cables shall not be less then the diameter of the cable. Trenches shall be provided with chequered plate/RCC covers. After laying and dressing of cables, trenches shall be filled with fine sand as directed.

On Trays/Walls

Wherever so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Type of c	Size	Clamping by	Fixing inte
LT	Upto and including 25 sq	Saddles 1 mm thick	45 cm
LT & HT	35 sq mm to 120 sq mm	Clamps 3 mm thick 25 mm	60 cm
LT & HT	150 sq mm and above	Clamps 3 mm thick 40 mm	60 cm

Note : The fixing intervals specified apply to straight runs. In the case of bends, additional clamping shall be provided at 30 cm from the center of the bend on both sides.

ROUTE

Before the cable laying work is undertaken, the route of the cable shall be decided by the Project Manager.

While shortest practicable route shall be preferred, cable runs shall generally follow fixed developments such as roads, footh-paths etc. with proper offsets so that future maintenance, identification etc. are rendered easy. Cross country run to shorten the route length is not desirable as it would lead to route identification and maintenance problems, besides posing difficulties during later development of open areas etc.

While selecting cable routes, corrosive soils, ground surrounding sewage and effluent etc. shall be avoided. Where this is not feasible, special precautions as approved by the Project Manager shall be taken.

As far as possible, the alignment of the cable route shall be decided taking into consideration the present and future requirements of other agencies and utility services affected by it, the existence of any cable in the vicinity as may be indicated by cable markers or cable schedules or drawing maintained for that area, possibilities of widening of roads/lanes, storm water drains etc. Cable routes shall be planned away from the drains and should be within the property.

Whenever cables are laid along well demarcated or established roads, the MV cables shall be laid further from the kerb line than HV cables.

Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted, MV cables shall be laid above HV cables.Where cables cross one another the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

WAY LEAVE

It may be necessary to obtain way leave for the cable route from the appropriate authorities some of whom are listed below :

Drainage, Public Health and Water Works.

Telephones and Telegraphs.

Gas works.

Other Undertakings.

Owners of properties.

Where necessary, joint inspection with representatives of other authorities may be arranged so that mutual interests are safeguarded. In case of private property, Section 12/51 of the Indian Electricity Act shall be complied with.

PROXIMITY TO COMMUNICATION CABLES

(I) Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communication cables the horizontal and vertical clearances shall not normally be less than 60 cms.

LAYING DIRECT IN GROUND

GENERAL

This method shall be adopted where the cable route is through open country along roads/lanes etc. and where no frequent excavation are encountered and where excavation is easily possible without affecting other services.

TRENCHING

WIDTH OF TRENCH :- The width of trench shall be determined on the following basis:

The minimum width of trench for laying single cable shall be 35 cm.

Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables, except where otherwise specified shall be at least 20 cm.

There shall be a clearance of at least 15 cm between axis of the end cables and the sides of the trench.

DEPTH OF TRENCH:- The depth of trench shall be determined on the following basis :

Where cables are laid in single tier formation, the total depth of trench shall not be less than 75 cm. for cables upto 1.1 KV and 1.20 m for cables above 1.1 KV.

When more than one tier of cables is unavoidable and vertical formation of laying is adopted, depth of trench in a (i) above shall be increased by 30 cm. for each additional tier to be formed.

EXCAVATION OF TRENCHES

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided complying with the requirements of Clause 6 / k.

Where gradients and changes in depth are unavoidable, these shall be gradual.

Excavation shall be done by any suitable means-manual or mechanical. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.

Adequate precautions shall be taken not to damage any existing cables, pipes or other such installations in the proposed route during excavation. Wherever bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried without the approval of the Project Manager.

Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Project Manager. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled in accordance with clause 7.6.2 (v)

If there is any danger of a trench collapsing and endangering adjacent structures, the sides should be well shored up with timbering and/or sheeting as the excavation proceeds. Where necessary, these may even be left in places when back filling the trench.

Excavation through lawns shall be done in consultation with the staff of the department/Owner concerned.

The bottom of the trench shall be level and free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 8 cm. in depth.

LAYING OF CABLE IN TRENCH

At the time of issue of cable for laying, the cores shall be tested for continuity and insulation resistance.

The cable drum shall be properly mounted on jacks or on a cable wheel, at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating.

The cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire cable length shall as far as possible be pulled of in one stretch. However, where this is not possible the remainder of the cable may be removed by 'Flaking' i.e. by making one long loop in the reverse direction.

a) i) After the cable has been uncoiled and laid into the trench over the rollers, the cable shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 m apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cable and then laid in a reasonably straight line.

ii) For short runs and sizes upto 50 Sq. mm of cables upto 1.1 KV grade, any other suitable method of direct handling and laying can be adopted with the prior approval of the Project Manager.

When the cable has been properly straightened, the cores shall be tested for continuity and insulation resistance. In case of PVC cables, suitable moisture seal tape shall be used for this purpose.

i) Cable laid in trenches in a single tier formation shall have a covering of clean, dry sand of not less than 17 cms above the base cushion of sand before the protective cover is laid.

ii) In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 30 cms. shall be provided over the initial bed before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30 cms. as stated above. The top most cable shall have a final sand covering not less than 17 cms. before the protective cover is laid.

At the time of original installation, approximately 3 m of surplus cable shall be left on each end of the cable and on each side of underground joints (Straight through/Tee/Termination) and at entries and places as may be decided by the Project Manager. The surplus cable shall be left in the form of a loop. Where there are long runs of cable length loose cable may be left at suitable intervals as specified by the Project Manager.

A final protection to cables shall be laid in accordance with para i to provide warning to future excavators of the presence of the cable and also to protect the cable against accidental mechanical damage by pick-axe blows etc.

Unless otherwise specified, the cables shall be protected by second class bricks of not less than 20 cm x 10 cm x 10 cm (nominal size) as per CPWD Building Specification or protection covers placed on top of the sand, (bricks to be laid breadth wise) for the full length of the cable to the satisfaction of the Project Manager. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and project at least 5 cm. over the sides of the end cables.

Back Filling

The trenches shall be back-filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 30 cm. Unless otherwise specified, a crown of earth not less than 50 mm. in the centre and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of earth however should not exceed 10 cms. so as not to be a hazard to vehicular traffic. The temporary re-instatements of roadways should be inspected at regular intervals, particularly during the wet weather, and any settlement should be made good . Further trenches cut through roadways or other paved areas shall be restored to the same density and material as the surrounding area and repaved in accordance with the relevant Specifications to the satisfaction of the Project Manager.

Where road berms or lawns have been cut or kerb stones displaced, the same shall be repaired and made good except turfing/asphalting to the satisfaction of the Project Manager and all surplus earth or rock removed to places as specified.

Route Markers

Route markers shall be provided along straight runs of the cables at locations approved by the Project Manager and generally at intervals not exceeding 100 m. Markers shall also be provided to identify change in the direction of the cable route and also for location of every underground joint.

Route markers shall be made out of 100 mm x 100 mm x 5 mm GI/Aluminium plate, welded or bolted on to 35 mm x 35 mm x 6 mm angle iron 60 cm. long. Such plate markers shall be mounted parallel to and 0.5 m or so away from the edge of the trench.

Alternatively cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) marker 60 cm x 60 cm 10 cm in size shall be laid flat and centred over the cable. The concrete markers unless otherwise instructed by the Project Manager shall project over the surrounding surface so as to make the cable route easily identifiable.

The work 'cable' and other details such as voltage grading, size etc. as furnished by the Project Manager shall be inscribed on the marker.

Cable Identification Tags

Wherever more than one cable is laid/run side by side, marker tags as approved by the Project Manager, inscribed with cable identification details shall be permanently attached to all the cables in manholes/pull pits/ joint pits/ entry points in buildings/open ducts/trenches etc. These shall also be attached to cables laid directly in ground at specified intervals, before the trenches are back-filled.

Laying in Pipes/Closed ducts :

In location such as road crossing, entry to building, on poles, in paved areas etc. cables shall be laid in pipes or closed ducts.

GI or Hume Pipes (spun reinforced concrete pipes) shall be used for such purposes. In the case of new construction, pipes as required shall be laid alongwith the Civil works and jointed according to the instructions of the Project Manager as the case may be. The size of pipe shall be as indicated in the electrical drawings. GI pipe shall be laid directly in ground without any special bed. Hume pipe (Spun reinforced concrete pipe) shall be laid over 10 cm. thick cement concrete 1:5:10 (1 cement :5 coarse sand : 10 graded stone aggregate of 40mm nominal size) bed, after which it shall be completely embeded in concrete. No sand cushioning or tiles need be used in such situations. Unless otherwise specified, the top surface of pipes shall be at a minimum depth of 1mtr. from the ground level when laid under roads, pavement etc.

Where steel pipes are employed for protection of single core cables feeding AC load, the pipe should be large enough to contain both cables in the case of single phase system and all cables in the case of polyphase system.

The pipes on road crossing shall preferably be on the skew to reduce the angle of bends as the cable enters and leaves the crossings. This is particularly important for high voltage cables.

Manholes of adequate size as decided by the Project Manager shall be provided to facilitate feeding/drawing in of cables and to provide working space for persons. They shall be covered by suitable manhole covers with frame of proper design. The construction of manholes and providing the cover is not in the scope of this Contract and shall be got executed and paid for by the Project Manager through an other agency.

Pipes shall be continuos and clear of debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing.

Pipes for cable entries to the building shall slope downwards from the building and suitably sealed to prevent entry of water inside the building. Further the mouth of the pipes at the building end shall be suitably sealed to avoid entry of water. This seal in addition to being waterproof shall also be fireproof.

All chases and passages necessary for laying of service cable connections to buildings shall be cut as required and made good to the original finish and to the satisfaction of the Project Manager.

Cable grips/draw wires and winches etc. may be employed for drawing cables through pipes/closed ducts etc.

TERMINATION/JOINTING OF CABLES

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable lugs shall be adopted for all cable terminations. Any terminations may without use of proper crimping tool is shall be liable to be rejected. In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and then a thin coat of tin is applied before pinching into any equipment. Heat shrinkable Raychem type terminations shall be provided for High Voltage cables and brass double compression glands shall be provided for LT cable terminations. Straight through jointing of LT or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from Project Manager and without cost.

MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap in joints. The rate shall include all the above mentioned material, labour etc for laying as required.

CABLE LOOPS

At the time of the installation approximately 3 meters of surplus cable shall be left

at each end of the cable

on each side of underground straight through/tee/termination joints.

at entries to buildings

and such other places as may be decided by the Project Manager . This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the Project Manager.

BONDING OF CABLES.

Where a cable enters any piece of apparatus it shall be connected to the casting by means of an approved type of armoured clamp or gland. The clamps must grip the armouring firmly to the gland or casting, so that in the event of ground movement no undue stress is placed on to the cable conductors.

TESTING & COMMISSIONING

Tests At Manufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810) :

Routine test on each drum of cables.

Acceptance tests on drums chosen at random for acceptance of the lot.

Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

The type tests shall include the following conforming to VDE 0278/IS Specifications. The type test certificates shall be submitted.

Rated withstand AC voltage test

Partial discharge test

Rated withstand surge voltage test

Continuous AC voltage test with cyclic current loads (Number of heating cycles -3,)

Partial Discharge Test

Continues AC voltage Test with cyclic current (Number of Heating cycles-60)

Thermal Short Circuit Test.

Continuous AC Voltage Test with cyclic current load. (Number of heating Cycles-63)

Rated withstand Surge Voltage Test.

DC Voltage Test.

Test under the Influence of Moisture.

Dynamic short circuit Test.

The PVC cables shall also be tested as per IS 1554 and the XLPE cables as per IS 7098.

Site Testing

Testing before laying

All cables, before laying shall be tested with a 500V megger for cables of 1.1 kV grade, or with a 2500 / 5000Vmegger for cables of higher voltage. The cable core shall be tested for continuity, absence of cross phasing, insulation resistance from conductors to earth / armour and between conductors.

Testing before backfilling

All cables shall be subjected to the above mentioned tests, before covering the cables by protective covers and back filling and also before taking up any jointing operation.

Testing after laying

After laying and jointing, the cable shall be subjected to a 15 minutes pressure test. The test pressure shall be as given below. DC pressure testing may normally preferred to AC pressure testing

Working volts in k Cables	AC 15 minutes test		DC 15 minutes test	
	Between condu in KV	Conductors to in KV	Between condu in KV	Conductors to in KV
Upto				
1.1	2.0	2.0	3.0	3.0
3.3	6.0	3.5	9.0	5.0
6.6	12.0	7.0	18.0	10.5
11	20.0	11.5	30.0	17.5

Or as per latest IS/IEC codes.

Test Witness

Tests shall be performed in presence of representative of Project Manager. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

Completion plan and completion certificate

a) After completion of the work the Contractor shall draw completion plans to a suitable scale and shall submit to the Project Manager. The completion plans shall, inter-alia, give the following details:-

Layout of cable work

Length, size, type and grade of cables.

Method of laying i.e. direct in ground, in pipes etc.

Location of each joint with jointing method followed.

Route marker and joint maker with respect to permanent land marks available at site.

Wherever the previously laid cable is cut and additional joints are introduced etc., the cable records shall suitably be amended.

FIRE SURVIVAL ARMOURED CABLE

As per IEC standard recommend the following special guidelines, in conjunction with the standard installation instructions.

The LSZH cable must be stored in proper packed condition, in the shade. Direct exposure to sun must be avoided.

As LSZH sheaths have lower tear strength property when compared to PVC and PE sheaths, special care must be taken during installation to avoid any damage. Even a small cut on the LSZH sheath could result in the sheath splitting.

Use pay-in rollers and corner rollers of non- metallic material (Nylon or Teflon) at least every 4 meters when laying the cable.

Where possible installation must be under cover or indoors. Where outdoor installation is unavoidable, direct exposure to sunlight must be avoided by using suitable cable trays with suitable covers.

The cables must not come into contact with hot surfaces.

The installation bending radius must not be less than that stated on the cable data sheet. (Care must be taken, particularly if cable is installed by the flaking method, that this minimum bending radius is not compromised).

Any clamping device must not be applied directly on to the outer sheath. There must be some form of cushion (for instance a rubber pad of approximately 3 mm thickness) between the cable's outer sheath and the clamps.

The distance of unsupported length of cable for horizontal and vertical run must not exceed as defined parameters.

EARTHING

DESCRIPTION OF WORK

The non-current carrying metal parts of electrical installation shall be earthed properly. All metalic structure, enclosures, junction boxes, outlet boxes, cabinets, machine frame, portable equipments, metal conduits, trunking, cable armour, switchgear and all other parts made of metal in close proximity with electrical circuits shall be bonded together and connected by means of specified earthing conductors to an efficient

earthing system. Every item of equipment served by the electrical system shall be bonded to earthing system.

CODES AND STANDARDS AND APPLICABLE PUBLICATION

Indian Electricity Rules, 1956

IS : 3043 : Earthing

SUBMITTALS

Drawing Data

Earthing pits layout along with earthing tape routing etc.

Block Diagram for earthing showing all earthing pits and their coneections.

Tests & Test Reports

a) Test results of all Earthing pit test carried out at site with multiple electrode testing procedure.

SPECIFICATIONS

EARTHING CONDUCTORS

G.I. earthing system shall be provided except for neutral earthing of transformers and DG sets for which Cu earthing system shall be provided. All the bus ducts/cable trays shall be provided with suitable size of 2 nos. G.I. strips in the full length. All electrical equipment shall be earthed with 2 nos. G.I. strips/wires .

The resistance to each earthing system shall not exceed 1.0 ohm.

EARTHING STATION

PLATE ELECTRODE EARTHING

Earthing electrode shall consist of a G.I. plate of dimensions 600 mm x 600 mm x 6.3 mm thick or Copper plate of 600 mm X 600 mm X 3 mm as called for in the Bill of Quantity. The plate electrode shall be buried as far as practicable below permanent moisture level but in any case not less than 3 meters below ground level. Wherever possible, earth electrode shall be located as near the water tap, water drain or a down take pipe as possible. Earth electrode shall be kept clear of the building foundations and in no case shall it be nearer than 2 meters from the outer surface of the wall.

CONNECTION OF EARTHING CONDUCTORS

Main earthing conductor shall be taken from the earth connections at the main distribution panel to the main L.T. panel with which the connection is to be made. For distribution boards, earthing conductors shall run from main distribution boards. Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution boards or to an earth leakage circuit breaker. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of equipment shall be earthed with 2 no. G.I. strips/wires and non current carrying metallic parts with, 1 no. G.I. strips/wires.

Neutral conductor, sprinkler pipes, or pipes conveying gas, water or inflammable liquid, structural steel work, metallic enclosures cables and conductors, metallic conduits and lightning protection system conductors shall not be used as a means of earthing an installation or even as a link in earthing system. The Electrical resistance of metallic enclosures for cables and conductors measured between earth connections at the main switch boards and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate circuit breakers and shall not exceed 1 OHM.

EARTH CONNECTIONS

All metal clad switches and other equipment carrying single phase circuit, shall be connected to earth by a single connection. All metal clad switches carrying 3 phase shall be connected with earth by two separate and distinct connections. The earthing conductor inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size. The earthing conductor shall be painted to protect it against corrosion. Earthing conductor outside the building shall be laid 600 mm below finished ground level. The over lapping in G.I. strips in joints shall be welded. Lugs of adequate capacity and size shall be used for all termination of conductor wires. Lugs shall be bolted to the equipment body to be earthed after the metal is cleaned of paint and other oily substance and properly tinned.

PROTECTION FROM CORROSION

Connection between copper and galavanised equipment shall be made on vertical face and protected with paint and grease. Galvanised fixing clamps shall not be used for fixing earth conductors. Only copper fixing clamp shall be used for fixing earth conductors. When there is evidence that the soil is aggresive to copper, buried earthing conductors shall be protected by suitable serving and sheathing.

ARTIFICIAL TREATMENT OF SOIL

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, as specified in Clause no. 4.3.2 then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, Calcium chloride, sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions.

RESISTANCE TO EARTH

No earth electrode shall have a greater ohmic resistance than 3 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be upto 5 ohms. The electrical resistance measured between earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate circuit breakers, and shall not exceed 1 ohm.

INSTALLATION

The earth plate shall be set vertically and surrounded with 150 mm thick layer of charcoal dust and salt mixture. A 20 mm dia GI pipe shall run from the top edge of the plate to the ground level. The top of the pipe shall be provided with a funnel and a mesh for watering the earth through the pipe. The funnel over the GI pipe shall be housed in a masonry chamber approximately 300 mm x 300 mm x 300 mm deep. The masonry chamber shall be provided with a cast iron cover resting over a CI frame. Test facility shall be provided with test links for the earthing station.

TESTING & COMMISSIONING

Testing Of Earth Continuity Path

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

CONDUITING AND WIRING

GENERAL

The system of wiring shall consist of single-core/multi-core PVC insulated Copper conductor wires in Metallic/PVC conduits concealed/exposed or Raceways as called for.

2 STANDARDS AND CODES

Updated and current Indian Standard Specifications and Codes of Practice as stipulated below shall apply to the equipments and the work covered in this section. In addition the relevant clauses of the Indian Electricity Act 1910, Indian Electricity Rules 1956, National Building Code 2005, National Electric Code 1985, Code of Practice for Fire Safety of Building (general) : General Principal and Fire Grading – IS 1641 and IEE wiring regulation 16th edition as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

660/1100 V grade FR/FRLS PVC insulated wires. IS 694 : 1990

PVC Conduits IS 2509, 3419, 6946

Accessories for rigid steel conduits IS 3837 : 1990

Flexible steel conduits for electrical wiring IS 3480 : 1990

Switch socket outlets IS 4615 : 1990

3 pin plugs and socket outlets upto 250 volts IS 1293 : 1988 Glossary of items for electrical cables and conductors IS 1885 : 1971 Conductors for insulated electric cable IS 8130 : 1984 General and safety requirements for fluorescent lamps

luminaries IS 1913 : 1978

Switches for domestic and similar purposes IS 3854 : 1997

Boxes for the enclosure of electrical accessories IS 5133 : Parts I &II 1969

Danger notice plates IS 2551 : 1982

Code of practice for personal hazard fire safety of buildingsIS 1644: 1998 Code of practice for electrical installation fire safety of

buildings IS 1646 : 1997

Code of practice for electrical wiring installations IS 732 : 1989 Code of practice of fire safety buildings (General- Electrical

installations) IS 1646 : 1982

Guide for safety procedure and practices in electrical works IS 5216 : 1982

CHECKING OF DRAWINGS

Before commencing the conduiting work, the Contractor shall carefully examine the drawings indicating the layout of conduits, check the number and size of conduits with respect to number of wires , location of junction boxes, sizes and location of switch boxes and other relevant details. Any changes suggested by the Contractor shall be got approved from the Consultants before the actual laying of conduits. Any discrepancy found in the drawings shall be brought to the notice of the Architects/ Consultants promptly before execution of the work.

MATERIAL

Conduits shall be black enameled mild steel and be solid drawn or lap welded conduits, stove enameled inside and outside with minimum wall thickness of 1.6 mm for conduits upto 25 mm diameter and 2 mm wall thickness for conduits above 25 mm diameter. The PVC conduits shall be 2 mm thick. PVCConduits shall be rigid unplasticised PVC conduits of 2 mm thickness. The conduits shall be delivered to the site in original bundles and each length of conduit shall bear the label of the manufacturer. The number of insulated copper conductor wires that may be drawn in the conduits of various sizes are given below and the conduit

fill shall not exceed 40%. The minimum size of conduits shall be 20mm diameter for lighting and outlets and conduit size shall be increased as per relevant IS code depending on the number of wires. Wires shall be PVC insulated copper conductor and ISI marked.

FR /FRLS PVC insulated wires

Flame Retardant (FR)/Flame Retardant Low smoke PVC insulated wires shall be single core unsheathed in voltage grade 1100 V as per IS 694 – 1990 with 99.97% pure electrolytic grade bright annealed stranded bare copper conductors. Special parameters of FR PVC insulation like critical oxygen index, temperature index, smoke density and flammability test shall conform to relevant IEC and ASTM Standards. Coil packings shall be ISI marked as stipulated in IS 694

CONDUIT FILL :-

The maximum number of 650/1100 Volts grade single core PVC insulated copper conductor wires that may be drawn in the conduits of various sizes are given below.

Size of wire	Size of Conduit (MS/PVC)				
Area of the wire					
20	25	32	40	50	
Sq. mm	(Number of wires maximum)				
1.5	6	10	14	-	-
2.5	5	8	12	-	-

4.0	3	6	10	14	-
6.0	2	5	8	11	-
10.0	-	4	7	9	-
16.0	-	2	4	5	12
25.0	-	-	2	2	6
35.0	-	-	-	2	5

JOINING OF CONDUITS :-

PVC Conduits shall be joined by means of PVC solvent cement. Proper jointing compound recommended by manufacturers shall be used for the same. Where there are long runs of straight conduit, inspection boxes shall be provided at 10 meter intervals. Junctions between conduits and adapatable boxes, switch outlet boxes must be provided with entry spouts and smooth PVC bushes.

CONDUIT CONNECTIONS:-

The threads of pipe and sockets shall be free from grease and oil and shall be thoroughly cleaned before making the screwed joints. All joints shall be fully water tight. Junction boxes and running joints shall be provided at suitable places to allow for subsequent extension if any, without undue dismantling of conduit system. As far as possible, diagonal run of conduits and adaptable boxes, back outlet boxes, switch boxes and the like must be provided with entry spouts and smooth rubber bushes. Joint between conduit and iron clad distribution boards and control gear shall be effected by means of conduit couplers into each of which will be coupled smooth rubber bushes from the inside of box or case.

Conduit system shall be vertical and straight as far as possible. Traps where water may accumulate from condensation shall be avoided, however if it is unavoidable suitable provision for draining the water shall be made. Separate conduits shall be run for lighting and 15 amps power outlet wiring. Wires belonging to different phases shall no be run in the same conduit . For every phase wire a separate neutral wire shall be run. Conduits connections for MS conduits shall be screwed metal to metal and be painted with one coat of self etching zinc chromate primer and two coats of enamel paint. The threads and sockets shall be free from grease and oil. Connections between screwed conduit and sheet metal boxes shall be by means of a rubber bush. The joints in conduits shall be free of burrs to avoid damage to insulation of conductors while pulling them through the conduit. External conduits (exposed to elements) should be insulated through clamp and water tight fitting.

BENDS IN CONDUIT :-

Where necessary, bends may be carried out by means of conduit bends and/or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system, each junction box shall be provided with a cover properly secured and flushed with the finished wall/ceiling surface, so that the conductors inside the conduit are accessible. No bends shall have radius less than

2.5 times the outside diameter of the conduit. Special spring may be used for bending the conduit. Heating to soften the conduit for bending is not allowed. Caution should be excersied in using PVC conduits in location where ambient temperature is 50° C. Use of PVC conduits where temperature is 60°C. or above is prohibited

Large right angle bends (more than 75 mm radius) or non right angle bends in conduit runs shall be made by means of conduits bending machines carefully so as not to cause any crack in the conduit. Small right angle bends in conduits runs can be made by standard conduit accessories (solid/inspection bends/elbows). No run of conduit shall have more than four right angle bends from outlet to outlet. Bends in multi runs of conduits shall be parallel to each other and neat in appearance, maintaining the same distance as between straight runs of conduits.

Flexible Conduit

All final connections specially to vibrating equipments shall be made through steel flexible conduits. However the use shall be restricted to only those areas where it is not possible to use rigid PVC conduits with approval of Project Manager.

Conduit Accessories.

Standard accessories

PVC standard conduit fittings and accessories like standard/extra-deep circular boxes, looping in boxes, junction boxes, solid /inspection elbows , solid/inspection tees, couplers, nipples, saddles, check nuts, earth clips, ball socket joints, bushes etc. shall be of superior quality and of approved makes. Heavy duty covers screwed with approved quality screws shall be used. Samples of all conduits fittings and accessories shall be got approved by Project Manager before use.

Fabricated accessories

Wherever required, outlet/junction boxes of required sizes shall be fabricated from 1.6 mm thick MS sheets excepting ceiling fan outlet boxes which shall be fabricated from minimum 3 mm thick sheets. The outlet boxes shall be of approved quality, finish and manufacture. Suitable means of fixing connectors etc., if required, shall be provided in the boxes. The boxes shall be protected from rust by zinc phosphate primer process. Boxes shall be finished with minimum 2 coats of enamel paint of approved colour. A screwed brass stud shall be provided in all boxes as earthing terminal.

Outlet Boxes For Light Fittings.

These shall be minimum 75mm x 75mm x 50mm deep and provided with required number of threaded collars for conduit entry. For ceiling mounted florescent fittings, the boxes shall be provided 300 mm off centre for a 1200 mm fitting and 150 mm off centre for a 600 mm fitting so that the wiring is taken directly to the down rod. 3 mm thick perspex/hylam sheet cover of matching colour shall be provided.

Outlet Boxes For Ceiling Fans

Outlet boxes for ceiling fans shall be fabricated from minimum 3 mm thick MS sheet steel. The boxes shall be hexagonal in shape of minimum 100 mm depth and 60 mm sides. Each box shall be provided with a recessed fan hook in the form of one 'U' shaped 15 mm dia rod welded to the box and securely tied to the top reinforcement of the concrete slab for a length of minimum 150 mm on either side. 3 mm thick Perspex/hylam sheet cover of matching colour shall be provided.

Boxes For Modular Wiring Accessories

Boxes for housing modular wiring accessories (switches, switched socket outlets, telephone/computer / TV outlets, bell pushes, electronic fan regulators etc..) shall be fabricated from minimum 1.6 mm thick MS/GI sheets provided with rust inhibiting zinc phosphating treatment. The MS boxes shall be suitable for a grid plate being fixed over it for mounting wiring accessories leaving ample space at the back and on the sides for accommodating wiring conductors, M.S./GI boxes shall be provided with a brass earth terminal. The MS/GI boxes shall have knockout holes for conduit entry which shall be secured in position by check nuts and provided with bushes. No timber shall be used for any supports. Switch and outlet boxes shall be located as shown in the drawings.

In case the number of switches in one box is not tallying with that available in standard manufacture, the box accommodating the next higher number of switches shall be provided without any extra cost.

Modular Cover Plated Mounted Wiring Accessories

Switches

All 6 and 16 amps switches shall be of the modular enclosed type flush mounted 220 Volt AC of the best quality and standard. The switch moving and fixed contacts shall be of silver nickel and silver graphite alloy and contact tips coated with silver. The housing of switches shall be made from high impact resistant, flame retarding and ultra violet stabilized Project Managering plastic material. The switch shall be connected on to the phase wire of the circuit.

Molded Cover Plates

Switches, receptacles and telephone system outlets in wall shall be provided with molded cover plates of shape, size and colour approved by the Project Manager made from high impact resistant, flame retarding and ultra violet stabilized Project Managering plastic material, and secured to the box with counter sunk round head chromium plated brass screws. Where two or more switches are installed together, they shall be provided with one common switch cover plate as described above with notches to accommodate all switches either in one, two or three rows.

One and two gang switch cover plate, telephone outlet cover plate, 6 and 16 amps switched/unswitched plates, shall have the same shape and size. Three and four gang switch cover plates shall have the same shape and size. Six and eight gang switch cover plates shall have the same shape and size. Nine and twelve switch cover plates shall have the same shape and size. Wherever five switches, seven switches, ten switches and eleven switches are to be fixed the next higher size of gang switch cover plate to be used and openings shall be provided with blank-off covers at no extra cost.

Wall Socket Outlets

All 6/16 amps wall socket outlets unless otherwise mentioned on the drawings shall be switched, with round pins and fitted with automatic linear safety shutters to ensure safety from prying fingers. Unswitched 6/16 amp wall socket outlets where called for in the drawings shall be of three pin type. The socket outlets shall be made from high impact resistant, flame retarding and ultra violet stabilized Project Managering plastic material. The switch and sockets shall be located in the same plate. The plates for 6 amp switched/unswitched plugs and telephone outlets shall be of the same size and shape. All the switched and unswitched outlets shall be of the best standard. The switch controlling the socket outlet shall be on the phase wire of the circuit. An earth wire shall be provided along the cables feeding socket outlets for electrical appliances. The earth wire shall be connected to the earthing terminal screw inside the box. The earth terminal of the socket shall be connected to the earth terminal provided inside the box.

CONDUIT INSTALLATION

System

The whole conduit system shall be installed to comply fully with relevant provision in Indian Standard Specifications, Indian Electricity Rules and IE wiring regulations. Conduits shall be laid either recessed in walls and ceilings or on surface on walls and ceilings or partly recessed and partly on surface, as required. Same rate shall apply for recessed and surface conduiting in this contract. Stranded copper conductor insulated wire of size as per schedule of quantities shall be provided in entire conduiting for loop earthing. steel wire of suitable size to serve as a fish wire shall be left in all conduit runs to facilitate drawing of wires after completion of conduiting.

Layout

Conduits layout and routes shall be submitted for Project Manager's approval prior to execution. Allowance for adjustments due to site conditions shall be provided with no extra cost.

Conduit routes shall be chosen for easy, straight runs with a minimum of bends and crossings. Generally they shall follow the structure of building, running at right angles or in parallels to floors and ceilings. Conduit shall be kept within 300 mm of floors and ceiling when running parallel to them.

Outlets boxes for housing accessories shall be used as draw boxes. The total number of draw boxes shall be kept to a minimum and shall be provided so that conduits runs do not exceed 12 m or have more than two right angle bends.

All conduits shall be kept clear of gas and water pipes. In particulars, conduits shall be at least 150 mm away from gas pipe. Where proximity to these pipes is unavoidable, they shall be effectually segregated e.g. using rubber or other insulating material to prevent appreciable voltage difference at possible points of contact. Segregation from extra low voltage circuits and telecommunication circuits shall also apply unless these are wired to the same voltage requirements as lighting and power circuits.

Conduits from different distribution boards shall not be connected to the same junction box. Each run of conduit shall be assembled complete with draw in wires.

Joints and terminations

Electrical and mechanical continuity shall be maintained throughout all conduits joints and terminations. Conduit threads shall be thoroughly cleaned and the conduits tightly screwed. The conduit system shall be watertight after installation.

Conduits shall be connected using couplers or via boxes. With a coupler, the ends of the conduit shall butted close together and the running coupler is screwed tightly on and tightened by a locknut.

Conduits terminating into boxes provided with spouts shall be threaded so that there are no exposed threads. For boxes with no spouts, the termination shall be made using a brass bush and a coupler. The conduit is pushed through the knockout or drilled entry and the bush is screwed tightly onto its end. The coupler is screwed to butt firmly against the exterior wall of the box.

Where conduits are not jointed or terminated in boxes, they shall be terminated in a screwed brass bush.

In all joints and terminations, conduits threads shall not be exposed. Where this cannot be avoided as in a running coupler, the exposed threads shall be coated with red lead paint to seal against the ingress of water.

Bends

Conduits shall be bent cold with an approved type of bending block or bending machine, without altering the dimensions of their sections.

All conduits bends shall be such as to permit compliance to the requirements for bends in cables to as stated in the IEE regulations

Bends shall be made with as large a radius as the position of the conduit within the building permits. Where the bend is more than 90 degree, circular or rectangular junction boxes shall to be used for connecting conduits.

Recessed Conduiting

Conduits recessed in concrete members shall be laid before casting, in the upper portion of slabs or otherwise as may be instructed, so as to embedded the entire run of conduits and ceiling outlet boxes with a cover of minimum 12 mm concrete. Conduits shall be adequately tied to the reinforcement to prevent displacement during casting at intervals of maximum 1 meter. No reinforcement bars shall be cut to fix the conduits. Suitable flexible joints shall be provided at all locations where conduits cross expansion joints in the building.

Conduits recessed in brick work shall be laid in chases to be cut by electrical Contractor in brick work before plastering. The chases shall be cut by a chase cutting electric machine. The chases shall be of sufficient width (minimum 10 mm spacing between adjacent conduit) to accommodate the required number of conduits and of sufficient depth to permit full thickness of plaster (minimum 6 mm) over conduits. The conduits shall be secured in the chase by means of heavy duty pressed steel clamps screwed to MS flat strip saddles at intervals of maximum 1 meter. The chases shall then be filled with cement and coarse sand mortar (1:3) and properly cured by watering. For chases more than 75 mm width, a wiremesh shall be provided for the full length and width of the chase in the plaster to prevent cracking.

Junction boxes intended for facilitating drawing of wires in conduiting system shall be located in accessible locations to permit redrawing of wires in future. Open ends of conduits laid in slabs and walls shall be suitably plugged before pouring concrete / plastering to prevent ingress of water / debris in to the conduits

Entire recessed conduit work in concrete members and in brick work shall be carried out in close coordination with progress of civil works. Conduits in concrete members shall be laid before casting and conduits in brick work shall be laid before plastering. Should it become necessary to embedd conduits in already cast concrete members, suitable chase shall be cut in concrete for the purpose. For minimising this cutting, conduits of lesser diameter than 25 mm and outlet boxes of lesser depth than 50 mm could be used by the Contractor for such extensions only after obtaining specific approval from Project Manager. For embedding conduits in finished and plastered brick work, the chase would have to be made in the finished brick work. After fixing conduit in chases, chases shall be made good in most workmanlike manner to match with the original finish.

Cutting chases in finished concrete or finished plastered brick work for recessing conduits and outlet boxes etc shall be done by the Contractors without any extra cost. In the concealed MS/PVC conduit system all boxes for accessories and draw/junction boxes shall be installed such that the outer rim is flush with the finished surface of the wall.

Surface Conduiting

Wherever so desired, conduit shall be laid in surface over finished concrete and/or plastered brickwork. Suitable spacer saddles of approved make and finish shall be fixed to the finished structural surface along the conduit route at intervals not exceeding 600 mm. Holes in concrete or brick work for fixing the saddles shall be made neatly by electric drills using masonry drill bits. Conduits shall be fixed on the saddles by

means of good quality heavy duty GI clamps screwed to the saddles by counter sunk screws. Neat appearance and good workmanship of surface conduiting work is of particular importance. The entire conduit work shall be in absolute line and plumb. Conduits above false ceiling shall be fixed on suitable hangers supported from the structural ceiling. All surface conduits shall be run in a vertical or horizontal direction. Diagonal runs shall not be permitted.

Fixing of conduit fittings and accessories

For concealed conduiting work, the fittings and accessories shall be completely embedded in walls/ceilings leaving top surface flush with finished wall/ceiling surface in a workman like manner.

Loop earthing wire shall be connected to a screwed earthstead inside outlet boxes to make an effective contact with the metal body.

Protection of Conduits

To safeguard against filling up with mortar/plaster etc. all the outlet and switch boxes shall be provided with temporary covers and plugs which shall be replaced by sheet/plate covers as required. All screwed and socketed joints shall be made fully water tight with white lead paste.

Cleaning of Conduit Runs

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

Protection Against Dampness

All outlets in conduit system shall be properly drain and ventilated to minimise chances of condensation/sweating.

Expansion Joints

When crossing through expansion joints in buildings, the conduit sections across the joint shall be through approved quality heavy duty metal flexible conduits of the same size as the rigid conduit.

Loop Earthing

Loop earthing shall be provided by means of insulated stranded copper conductor wires of sizes as per Schedule of Quantity laid alongwith wiring inside conduits for all wiring outlets and sub-mains. Earthing terminals shall be provided inside all switch boxes, outlet boxes and draw boxes etc.

LAYING AND DRAWING OF WIRES

Bunching of Wires

Wires carrying current shall be so bunched in conduits that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit. No joint shall be permitted in the run of wires.

Drawing of Wires

The drawing of wires shall be done with due regard to the following precautions:-

No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire is completed. Burrs in cut conduits shall be smoothened before erection of conduits. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Approved type bushes shall be provided at conduit terminations.

Before the wires are drawn into the conduits, conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits if necessary..

While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which cause breakage of conductors.

There shall be no sharp bends.

The Contractor shall, after wiring is completed, provide a blank metal/sunmica plate on all switch / outlet / junction boxes for security and to ensure that wires are not stolen till switches / outlets etc.. are fixed at no extra cost. The contractor shall be responsible to ensure that wires and loop earthing conductors are not broken and stolen. In the event of the wire being partly / fully stolen , the contractor shall replace the entire wiring alongwith loop earthing at no extra cost. No joint of any nature whatsoever shall be permitted in wiring and loop earthing .

Termination /Jointing of Wires

Sub-circuit wiring shall be carried out in looping system. Joints shall be made only at distribution board terminals, switches/buzzers and at ceiling roses/connectors/lamp holders terminals for lights/fans/socket outlets. No joints shall be made inside conduits or junction/draw/inspection boxes.

Switches controlling lights, fans or socket outlets shall be connected in the phase wire of the final sub circuit only. Switches shall never be connected in the neutral wire.

Wiring conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any special reason shall be made by approved connectors. Specific prior permission from Project Manager in writing shall be obtained before making such joint.

Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or wringing.

Strands of wires shall not be cut for connecting terminals. All strands of wires shall be twisted round at the end before connection..

Conductors having nominal cross sectional area exceeding 1.5 sq. mm shall always be provided with crimping sockets. Tinning of the strands shall be done wherever crimping sockets are not available as per instructions of the Project Manager

All wiring shall be labelled with appropriate plastic ferrules for identification.

At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used.

Brass nuts and bolts shall be used for all connections.

The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less.

Only certified valid license holder wiremen shall be employed to do wiring/jointing work.

Load Balancing

The Contractor shall plan the load balancing of circuits in 3 phase installation and get the same approved by Project Manager before commencement of the work.

Colour Code of Conductors

Colour code for normal supply – Red, Yellow, Blue for three Phases, Black for Neutral and Green for Earth – shall be maintained for the electrical wiring installation

Colour code for UPS supply – Red/white, Yellow/white, Blue/white for three Phases, white for Neutral and Green for Earth

LIGHTING FIXTURES

The light fixtures and fittings shall be assembled and installed complete and ready for service, in accordance with details, drawings, manufacturer's instructions and to the satisfaction of the Project Manager.

Wires brought out from junction boxes shall be encased in PVC flexible pipes for connecting to fixtures concealed in suspended ceiling. The flexible pipes shall be provided with a checknut at the fixture end.

Pendant fixtures specified with overall lengths are subject to change and shall be checked with conditions of the job and installed as directed.

All suspended fixtures shall be mounted rigid and fixed in position in accordance with drawings, instructions and to the approval of the Project Manager.

Fixtures shall be suspended true to alignment, plumb, level and capable of resisting all lateral and vertical forces and shall be fixed as required.

All suspended light fixtures etc. shall be provided with concealed suspension arrangement in the concrete slab/roof members. It is the duty of the Contractor to make these provisions at the appropriate stage of construction.

All switch and outlet boxes shall be bonded to earth with insulated stranded copper wire as specified. Wires shall be connected to all fixtures through connector blocks.

Flexible pipes, wherever used, shall be of make and quality approved by the Project Manager.

MEASUREMENT AND PAYMENT OF WIRING

Wiring for lights, fans and convenience socket outlets shall be measured and paid for on Point Basis as itemized schedule of quantities and as elaborated as below (unless otherwise stated).

Average wiring Length.

The point wiring basis for wiring for lights, fans and convenience socket outlets shall assume average wiring length and average conduiting length per point based on parameters stipulated in para 15.3 below. The average wiring length and average conduiting length forming the basis of point wiring payment, shall take the electrical layouts of the entire project into consideration. Tenderers are advised to seek clarifications, if they so desire, on this aspect before submitting their tenders. No claim for extra payment on account of electrical layouts in part or whole of the project requiring larger average wiring and conduiting length per point, whether specifically shown in tender drawings or not, shall be entertained after the award of contract.

Point wiring for Lights – Primary and Secondary Light Points.

In respect of group control of lights (more than one light controlled by one switch or MCB), wiring upto the first light in the group shall be measured and paid for as a primary light point. Wiring for other lights looped in one group for switch controlled as also MCB controlled lights shall be measured and paid for as secondary light points. Primary light points for switch controlled lights shall not include the cost of control switch and also primary light points controlled by MCBs shall not include the switch cost . The cost of MCB controlling such lights shall not be included in the primary light point rate since the MCB shall be paid for in

the item of DB. Primary light points shall include the cost of circuit wiring (wiring from DB terminal to the first switch in the sub circuit)

Design Parameters: Wiring shall be carried out as per following design parameters in recessed/ surface conduit/conduit cum raceway system.

Only looping system of wiring shall be adopted throughout. No joints excepting at wiring terminals shall be permitted.

All accessories shall be flush type unless otherwise stated.

For estimation of load, following loads per point shall be assumed.

Light points 60/100 Watts. 6 amps socket outlet points 100 Watts.

Fan points 60 Watts.

Exhaust fan points 100 Watts unless otherwise specified.

16 amp socket outlet points 500/1000 Watts. unless otherwise specified

Light and fan points shall be wired on a common final sub-circuit. Each sub circuit shall not have more than a total of 10 nos lights and fans or a load of 800 watts whichever is lesser unless specifically stipulated otherwise. Wiring shall be carried out in PVC conduiting system.

Scope of Point Wiring

Wiring for Lights

Primary Light Points : Wiring for Primary light points, as defined in para 15.2 above, shall commence at the DB terminals and shall terminate at the ceiling rose/connector via the control switch (for switch controlled lights). Rates for Primary light point wiring shall be deemed to be inclusive of the cost of entire material and labour except switch, socket and modular cover plate require for completion of Primary light point thus defined including : .

Recessed/surface conduting system with all accessories, junction/draw/inspection boxes, bushes, check nuts etc. complete as required,

Wiring with stranded copper conductor FR/FRLS (as specify in BOQ) PVC insulated 660/1000 volt grade wires including terminations etc. complete as required.

Loop earthing with insulated copper wires.

Secondary Light points :

Secondary light points, as defined in para 15.2 above, shall cover the cost of interconnection wiring between group controlled light fittings and shall be deemed to be inclusive of the cost of entire materials and labour required for completion of the secondary light point thus defined including

Recessed / surface conduting system with all accessories, junction/draw/inspection boxes, bushes, check nuts etc. complete as required,

Wiring with stranded copper conductor FR/FRLS (as specify in BOQ) PVC insulated 660/1000 volt grade wires including terminations etc. complete as required.

Loop earthing with insulated copper wires.

Wiring for Ceiling Fans

Wiring for ceiling fan points shall be same as for Primary light points and shall, in addition, include ceiling outlet box with recessed fan hooks and installation of fan regulator.

Wiring for Exhaust Fans

Wiring for exhaust fan points shall be same as for Primary light points and shall in addition include ceiling rose as required.

Wiring for Convenience Socket Outlets

Wiring for 6 amps socket outlets on work tables shall be carried out partly in MS/PVC conduits as specify in BOQ and indicated in electrical layout drawings.

Point wiring for 3 pin 6 amps convenience socket outlets

Point wiring for 3 pin 6 amps socket outlets on point wiring basis shall be the same as Primary light points defined in para 15.4.1. including loop earthing of the third pin complete as required and as itemised in scheduled of quantities.

Point wiring for 3 pin 16 amps convenience socket outlets

Point wiring for 3 pin 16 amps socket outlets on point wiring basis shall be the same as Primary light point defined in para 15.4.1. including loop earthing of the third pin complete as required and as itemised in scheduled of quantities.

Submains wiring

Submains wiring shall be measured and paid for on linear basis as per the length of conduit actually installed between terminations. This shall include conduit system with all accessories, wires and insulated loop earthing conductors as itemised in schedule of quantities. The quoted rates shall include termination of wiring at either end. Cost of wires only without conduits at either end required for end terminations and taken inside switchboards etc shall be deemed to be included in the liner running meter rate of Submain wiring in conduit and no extra shall be paid for such additional wiring without conduit..

ROUTINE AND COMPLETION TESTS

Installation Completion Tests

At the completion of the work, the entire installation shall be subject to the following tests:

Wiring continuity test

Insulation resistance test

Earth continuity test

Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

Wiring Continuity Test

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energised.

Insulation Resistance Test

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all protection in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for LT circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 12.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

Testing Of Earth Continuity Path

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

Testing Of Polarity Of Non-Linked Single Pole Switches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Project Manager as well as the local authorities.

Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

Performance

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

Tests And Test Reports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Project Manager for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge. All test reports shall be approved by the Project Manager prior to energizing of installation.

MCB DISTRIBUTION BOARDS (SUB DISTRIBUTION BOARDS)

DESCRIPTION OF WORK

This section covers specification of Distribution Boards (DBs) suitable for operation on 415 V 3 Phase 4 wire 50 Hz supply feeding final lighting and power sub circuits.

APPLICABLE CODES, STANDARDS AND APPLICABLE PUBLICATIONS

Updated and current Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act, Indian Electricity Rules, National Building Code 2016, National Electric Code, Code of Practice for Fire Safety of Building (general): General Principal and Fire Grading – IS 1641 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

Miniature Air Circuit Breakers for AC circuits IS 8828 : 1996 and IEC 947

Residual current operated Circuit Breakers IS 12640 : 1988

Low voltage switchgear and controlgear Part II IS 13947 : 1993 Degrees of Protection provided by enclosures for low

voltage switchgear IS 2147 : 1962

Code of Practice for installation and maintenance of

switchgear not exceeding 1000 volts IS 10118 : 1982

General requirements for switchgear and controlgear for

voltages not exceeding 1000 volts IS 4237 : 1982

SUBMITTALS

Drawings and Data

a) The following minimum information shall be furnished with the Shop Drawings :-

Overall dimensions showing front view, plan, elevation and cross section.

Complete bill of material module wise.

Complete one line diagram.

INSTRUCTION MANUALS

Contractor shall furnish 6 copies of instruction manual which shall contain detailed instruction for installation, testing, commissioning, operation and maintenance requirements.

SPECIFICATION

General

a) Distribution Boards shall be suitable for operation on 3 phase/single phase 415/230 Volts, 50 Hz neutral grounded at Transformer.

a) The Distribution Boards shall comply with the relevant Indian Standards and Indian Electricity Rules and Regulations.

MINIATURE CIRCUIT BREAKERS

The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system. The MCB's shall have a rupturing capacity of 10 KA Ics. The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with PVC cable characteristic. Watt loss per pole of MCB shall confirm to value specified in IS 8828 – 1996. Type test certificates from independent authorities shall be submitted with the tender.

RESIDUAL CURRENT CIRCUIT BREAKERS (RCCB)

RCCBs shall comply to IS 12640 – 1988 and shall be of the current operated type. The RCCB shall be designed to trip within 20 mili sec at a current sensitivity of 30mA/ 100 mA/ 300mA as specified in BOQ. The RCCB shall be of 2 pole construction for single phase and 4 pole construction for 3 phase. All RCCB shall be complete with test buttons. RCCB shall have a minimum life expectancy of 20,000 operations.

DISTRIBUTION BOARDS

DBs shall be wall mounting, recessed/surfaced type, totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, busbars, neutral link etc as required, of ratings detailed in the schedule of quantities.

DBs shall be double door type access to the wiring shall not be possible with opening of the outer hinged cover. A cover shall be provided inside the DB to protect all live parts. Only the operating handle/knobs shall project outside the cover plate. The door shall be earthed with insulated copper braded flexible wires.

Components forming a part of the DBs shall comply to the relevant Standards and Codes of the Bureau of Indian Standards.

DBs shall be fabricated from minimum 18 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover. All cutouts and covers shall be provided with synthetic rubber gaskets. The entire construction shall give a IP 54/55 degree of protection unless otherwise stated.

The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length. The minimum spacing between phases shall be 25 mm and between phase and earth 19 mm

Separate neutral link for each phase shall be provided.

All the internal connections shall be with either solid copper PVC insulated or copper conductor FRLS PVC insulated wires of adequate rating.

All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.

All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted on a frame work for easy removal and maintenance.

The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.

All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Project Manager.

A sample of the completed board is to be got approved by the Project Manager before commencement of supply and erection.

Before commissioning, the distribution boards shall be megger tested for insulation and earth continuity.

The following colour coding shall be used for identification of the busbars and wiring as per IS 5578:1984.

Red phase - Red

Yellow phase - Yellow

Blue phase - Blue

Neutral – Black

Earthing - Green

Control wiring - Grey

The incoming and outgoing terminals shall be suitable for the termination of cables as required. All terminals, bus bars shall be insulated and shrouded to avoid accidental contact.

All metal parts shall be adequately earthed. An earth bus of tinned copper shall be provided of adequate section and length to accommodate all circuits

SHEET STEEL TREATMENT AND PAINTING

Sheet steel used in the fabrication of DBs shall undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process after which a coat of primer paint compactively with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 50 micron thickness, of sheet approved by Project Manager shall then be provided.

All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

NAME PLATES AND LABELS

Suitable engraved white on black name plates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

TYPE TEST

Type test certificates as per IS 8623 shall be submitted.

LIGHTNING PROTECTION & EARTHING SYSTEM

Earthing system shall confirm the following regulation and standards

CEA regulations for Measures relating to Safety and Electric Supply 2010 IS 3043, IS 732, NEC:2011(SP30) & NBC 2016

TN-S system with PME - Double earthing

Earthing for safety, voltage reference, shielding and Lightning current dissipation shall confirm the requirement as per the above standards. TN-S with double earthing for transformer, electrical panels and major equipment satisfying IS 3043, IS 732, IEC 60364

Earthing shall satisfy the requirement of PE conductor, Supplementary PE and reduce resistance less than 10 m□, Less than 1□ and less than 0.2 □ depending upon the application as per the above standards. Earthing shall include type B Earthing for Lightning Protection as well as include protective provisions to provide STAR/MESH/RING/IBN or other defined earthing topologies for IT enabled areas/buildings

The earthing system shall ensure that protection is achieved in the prescribed time specified in IS 732. After completion of the electrical installation, resistance need to be measured for each panel / equipment and the fault clearance time need to be recorded to ensure safety. Earthing and Structural bonding system shall confirm to the requirements of IS/IEC 62305 (all parts) as well as NBC 2016.

Structural bonding system consists of an additional conductor installed inside an RCC column along with structural steel. The grid thus formed shall be used for the interconnection of PE conductor with the structure and shall reduce over voltages due to fault inside the building. The conductor shall be of continuous length from basement to the top of the building. This conductor shall support the electrical installation and act as supplementary PE conductor. Sizing of the conductor shall be as per the loop resistance/fault current requirement of the installation confirming the standards. The conductor shall have minimum joints and all joints shall be exothermically welded for application in soil and under foundation. Clamp joints are permitted only inside concrete / exposed in air. All conductors for this purpose shall be copper coated and the coating thickness of conductor shall confirm to NBC-2016 and shall be minimum 100 microns.

Use of galvanised steel material is not allowed inside concrete as the zinc coating in steel damages concrete in most atmospheres (ref IS/IEC 62305-3 E.4.3.). Exothermic weld shall confirm the requirements of IEEE 837:2014. Every component used shall be able to withstand the fault current with minimum temperature raise. Fault duration shall be calculated as per electrical system design and approximate heat generation shall be submitted to the user for evaluation by the structural engineer.

The earth studs shall be 100 % corrosion resistant and shall confirm the requirements of IEC 62561.

EARTH CONDUCTOR & EARTH STUD

The earth conductor (eg - 10 mm round or other sizes specified based on transformer short circuit level. Copper coated steel tested to IEC 62561 shall be used as dedicated earth conductor in concrete as well as ring earth in case if the foundation has water proof plastic membrane. Earth studs are for the purpose of bringing the electrical connection between structural steel with other steel installations in the building. Both earth conductor as well as earth stud shall be corrosion resistant and shall be tested acc. to IEC 62561. Earth stud shall be connected to earth conductor by exothermic welding.

EXECUTION:

BUILDING WITH PLASTIC WATERPROOF MEMBRANE

The installation need to be carried out before installing the waterproof membrane, preferably below PCC. The earth conductor shall run under waterproof membrane as a grid of 10 meter by 10 meter. The grid shall be extended up to floor level outside the plastic membrane at every 10 meter. All joints shall be exothermically welded and in addition wrapped with corrosion protection bandage. Puncturing of water proof membrane is not permitted in case if this “under foundation earthing” is not carried before laying the waterproof membrane. Alternatively ring earthing with vertical earth electrodes at floor level can be done with special care. At floor level / above water proof membrane, the conductor shall be connected to Steel in RCC columns, plinth beams.

BUILDINGS WITHOUT WATERPROOFING

In case of raft / mat foundation which is in electrical contact with soil (without water proof plastic membrane) earth conductor running throughout the RCC as a mesh of 10 meter X 10 meter exothermically welded in all joints, connected to foundation steel at every 5 meter with a tested connector and every 1 meter with braid wire need to be installed.

BUILDINGS WITH FOUNDATION OTHER THAN RAFT / MAT FOUNDATION

The earth conductor shall run throughout the interconnected plinth beam. Plinth beam at the outer wall / perimeter of the building shall have earth studs at every 10 meter for the purpose of ring earthing interconnections.

GRID SIZING

For industrial and commercial buildings, the earth grid design shall satisfy NBC-2016 (5meter* 5meter grid) for improvement of the Earth termination system in a power source.

DOWN CONDUCTOR FOR LIGHTNING PROTECTION AS WELL AS BONDING CONDUCTOR FOR ELECTRICAL INSTALLATIONS (RCC BUILDING)

The dedicated copper coated 10 mm solid round conductor shall run inside columns on the periphery of the building and must be connected to the reinforced steel available in the columns will serve the purpose of down conductor for lightning protection as well as base for Equipotential bonding in every floor of a multi-storeyed building. If the distance between 2 columns are lesser than 5 meter, alternate columns shall be selected to route the down conductors. If the distance is more than 10 meter, all the columns shall be used for down conductor routing.

Provisions for interconnection of metal frame of wall cladding shall be provided at every 5 meters in vertical and horizontal sections based on the architectural design. Training for making this interconnection shall be provided to façade supplier / installer.

DOWN CONDUCTOR FOR LIGHTNING PROTECTION AS WELL AS BONDING CONDUCTOR FOR ELECTRICAL INSTALLATIONS (PEB BUILDING)

Steel Columns and / or metal façade interconnected to foundation Conductor through earth stud/foundation bolt satisfying the requirements of IS/IEC 62305 need not require separate down conductor.

EARTHING FOR SAFETY OF LV NETWORK

Additional earth studs need to be installed in places where electrical panels & electronic equipment are installed. All electrical rooms as well as every floor level in electrical shaft must have a local equipotential bonding earth stud extended from the structural earthing. Sizing of earth stud for electrical room shall be based on the Short circuit current requirements of the electrical system considering TN-S network. In addition earth studs for the purpose of testing the efficiency of protection system shall be provided in easily accessible places at top and bottom of the building at every 20 meters around the periphery of the building.

TESTING OF DOWN CONDUCTOR

Structural earthing used as a part of lightning protection system, overall resistance shall not be more than 0.2 ohm when measured between the air termination and the earthing test point provided at the ground level.

TESTING OF EARTH CONDUCTOR AS SUPPLEMENTARY PE

Structural earthing used as supplementary PE conductor, overall resistance of each stud shall be measured, fault clearance time of switchgear need to be established and expected heat generation in cables as well as earth stud / conductors during a fault has to be calculated. This data becomes the primary date for electrical safety in the building.

AIR TERMINATION SYSTEM

Air termination system (Horizontal/Vertical) in the roof shall be according to Lightning Protection Level specified in NBC 2016. The air termination system consisting of vertical rods and/or mesh shall be connected to the structural conductor through earth studs provided at the parapet / columns of the building. For this purpose, sufficient earth studs with provision of mechanically strong connection need to be provided at the parapet / wall / column at the top of the building. Air termination system shall be installed strictly after completion of the installation of all roof mounted electrical / metal installations.

For building with metal roof, the air terminal shall be directly connected to the steel roofing sheet with special leak proof screws. Bonding of roof steel and structural support columns shall be ensured by installing braided wires at every 10 meters

INSTALLATION, TESTING AND CERTIFICATION

The total installation need to be carried out by an UL listed Lightning Protection Installer as per IS/IEC 62035. The installation also need to be tested and certified by a qualified lightning protection expert as specified in IS/IEC 62305 with more than 10 years’ experience.

SANDWICH BUSTRUNKING SYSTEMS

SCOPE

This specification covers Sandwich type bustrunking for use as Feeder Busbar for interconnection between separate electrical equipment or load centers, and for use as Plug in busbar for power distribution.

SYSTEM DETAILS

The busbar shall be suitable for operation in a 1000 V system with frequency of either 50 Hz or 60 Hz. System can be either earthed or unearthed. Impulse voltage should be 12 KV.

STANDARDS:

The busbar shall be designed and manufactured in accordance with the following international standards for busbar trunking

IS 8623or 1993 Part I & II: Particular requirements of Busbar Trunking System

IEC 61439 Part I & VI: Particular requirements of Busbar Trunking System

IEC- 60529: Degree of protection

TESTING

The bus bars shall be type tested at a reputable national or International test laboratory (CPRI or UL or ASTA or DEKRA) for t he following:

Short Circuit Test: Test to be conducted for 01 second.

Degree of Protection: Rising Main shall be IP54/Busbuct shall be tested for IP55(for Indoor Application)or tested for IP65 (for Outdoor Application with Canopy)

Temperature Rise Test: Test Report from above said agencies shall be submitted alternately Test on specific rating shall be conducted at manufacturer’s premises at the time of inspection & clearance of material.

MANUFACTURERS

The manufacturer must have an established track record in design and manufacturing of Sandwich busbar trunking. The manufacturer must have ISO 9001 certification for design, manufacture and testing of busbar systems.

A Past record of at least 50 installations is a must.

GENERAL

The busbar shall be of Sandwich construction design. It shall be possible to mount the busbar system in any orientation, without affecting the current rating. The Sandwich busbar configuration must be compatible with the cast resin busbar, and must allow for interconnection of the two types, wherever required. The length of each section will be limited to max. 3 meters.

HOUSING

The housing shall be made of 1.6 mm electro galvanized sheet steel, with a 50 to 80 micron powder coating shade of RAL 7032.

The housing shall be clamped with Stiffeners at every 500mm to provide adequate strength during Short Circuit and efficient heat dissipation.

The width of the housings shall be same for all ratings of busbars, in order to provide interchangeability of tap off boxes.

BUSBARS:

The busbars shall be of C o p p e r , 99.9% pure ETP grade or Aluminum as specify in boq with high strength and high conductivity of 6101 or 63401 grade.

External earth: 2 No’s Earthing strips of copper or aluminum of appropriate size as per short circuit withstand capacity shall be provided, one on each side. Earthing strip shall properly bolted with enclosure at every 500mm with proper continuity with enclosure.

It should be possible to provide a 200% Neutral where specified.

The bus bar should be tin plate at joints/ connections.

Phase cross over box should have busbars crossing over each other not with cables.

INSULATION

The busbars shall be individually insulated with multilayer insulating film. Inner layer shall be of MICA and outer layer of POLYSTER material. The standard insulation level shall be class “F”.

JOINTS:

The joints between sections shall be made so as to provide flexibility during installation and expansion or contraction of busbar during operation. The joints shall be a uniblock with single

bolt type. The joint construction must have the following features. a)Thermal expansion of Busbars at joint of at least 4 mm per joint.

The joint insulators must be molded design instead of insulation plate cut form sheet with edges which can absorb moisture.

Joint assembly shall be removable as separate sub-assembly so that two sections can be isolated without disturbing the adjacent sections.

The busbars ends shall not have any holes or slots at the joints area– the electrical continuity shall be through pressure plates, achieving a high area of joint cross section and expansion capability.

TECHNICAL SPECIFICATION OF SERVO STABLIZER

Indoor type Air Cooled Servo stabilizer with following parameters:

Rating - 100kVA, 3-phase

Input Voltage Range - 340V to 465V,47 -53Hz, 4 Wire

Output Voltage Range - 400V +/- 1%

Duty Cycle - Continous 24 x 7

Cooling - Natural / Forced Air Cooled

Waveform Distortion - Nil

Response Time - Less Than 10ms

Suitability - All Power Factors Load

Class of Insulation - B Class

Breakdown Strength - 1500V AC for 2 Minutes

Insulation Resistance < 50 Mega Î © at 500C DC

Additional Facility - Manual operation

Installation - Indoor Type

Degree of Protection - IP-30

No Load Loss - Less than 0.4%

Efficiency - 98-99%

Applicable Standards - IS-9815

"Type of Suiablity -

 Unbalanced Supply and Load. Suitable for 3 phase Unbalanced/ balanced Supply & Unbalanced/Balanced Load.

- The unit consists of 3 nos. Single phase individually AC servo motor controlled units of 1/3rd of the total capacity connected in Star configuration."

Input / Output Termination - On Brass studs / Connectors.

Winding & Wiring Material - Copper EC grade (99.9% Pure)

Mandatory Features & Protections are following:

- Overload Cut-Off and Short Circuit Protection.
- Low / High Voltage (out of input range) Alarm and / or Cut-Off.
- Single Phase Prevention Alarm and / or Cut-Off.
- High Temperature Alarm and / or Cut-Off.
- Reverse Phase Cut-Off.
- Auto Phase Correction in case of Phase Reversal.
- Spike and surge protection
- Ammeter, Temperature Meter,
- Digital Ammeter, Digital Voltmeter.
- Stabilizer By Pass System
- Remote control of stabilizer (with wires)
- Earth fault protection
- Delay on Circuits

IMPORTANT INSTRUCTION FOR ELECTRICAL WORKS

GENERAL

Rates quoted shall be for work to be carried out at all heights and levels as required at site. No extra payment on this account shall be admissible.

WIRING

Rates quoted for Point Wiring items shall be based on average wiring and average conduiting length in all areas of the project. irrespective of their being shown in tender drawings or not. No extra claim on this account shall be admissible.

Cost of circuit wiring (wiring from DB terminal to the first switch in any sub circuit) is included in the scope of Point Wiring item. Circuit wiring shall not be paid extra.

Rate quoted for Point Wiring for ceiling fan points shall also include the cost of providing fan hook cum outlet box in the ceiling. The switchbox shall have space provision for electronic fan regulator.

Same rate shall be payable for wiring in surface conduiting system or recessed conduiting system

Recessed conduiting work shall be carried out in close co-ordination with progress of civil works Conduiting system in slabs shall be laid on shuttering before concrete is poured. Chases in brick work shall be made prior to plastering. Cutting of concrete or plaster for conduit laying shall not be permitted.

Wiring colour code – Red, Yellow, Blue for three Phases, Black for Neutral and Green for Earth – shall be maintained for entire wiring except on UPS

All wiring accessories (switches, socket outlets, bell pushes etc..), shall be as per approved make, type and colour. Sample of each type shall be got approved by Project Manager before use on work.

Rates for wiring of IP 56/metalclad 20/32 amps single/three phase socket outlets shall include the cost of matching plugs also.

SUB-MAINS AND MAINS.

Payment of submain wiring in conduit shall be as per the length of conduit measured between conduit terminations. Wires without conduits inside equipments for making terminal connections at either end shall not be payable extra.

Payment of cables shall be based on length of cable laid between cable termination glands on either end. Length of cable leads inside the cable termination arrangement shall not be payable extra..

Single core cables shall be armoured with non magnetic material. The core insulations shall be colour coded (Red/Yellow/Blue for phases and Black for neutral)

Annular space around cables, conduits, busducts and rising mains shall be filled by fire resistant compound of approved make and type in accordance with the compound manufacturers instructions.

Annular space around cables/earth strips entering below ground level into the building shall be filled up with suitable mastic compound to prevent ingress of rodents and water into the building.

SWITCHBOARDS AND DISTRIBUTION BOARDS

Quoted rates shall be inclusive of the cost of the following.

Details of sub-circuits being fed by DBs shall be affixed on the back of the DB door of each DB

Earth bonding of all hinged doors (of DBs and SDB cubicles/panels) shall be effectively done by braided flexible copper wire .

All doors and operable covers shall be Gasketted with neoprene gaskets.

3 mm thick gland plate shall be provided at top/bottom of SDBs for cable entry.

1 no. sample DB shall be got approved from Project Manager before undertaking bulk procurement

/fabrication.

All DBs and SDBs shall be designated by engraved name plates of approved material, finish and lettering fixed by countersunk nickel/cadmium plated screws. Danger plates shall be affixed on all three phase boards.

An as-built schematic wiring diagram in stenciled permanent ink and housed in wooden frame with clear non- reflective acrylic cover shall be provided near main LT panel in substation/electrical room.

Framed safety instructions complete with emergency telephone numbers shall also be provided inside each switchroom and generator room..

Contractor shall provide bus bar rating calculation for current carrying capacity, short circuit thermal and electro dynamic stresses to comply to the current and fault current withstand specified for each item of switchboard, rising main, bus ducts etc. for approval of project manager prior to fabrication. Changes if any required by contractor shall be incorporated without any additional cost.

FIXING OF LIGHTING FIXTURES

Quoted rates shall include the following:

All components that may be required to make the installation complete in all respects such as,

Suitable length of down rod, hanger and connecting wires where called for..

Internal wiring between accessories.

Wiring for connecting the fixtures to the point through connection blocks.

Metal blocks to serve as base of fixtures.

Bonding with earth.

Drilling holes in supports where required.

Fixing clamps, GI bolts and nuts, brass screws, saddles, rawl plugs and other fixing accessories as required.

For any fixtures and fittings required to be fixed to the RCC slab, the Contractor shall drill the required holes with the use of an appropriate drilling machine with drill bits and no extra charges shall be payable on this account..

SUPERVISION

The installation, testing and commissioning of Main LT panel, 11KV Panels, Transformers, Bus ducts, Rising mains, 11 kV cables termination shall be supervised and certified by the respective manufacturers.

TECHNICAL SPECIFICATION OF CCTV SYSTEM

The objective of CCTV system is to provide video surveillance and recording function for the Commercial complex operators to monitor strategic area to secure the safety and security of the public and staff.

General Requirements for CCTV System

The CCTV system shall be used for observation of public movement for security, disaster measures. According to them, the basic requirements for CCTV system shall be as follows

Monitoring Patients and Public Movement

The CCTV camera shall be installed at a different location like entry exit ,waiting area etc for the purpose of monitoring of public services, including patients .

NETWORK VIDEO RECORDER (NVR)

The Contractor shall provide NVR in consideration of the following specifications

General

1. The NVR should support recording of MPEG-2 and MPEG-4 source simultaneously. It Should support recording of video and audio. The NVR should support applications, recording, re-play and backup simultaneously.

2. System should ensure that once recorded, the video cannot be altered ensuring the audit trail is intact for evidential purposes.

3. System to have facility of additional camera installation beyond the originally planned capacity up to 25% at each station without impacting on the performance of the system in any manner

4. The recording resolution and frame rate for each camera should be user programmable.

5. System must provide built-in facility of watermarking or Digital certificate to ensure tamperproof recording so that these can be used as evidence at a later date, if so desired. The recording should support audit trail feature.

6. The software should have user access authority configurable on per device or per device group basis. The user should have the facility to request the access of any camera and can control the camera for a reservation period. Control of camera is released after the reservation period.

7. In order to optimize the memory, while recording, video should be compressed using MPEG-4 or better standard and streamed over the IP network. Once on the network, video can be viewed on a Control room workstation or on analog monitor using a hardware decoder (MPEG-4/compatible standard Receiver) and should be recorded on NVR SERVER and should be backed up on NAS/RAID Backup device. The decoder should be capable of forward integration with the future editions of MPEG standards likely to be evolved at least up to the end of the DLP.

8. Video stream from individual cameras should be recorded on respective NVR &, subsequently, archived to NAS box/RAID backup device. System should have provision to automatically over-write the new information after the period of 7 days & necessary script/algorithm must be available in the Application.

9. The software should Support flexible 1/2/4 Windows Split screen display mode or scroll mode on the PC monitor or on preview monitor as per site requirement.

10. NVR Should have below specification

Processor	Dual-core embedded processor
Operating System -	Embedded LINUX
IP Camera Input	32 channel Analog or 64 Channel IP
Two-way Talk	1 channel Input, 1 channel Output, RCA
User Interface	GUI
Video Output	1 HDMI, 1 VGA
Compression	H.264+/H.264/MJPEG

Video Resolution	2560 × 1920, 2048 × 1536, 1920 x 1080, 1280 x 1024, 1280 x 720, 1024 x 768
MD Zones	396 (22 × 18)
Video Loss	Supports
Camera Blank	Supports
Alarm Input	4 channel
Alarm Output	2 channel
Hard Disk	4 SATA Ports, up to 8TB
Smart Phone	Smart Phone - iPhone, iPad, Android Phone
Trigger Events	Recording, PTZ, Tour, Alarm, Video Push, Email, FTP, Spot, Buzzer & Screen tips
Recording Mode	Manual, Schedule (Regular, Continuous), MD (Video detection: Motion Detection, Camera Blank, Video Loss), Alarm, Stop
Search Mode	Time/Date, Alarm, MD & Exact search (accurate to second), Smart search
Playback	Play, Pause, Stop, Rewind, Fast play, Slow play, Next file, Previous file, Next camera, Previous camera, Full screen, Repeat, Shuffle, Backup selection, Digital zoom
Backup Mode	USB Device /Network
Interface Ports	1 HDMI, 1 VGA, 2 USB(1 USB 2.0 , 1 USB 3.0), 1 RS485, 1 RS232, 1 RJ45
Record Interval	1~120 min (default: 60 min), Pre-record: 1~30 sec, Post-record: 10~300 sec
Max User Account	128 users
Ethernet	1 RJ-45 port (10/100M/1000M)
Protocols	HTTP, TCP/IP, IPv4/IPv6, UPNP, RTSP, UDP, SMTP, NTP, DHCP, DNS, IP Filter,PPPOE, DDNS, FTP, Alarm Server,ONVIF Version 2.4
Power Supply	DC12V/4A
Power Consumption	20W(without HDD)
Working Temp	. -10 ~+55°C / 10~90%RH / 86~106kpa

High Resolution IP Fixed Box type Camera (Day/Night)

Image Sensor:	1/2.8" Progressive Scan CMOS
Signal System:	PAL/NTSC
Min. Illumination:	Color: 0.005 lux @(F1.2, AGC ON), 0 lux with IR
Shutter time:	1/3 s to 1/100,000 s
Slow shutter:	Support
Lens:	2.8 mm, horizontal field of view: 108° 4 mm, horizontal field of view: 86.4° 6 mm, horizontal field of view: 52° 8 mm, horizontal field of view: 40° 12 mm, horizontal field of view: 25°
Lens Mount:	M12
Adjustment Range:	Pan: 0° to 360°, tilt: 0° to 90°, rotate: 0° to 360°
Day& Night:	IR cut filter with auto switch
Wide Dynamic Range:	120 dB
Digital noise reduction:	3D DNR

Compression Standard

Video Compression:	H.265+/H.265/H.264+/H.264/MJPEG
Video bit rate:	32Kbps~16Mbps
Triple Streams:	Yes

Image

Max. Image Resolution:	1920 x 1080
Frame Rate:	50Hz: 25fps (1920 × 1080, 1280 × 960, 1280×720) 60Hz: 30fps (1920 × 1080, 1280 × 960, 1280×720)
Sub Stream:	50Hz: 25fps (640 × 360, 352 × 288) 60Hz: 30fps (640 × 360, 352 × 240)
Third Stream:	50Hz: 25fps (1920 × 1080, 1280×720, 640 × 360, 352 × 288) 60Hz:

	30fps (1920 × 1080, 1280×720, 640 × 360, 352 × 240)
Image Enhancement:	BLC/3D DNR
Image Settings:	Rotate Mode, Saturation, Brightness, Contrast, Sharpness adjustable by client software or web browser
Target Cropping:	Support
ROI:	Support 1 fixed region for each stream, and face dynamic tracking
Day/Night Switch:	Auto/Scheduled
Network	
Protocols:	TCP/IP, UDP, ICMP, HTTP, HTTPS, FTP, DHCP, DNS, DDNS, RTP, RTSP, RTCP, PPPoE, NTP, UPnP, SMTP, SNMP, IGMP, 802.1X, QoS, IPv6
General Function:	One-key reset, Anti-Flicker, heartbeat, mirror, password protection, privacy mask, Watermark, IP address filtering
System Compatibility:	ONVIF (Profile S, Profile G), PSIA, CGI, ISAPI
Interface	
Communication Interface:	1 RJ45 10M / 100M Ethernet interface
On-board storage:	Built-in Micro SD/SDHC/SDXC slot, up to 128 GB
Smart Feature-set	
Behavior Analysis:	Line crossing detection, Intrusion detection, Unattended baggage detection, Object removal detection
Line Crossing Detection:	Cross a pre-defined virtual line
Intrusion Detection:	Enter and loiter in a pre-defined virtual region
Unattended Baggage:	Objects left over in the pre-defined region such as the baggage, purse, dangerous materials
Object Removal:	Objects removed from the pre-defined region, such as the exhibits on display.
Recognition:	Face Detection

High Resolution IP Fixed Dome type Camera

Image	1/3" Progressive Scan CMOS

Sensor:	
Signal System:	PAL/NTSC
Min. Illumination:	Color: 0.005 lux @(F1.2, AGC ON), 0 lux with IR
Shutter time:	1/3 s to 1/100,000 s
Slow shutter:	Support
Lens:	2.8 mm, horizontal field of view: 108° 4 mm, horizontal field of view: 86.4° 6 mm, horizontal field of view: 52° 8 mm, horizontal field of view: 40° 12 mm, horizontal field of view: 25°
Lens Mount:	M12
Adjustment Range:	Pan: 0° to 360°, tilt: 0° to 90°, rotate: 0° to 360°
Day& Night:	IR cut filter with auto switch with 36IR LED
Wide Dynamic Range:	120 dB
Digital noise reduction:	3D DNR
Compression Standard	
Video Compression:	H.265+/H.265/H.264+/H.264/MJPEG
Video bit rate:	32Kbps~16Mbps
Triple Streams:	Yes
Image	
Max. Image Resolution:	1920 x 1080
Frame Rate:	50Hz: 25fps (1920 × 1080, 1280 × 960, 1280×720) 60Hz: 30fps (1920 × 1080, 1280 × 960, 1280×720)
Sub Stream:	50Hz: 25fps (640 × 360, 352 × 288) 60Hz: 30fps (640 × 360, 352 × 240)
Third Stream:	50Hz: 25fps (1920 × 1080, 1280×720, 640 × 360, 352 × 288) 60Hz: 30fps (1920 × 1080, 1280×720, 640 × 360, 352 × 240)
Image	BLC/3D DNR

Enhancement:

Image Settings:	Rotate Mode, Saturation, Brightness, Contrast, Sharpness adjustable by client software or web browser
Target Cropping:	Support
ROI:	Support 1 fixed region for each stream, and face dynamic tracking
Day/Night Switch:	Auto/Scheduled

Network

Protocols:	TCP/IP, UDP, ICMP, HTTP, HTTPS, FTP, DHCP, DNS, DDNS, RTP, RTSP, RTCP, PPPoE, NTP, UPnP, SMTP, SNMP, IGMP, 802.1X, QoS, IPv6
General Function:	One-key reset, Anti-Flicker, heartbeat, mirror, password protection, privacy mask, Watermark, IP address filtering
System Compatibility:	ONVIF (Profile S, Profile G), PSIA, CGI, ISAPI

Interface

Communication Interface:	1 RJ45 10M / 100M Ethernet interface
On-board storage:	Built-in Micro SD/SDHC/SDXC slot, up to 128 GB

TECHNICAL SPECFICATION OF UPS

SYSTEM COMPONENTS

IGBT technology (IGBT Rectifier & IGBT Invertor) with galvanic isolation transformer.

POWER

On-Line UPS

PRODUCT CERTIFICATION/TESTING

The product shall have certification from any one of the following -

a) ERTL

b) ETDC

c) STQC

d) I E C

e) ISO 9001

OPERATING TEMPERATURE

0 - 40 degree Centigrade

HUMIDITY

Up to 95%

OUTPUT FREQUENCY

50 Hz +/- 0.01% Hz

WAVE FORM

Pure Sine Wave

TRANSIENT RESPONSE

+/- 1% maximum under following conditions:

a) Loss or Return of Input AC supply

b) 100% step load

RECOVERY TIME

To nominal voltage in less than 10 milli second.

EFFICIENCY (OVER ALL)

Minimum 90% at full load.

LOAD POWER FACTOR

0.9 lag to unity.

CREST FACTOR

Greater than 3:1

MTBF

Minimum 100000 hrs.

SWITCH OVER TIME

Zero

OVERLOAD RATING

110% for 30 minutes

125% for 10 minutes

150% for 1 minutes

NOISE

Less than 65 dB at 1 mtr.

SWITCHING SPEED

Minimum 2 KHZ

INDICATION

Mains ON/OFF, /Battery HIGH/LOW, Battery ON, Invertor ON/TRIP, O/P HIGH/LOW, Battery HIGH/LOW, Alarm for Battery Discharge.

PROTECTION

Input - Over/Under voltage, Over Current.

Battery - Over/Under Voltage, Over Current, Battery Low Alarm/Trip.

Output - Over/Under Voltage, Over Current.

Output - Short Circuit Over Temperature DC Over Current

CONTROL CIRCUITORY

Microprocessor based control circuitory be provided and all indications will be digitally displayed using microprocessor based software.

METERING

Digital display with multifunctional key panel indicate.

Output Voltage/Current

DC Voltage/Current

Output Frequency

COMMUNICATION PORT

RS 232

DIAGNOSIS & CONFIGURATION SOFTWARE

Compatible with Unix/Windows.

OUT LOOK

Compact size with aesthetically good look (specify the size and weight)

UPS FAILURE

During failure in the UPS equipment the static switch automatically transfer the A.C. load directly to the AC. line in less than 1/4 cycle so that transfer does not affect critical equipment operation.

HARMONIC DISTORTION OF WAVE FORM

Total harmonic distortion (THD) should be below

2% for linear load and below 3% for nonlinear load.

MAINTENANCE BY PASS SWITCH

The portion of UPS module used to connect the alternator supply to critical load while electrically isolating static switch and inverter for maintenance purpose.

BATTERY DISCONNECT SWITCH

The switch used to electrically isolate the storage batteries from UPS module.

STATIC TRANSFORMER SWITCH

The switch senses an inverter shutdown signal or degradation of inverter output item. It shall automatically transfer the loads from one inverter to the alternative AC power without interruption.

RETRANSFER TO INVERTOR

The static transfer switch shall be capable of automatically retransferring the load back to inverter after the inverter has returned to normal voltage and stabilized for period of time.

QUALITY ASSURANCE

The manufacturer shall have quality assurance program with check on incoming parts and final products. A final test procedure for product shall include a check of all performance specifications and a minimum 24 hour running.

INSTALLATION DRAWING

After the receipt of order a minimum two sets of installation drawings showing outline dimension, weights and connections and a one line drawing of the UPS shall be sent to the purchaser to be used in planning the installation of the system.

PRODUCT DOCUMENTATION

Manufacturer shall supply a comprehensive set of product documentation for:

1. Installation
2. Operation
3. Maintenance

This should include complete outline and external connection drawings and schematic and physical wiring diagrams as well as parts list and parts layout down to the smallest components level. It should include startup and service manuals with complete privation and remedial maintenance and trouble showing instructions. This should include all ancillary equipment and accessories.

TRAINING

It is important that at least -2 personnel who are to be responsible for operation and maintenance of UPS be trained at the manufacturer site.

SPARE PARTS

The recommended spare parts for 5 years of maintenance are to be listed and should be quoted along with main modules.

MATERIAL AND WORKMANSHIP

Workmanship shall be first class in every respect.

All material shall be new and of best commercial grade.

Brackets and securing hardware shall be electroplated with corrosion resistance material.

Internal wiring conductors shall be combined into cable or bundles and shall be tied securely together and numbered or coded to correspond with documentation.

STORAGE BATTERY

The storage battery shall be furnished with racks connecting hardware and standard service resistance material accessories. The battery shall be delivered charged and filled ready for service. The battery shall be maintenance free type.

SERVICE REPORT

Assigned field service report describing start-up and on site testing shall be furnished.

MAINTENANCE

If the battery is taken out of service for maintenance by manually opening battery disconnect switch the UPS shall continue to function and meet all the performance criteria specified except.

INVERTOR EFFICIENCY

96% minimum

PROTECTION CLASS

IP – 20

PARALLEL – CONNECTION

Up to 4 module

TECHNICAL SPECIFICATION OF CABLES :-

Cables of appropriate size to be used in the system shall have the following characteristics:

Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards

Temp. Range: –10oC to +80oC.

Voltage rating 660/1000V

Excellent resistance to heat, cold, water, oil, abrasion, UV radiation

Flexible

Sizes of cables between array interconnections, array to junction boxes, junction boxes to Inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%)

For the DC cabling, XLPE or, XLPO insulated and sheathed, UV- stabilized single core multi-stranded flexible copper cables shall be used; Multi-core cables shall not be used.

For the AC cabling, PVC or, XLPE insulated and PVC sheathed single or, multi-core multi-stranded flexible copper cables shall be used; Outdoor AC cables shall have a UV-stabilized outer sheath.

The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use. Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour.

The DC cables from the SPV module array shall run through a UV- stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.

Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.

All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 mm2 copper; the minimum AC cable size shall be 4.0 mm2 copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.

Cable Routing / Marking: All cable/wires are to be routed in a GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified. In addition, cable drum no. / Batch no. to be embossed/ printed at every one meter.

Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in colour.

All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV

radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1kV as per relevant standards only.

The ratings given are approximate. Contractor to indicate size and length as per system design requirement. All the cables required for the plant shall be provided by the contractor. Any change in cabling sizes if desired by the Contractor shall be approved after citing appropriate reasons. All cable schedules/ layout drawings shall be approved prior to installation.

Multi Strand, Annealed high conductivity copper conductor PVC type ‘A’ pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection Armoured cable for underground laying. All cable trays including covers to be provided. All cables conform to latest edition of IEC/ equivalent BIS Standards as specified below: BoS item / component Standard Description Standard Number Cables General Test and Measuring Methods, PVC/XLPE insulated cables for working Voltage up to and including 1100 V, UV resistant for outdoor installation IS /IEC 69947.

The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.

The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

TECHNICAL SPECIFICATION OF HVAC SYSTEM

The specifications given hereunder relate to the HVAC System and shall be read in conjunction with the appropriate Indian and International Standard Specifications.

1.0 Architects & Consulting Engineers

2.0 Site

The air-conditioning system using Variable Refrigerant Flow System is being considered for GOLE MARKET at New Delhi to provide summer & monsoon cooling.

3.0 Scope of Work

The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under the Contract in every respect in conformity with the contract documents and with the directions of and to the satisfaction of the Architects/ Consulting Engineers and Owners. The Contractor shall furnish all labor, materials and equipment (except those to be supplied by the Owners, if any) as listed under Schedule of Quantities & specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of complete HVAC system as described in the specifications and as shown on the drawings. This also includes all materials, equipment, appliances and incidental work not specifically mentioned herein or noted on the drawings or documents as being furnished or installed, but which are necessary and customary to make a complete installation. Following shall be the scope of work in brief to be carried out under this Contract:

Supply, Installation, Testing & Commissioning of VRF systems.

Supply, Installation, Testing & Commissioning of Air Handling Units.

Supply, Installation and Testing of copper refrigerant piping sandwiched between slotted angle cable trays complete with fittings and insulation.

Supply & Installation of condensate drain piping complete with insulation.

Supply & Installation of electrical work associated with HVAC system comprising of panels complete with cabling, wiring & earthing.

Supply & Installation of vibration isolators for HVAC equipment.

Balancing, Testing and commissioning of the entire installation under scope.

4.0 Exclusions:

The following works associated with the HVAC installation do not fall in the scope of HVAC package:

Associated works: Civil

Foundations for various equipment including VRF Outdoor Unit, etc. being installed in service building. Overdeck thermal insulation for all exposed roofs using 40mm thick extruded polystyrene, density not less than 32Kg/CuM amalgamated with water proofing treatment.

Providing PCC/RCC Blocks as foundations for air conditioning equipment including AHUs, etc. as required.

Providing cutouts in slabs/walls for passage of ducts, refrigerant pipes.

Finishing & making good of the above openings/cutouts. Openings provided in slab on terrace to be provided with rain water protection arrangement.

Any kind of false ceiling work required for enclosing the ductwork and piping.

Necessary epoxy paint to be applied on various components of structural platform to be installed on terrace for HVAC equipments.

Associated Works: Electrical

415+ 10% V, 3 Phase AC power supply along with earthing to be terminated at the following locations :

In VRF outdoor unit located on terrace.

In AHU panel as shown in drawings.

Existing package units shown in drawings.

220 + 10% Volts, Single Phase power point to be provided near each cassette unit and DX-split units as shown in drawings.

220 + 10% Volts, Single Phase power point to be provided near each inline fan for exhaust as shown in drawings.

Associated Works: Plumbing

Providing drainage facility near Air Handling Units.

5.0 Equipment:-

Testing and Commissioning shall include furnishing all labour, materials, instruments etc. and incidentals necessary for complete testing of each component as per the specifications and manufacturer’s recommendations.

Maintenance services for the complete HVAC installation under scope shall be provided during the defects liability period.

6.0 Basis of Design:

The parameters influencing the air-conditioning system design have been considered as under:

a. Orientation

The building orientation is as envisaged in the architectural plans.

b. Outside Design Conditions

The outside design conditions for New Delhi have been given here under:

Season	Dry Bulb Temperature	Wet Bulb Temperature
Summer	110 F (43.3 C) db	75 F (23.9 C) wb
Monsoon	95 F (35.0 C) db	83 F (28.3 C) wb

c. Inside Design Conditions

Summer & Monsoon :

Temperature	73 + 2F (22.7 + 1 C) db
Relative Humidity	Not to exceed 65% during Monsoon

6.1 Design Data

Floor/ Space	Floor Area (Sft)	Height (ft)	Occupancy (Persons)	Lighting Load (Watts/Sft)	Equipment Load (Watts/Sft)
Ground Floor					
Gallery-1	630	16	18	3.5	0.5
Gallery-2	640	16	18	3.5	0.5
Gallery-3	630	16	18	3.5	0.5
Gallery-4	630	16	18	3.5	0.5
Ticket Counter	640	16	5	1	2

Café	390	16	12	1	1 kW
Single height corridor	900	16	15	1	Nil
Double height dome	2230	30	30	1.5	Nil
Total Ground Floor	6930				
First Floor					
Multi Purpose Room	590	10.8	16	3.5	0.5
Gallery-5	590	10.8	16	3.5	0.5
Gallery-6	600	10.8	16	3.5	0.5
Gallery-7	1500	10.8	45	3.5	0.5
Office-IT Room	590	10.8	8	1	3
Single Height Corridor	1800	10.8	15	1	Nil
Total First Floor	6810				
Grand Total	13100				

NOTE:

The above design data needs to be ratified by the end user.

7 .0 Heat Loads

Based on the Architectural layouts and above design data, the Heat Loads for the various spaces to be air-conditioned have been worked out and the heat load results and maximum demand have been furnished below:

Floor/ Space	Floor Area to be air conditioned (Sft)	Refrigeration Load (TR)		Dehumidified Air Quantity (Cfm)	Fresh Air (Cfm)	Equipment Selection
		Summer	Monsoon			

Ground Floor						
Gallery-1	690	4.4	3.4	2060	190	1x2500 Cfm vertical FM AHU
Gallery-2	690	4.4	3.3	2110	190	1x2500 Cfm vertical FM AHU
Gallery-3	690	4.4	3.4	2110	190	1x2500 Cfm vertical FM AHU
Gallery-4	690	4	3.2	1900	190	1x2500 Cfm vertical FM AHU
Souvenir Shop & Office	690	4.5	3.6	2190	150	1x2500 Cfm vertical FM AHU
Café	390	2.5	1.9	1210	160	1x1500 Cfm vertical FM AHU
TFA for Kitchen	--	4.1	5	900	1800	1x1800 Cfm TFAU (F/B Type)
Double height dome	2160	25.7	21.2	8500	600	2x5000 Cfm Floor Mounted AHU
TFG For all Galleries & café	--	11.3	20.5	1500	3000	1x3000 Cfm TFA
Total Ground Floor	6000	65	66			
First Floor						
Gallery-5	590	3.1	2.6	1450	160	1x2500 Cfm vertical FM AHU
Library	600	3.3	2.7	1580	160	1x2500 Cfm vertical FM AHU

Gallery-7	1500	7.9	6.7	3700	450	2x2500 Cfm vertical FM AHU
Partition of India	590	4.1	3.4	1970	160	1x3000 Cfm vertical FM AHU

Floor/ Space	Floor Area to be air conditioned (Sft)	Refrigeration Load (TR)		Dehumidified Air Quantity (Cfm)	Fresh Air (Cfm)	Equipment Selection
		Summer	Monsoon			
Office-IT Room	590	2.7	2.2	1310	80	1x2000 Cfm vertical FM AHU
Single Height Corridor	1660	6.8	4.7	3400	150	Fed Galleries & Office AHUs of first floor
Total First Floor	5530	28	22			
Grand Total	13100	92	90			

Assumptions:

The heat loads mentioned above have been worked out based on the following assumptions:

Under-deck thermal insulation shall be provided for exposed roof using at least 50mm thick fiber glass board having density 32kg/cum.

All structural glazing and windows shall be provided with double glass – U Value = 0.7 BTUs/hr/Sft. Deg F & Solar Factor = 0.56 (with thick curtains/internal venetian blinds). Skylight shall be provided with single glass having U Value = 0.52 BTUs/hr/Sft. Deg F & Solar Factor = 0.65

7.2 Maximum Demand & High Side Equipment Selection

S. No.	Description	Peak Average Heat load in Tons of Refrigeration
a.	Proposed capacity of outdoor units for Double Height area	1x40 HP VRF Outdoor Units
b.	Proposed capacity of outdoor units for Ground Floor	1x36 HP VRF Outdoor Units
c.	Proposed capacity of outdoor units for First Floor	1x40 HP VRF Outdoor Units
d.	Proposed capacity of outdoor units for TFA	1x32 HP VRF Outdoor Units

7.3 System Design

A comfort air conditioning system using VRF system coupled with compatible indoor units has been designed to facilitate air- conditioning of Galleries at various floors to achieve flexibility in operation.

The indoor units shall be installed at strategic locations as shown in design drawings. Outdoor units shall be installed at service building, with minimum refrigerant piping between indoor & outdoor units. The copper refrigerant piping shall be carried out neatly on ladder type cable trays suitable for R410a refrigerant.

Condensate drain piping associated with indoor units, shall be carefully carried out to ensure leak proof disposal of condensate water.

8.0 Noise Level

Noise level in conditioned spaces due to all refrigeration and air conditioning equipment shall not exceed 42 dB at 125 Hz (without operation of any other equipment) when measured at any point in occupied spaces less than 150 cm above floor level and not closer than 150 cm from any supply air register or 60 cm from any return air register.

9.0 Design Parameters

Performance rating of various equipment shall be based on the following design Parameters:

9.1 Design parameters for Air-Handling Unit shall be:

Maximum face velocity across filters	500 FPM (152 MPM)
Maximum face velocity across coils	500 FPM (152 MPM)
Maximum fan outlet velocity	1800 FPM - For ceiling (549 MPM) suspended AHUs 2000 FPM For vertical (610 MPM) - & horizontal AHUs
Maximum fan speed	1000 RPM
Maximum fan motor speed	1500 RPM

9.2 Design parameters for duct designing shall be:

Maximum flow velocity	1500 FPM (457 MPM)
Maximum friction	0.09 inch WG per100 ft. run (7.5mm WG per100 M run)
Maximum velocity at supply air outlet	500 FPM (152 MPM)
Maximum flow velocity in exhaust air duct.	1800 FPM (550 MPM)

10.0 SMOKE EVACUATIONSYSTEM FOR VARIOUS SPACESON UPPER FLOORS

Various parameters influencing the smoke evacuation system are being given hereunder:

Design Data & Equipment Selection

Floor/ Space	Floor Area (Sft)	F/C Height (Ft)	ACPH for Smoke Evacuation	Extract Air Quantity (Cfm)	Equipment Selection	
					(For Smoke Evacuation)	(For Outdoor Compensation Air)
Ground Floor						
Double height Dome area	2160	30	12	12960	4x3300 Cfm capacity Vane axial flow fan	Make Air shall be replenished through doors.

11.0 Technical Submittals

The successful tenderer after award of work shall furnish technical submittals for various items incorporating complete technical details prior to procurement of equipment/materials, for the approval of the Consultants. The submittals for items mentioned in the tender document but not restricted to the following:

a.	Variable Refrigerant Flow System.
b.	Air Handling Units
c.	Extract Fan section.
d.	Dry Scrubber
e.	Copper Piping
f.	Axial Flow Fans

g.	Inline Fans
h.	Air Distribution System
i.	Thermal & Acoustic Insulation
j.	Electrical Panels
k.	Control Wiring
l.	Fresh Air Louver

Test certificates for various items shall also be submitted by the contractor.

12.0 Performance Guarantee

The Contractor shall guarantee uninterrupted service and stipulated quality of performance of the installed HVAC plant. The guarantee shall be furnished in the proforma indicated in the Appendix-I. It is to be clearly understood that the specifications indicated represent minimum performance requirements for the tenderers guidance.

13.0 Taxes & Duties:

i. All duties and taxes like excise duty, local sales tax, octroi, sales tax on works contract, VAT, Service Tax etc. shall be included in the quoted price.

ii. Transit insurance shall be borne by the Contractor.

iii. All the price indicated shall be F O R destination.

14.0 Fees and Permits

The Contractor shall obtain all permits /licenses and pay for any and all fees required for the installation, inspection and commissioning of the work.

15.0 Liability to Govt. Regulations :

a. The Contractor shall be responsible and shall abide by all the Government rules and regulations pertaining to erection, testing and commissioning of complete HVAC system at site.

b. Any compensation towards damage/loss of property/material/ equipment or to any person working at site shall be borne by the Contractor as per standard terms of Contract.

c. No escalation/ change of prices would be admissible under any circumstances.

16.0 Insurance

16.1 Insurance Policies:

Before commencing the execution of works, the Contractor, without limiting his obligations and responsibilities under this contract, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property, including that of the Owner or to any person including any employee of the Owner or a member of the general public, by or arising out of the execution of the works or in carrying out of the contract. Unless otherwise, stipulated elsewhere in this contract, it shall be obligatory for the Contractor to obtain the insurance cover under the following policies:

a) Contractor's All Risk Insurance Policy to cover the following:

i. Entire contract value including cost of materials supplied by the Owner, if any for the period of completion including defects liability period.

ii. Third party insurance to cover for any damages to third party. This shall be upto the period of completion of work only.

iii. Policy should cover Civil commotion, riots and other similar disturbances.

b) Policy to cover Contractor's liability under workmen's Compensation Act, 1923, Minimum Wages Act 1948, Contract Labour (Regulation and Abolition) Act 1970 and other relevant Acts listed elsewhere. This shall be for the period of completion of work.

Insurance cover against damage, theft or any other loss of all materials and equipment brought to site for which advance payment is claimed -limit of liability not less than the value of such materials at any stage of the contract.

The Contractor shall insure against all such liabilities and shall continue such insurance during the whole of the time when any persons employed by him are on the works.

The Contractor shall produce certificates of Insurance to the Project Manager/ Architect. These certificates shall be fully executed and shall state that the policies cannot be cancelled until ten (10) days after written notice of such cancellation has been given to the Owner.

The Contractor shall obtain written certificates of similar certificates from all sub-contractors and thereby assume responsibility for any claims or losses to the Owner resulting from failure of any of the sub-contractors to obtain adequate insurance protection in connection with their work.

16.2 Failure to Insure:

If the Contractor fails to comply with the terms of this condition, the Owner may affect the Insurance and deduct the expenses from any moneys that may be or become payable to the Contractor or may, at his option, refuse payment of any certificate to the Contractor until the Contractor complies with this condition.

16.3 No Limit to Liability:

In addition to the liability imposed by law upon the Contractor for injury (including death) to persons or damage to property by reason of the negligence of the Contractor or his agents, which liability is not impaired or otherwise affected hereby, the Contractor hereby assumes liability for and agrees to save the Owner harmless and indemnifies him from every expense, liability or payment by reason of any injury (including death) to persons or damage, to property suffered through any act of omission of the Contractor, or any of his sub-Contractors, or any person directly or indirectly employed by any of them or from the conditions of the premises or any part of the premises which is in the control of the Contractor or any of his sub-contractors, or any one directly or indirectly employed by either of them, or arising in any way from the work called for by this contract.

17.0 Partial Ordering

Owners through Project Managers/Architects/Consultants reserve the right to order equipment & material from any and all the alternates and/or to order high side and/ low side equipment and materials or parts thereof from one or more tenderers.

Engineering Responsibility of the system

The responsibility of system design, manufacturing, erection, working and safety will solely be responsibility of the Contractor for the parameters as mentioned in the tender documents prepared by the Architects/Consultants.

The system after commissioning shall be handed over to the Owners and thereafter they will monitor the performance for standard designed (without operation of any other equipment) parameters for 30 days continuously.

In case during this period the performance is not found satisfactory and rectification/ replacement, design improvement or any other change as felt necessary, will be made by the Contractor at no extra cost. Though these improvements can only be done after getting the approval from the Owners/Architects.

19.0 Schedule and Manner of Operations

Time being the essence of this Contract, the Contractor will be expected to furnish all labour and materials in sufficient quantities and at appropriate times, expedite and schedule the work as required and so manage the operation that the work will be

completed within the time stated in the Contract. In addition to providing a detailed time and progress schedule, the Contractor shall submit an outlined and graphic schedule of proposed procedures to the Project Managers/ Architects/Consultants within two days of issue of work order.

20.0 Bye Laws & Regulations

The installation shall be in conformity with the bye-laws, regulations and standards of the concerned local authorities so far as these become applicable to the installation. However, if these specifications call for a higher standard of materials and /or workmanship than those required by the regulations and standards then these specifications shall take precedence over the said regulations and standards. If the specifications call for requirements which violate the bye-laws and regulations, the bye-laws and regulations shall govern the requirements of this installation.

21.0 Erection and Supervision

The Contractor shall depute engineers from time to time of commencement of assembly and installation work to inspect all relevant civil construction/ fabrication and other necessary facilities to make improved action if felt necessary. However, a site engineer preferably a graduate in mechanical or electrical discipline shall be deputed at site permanently till completion of the work and shall be identified to the Client at the time of appointment at site.

22.0 Power for Construction

The Owner has made arrangements to provide single/ three phase power connection for construction purposes as per site conditions. The Contractor shall make his own arrangements to take metered connection from the above point. He shall at his own cost provide and install the meter and all temporary service lines as required for his use on the work and remove the same on the completion of the work.

23.0 Electrical Power and Soft Water Requirement

The tenderer shall submit with their quotation the breakup of electrical power requirement for all the HVAC equipment besides soft water requirement.

24.0 Sub-Contractors

As soon as practicable and before awarding any sub-contract the Contractor shall notify in writing the names of the Sub-Contractor to the Architects/Consultants proposed for the principle parts of the work. The Contractor shall not employ any Sub-Contractor whom the Consultants finds incompetent.

25.0 Design Drawings

The drawings prepared by the Architects/Consultants as listed under Appendix-II are indicative only of the general arrangement of the entire installation. The Contractor shall follow these drawings and specifications in preparation of his shop drawings and subsequent installation. He shall check the drawings of other trades to verify space for his installation. The Contractor shall thoroughly examine all relevant architectural, structural, plumbing, electrical and other services layout drawings before preparing the shop drawings for this installation and report to the Architects/Consultants any discrepancy and obtain clarifications. Any changes found necessary for coordination and installation of this work with other services and trades shall be made with prior approval of the Consultant/Architect and Owner without any additional cost to the Owner.

26.0 Technical Data

The tenderer shall submit a comprehensive schedule of technical data and complete manufacturer's specifications for all items of equipment and material including the manufacturer's name. The technical data shall be furnished in the proforma indicated in Appendix V.

27.0 Shop Drawings

Within three days after the award of the Contract, the contractor shall furnish for the approval of the Architect/Consultant, three sets of detailed shop drawings of all equipment and materials including plant room, ducting, piping, ventilation system and electrical work associated with the HVAC system required to complete the project as per Specifications and as required by the Architect/Consultant. 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 by other Contractors. Each item of equipment proposed shall be a standard catalogue product of an established manufacturer as per specifications.

If the Architects/Consultants make any amendments 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 Consultant, the Contractor shall submit a further six sets of shop drawings for the exclusive use of and retention by the Architects/Consultants. 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 the particular material or equipment.

The shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material to allow Architects/Consultants ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved CPM charts.

Samples, drawings, specifications, catalogues, pamphlets and other documents submitted for approval shall be in quarduplicate, each item in each set shall be properly labeled, indicating the specific service for which material or equipment is to be used, giving reference to the governing section and clause number of Specifications clearly

identifying in ink the items and the operating characteristics data of a general nature shall not be accepted.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements of building conditions. Where drawings are approved said approval does not mean that drawings have been checked in detail nor does it way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract.

Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and detailing required thereof, shall be prepared by the Contractor at his own cost and approved by the Architect/Consultant.

Where the work of the Contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make satisfactory adjustments. If so directed by the Architect/ Consultant, the Contractor shall prepare composite working drawings and sections at 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 work of other trades, he shall make all the necessary changes without extra cost to the Owner.

28.0 Co-operation /Co-ordination with other agencies

During the currency of the Contract, a number of Contractors will be at site to execute works under their respective contracts viz. structure, finishing works, plumbing, firefighting, electrical, lifts and other services. All these agencies will be at site at the same time. The Contractor shall offer full co-operation to, all these agencies with regard to use of materials etc. and co-ordinate the work in such a manner that the time schedules of all agencies are not adversely affected. The work shall be executed as per program approved by the Architect/Consultant. If part of site is not available, for any reason, or if there is some unavoidable delay in supply of materials stipulated by the Owner, the program of construction shall be modified accordingly and the Contractor shall have no claim for any extras or compensation on this account.

No claim shall be entertained from the Contractor on the plea that the work has been executed in the above circumstances or under difficult conditions. It shall be the responsibility of the Contractor to enforce necessary discipline among his workers and staff to ensure smooth working at the site in spirit of co-operation and amity with all other agencies.

29.0 Construction Program & Schedule Of Operations

A tentative construction program indicating the scheduling of various activities forms an annexure to this document. The Contractor should examine this program with respect to

construction logic, scheduling and duration of various activities etc. in relation to the resources available at his disposal, and suitably modify the program without extending the total duration of the job as also the completion targets for major milestones of the job and submit a modified construction program along with a firm commitment to adhere to the dates of completion of various activities. This construction program shall after scrutiny and approval of the Architect/ Consultant form part of the agreement and shall be treated as a baseline schedule to monitor, determine delays in individual activities, work milestones or the overall duration of the work. In the event of the Contractor, not submitting any modified construction program, the tentative construction program shall remain binding on the Contractor.

The Contractor shall mobilize equipment, tools, plant, scaffolding, shuttering, material, labour etc. in sufficient quantities so as to complete the work to meet the above agreed construction program. In the event of delays in the construction activities, the Contractor shall mobilize additional resources to complete the job in the specified time period and at no extra cost to the Owner.

The Architects /Consultants/ Owner may suggest an alternative scheduling of operations, should they find it necessary to accomplish the targets and the Contractor shall accordingly mobilize additional resources at no extra cost to the Owner.

30.0 Electrical Installation and Cabling

The electrical works related to the HVAC system shall be carried out in full knowledge and with complete co-ordination of the Contractor. It is to be clearly understood that the final responsibility for sufficiency, adequacy, and conformity to the performance of the HVAC system shall be with the Contractor.

31.0 Testing and Commissioning

On completion, the installation shall be tested for conformity with the stipulated performance specifications. Any defect, shortcoming detected in the system/ material/workmanship shall be rectified by the Contractor to the entire satisfaction of the Consultants without any extra cost to the Owner. The installation shall be tested again after the removal of the defects and shall be commissioned only after approval by competent inspecting authority or the Consultants and the Owner. All tests shall be carried out in the presence of the Consultants and Owner’s representative.

32.0 Completion Certificate

On successful completion of the installation, a certificate in the approved format shall be furnished by the Contractor. The Contractor shall be responsible for getting the entire installation duly approved by the Electrical Inspector or concerned authority, if any, and shall bear the all expenses in connection with the same.

33.0 Completion Documents

a. 5 copies of operation manuals/catalogues of all standard equipment to be furnished by the contractor immediately after commissioning of plant.

b. 5 copies of write up on preventive maintenance, trouble shooting and operating instructions of the system along with as-built drawings to be supplied by the Contractor at time of commissioning.

c. 5 sets of catalogues of all accessories such as dampers, valves, strainers, gauges, electrical components etc.

34.0 Completion Drawings

On completion of the work in all respects, the Contractor shall supply five port folios (300 x 450mm) each containing a complete set of drawings at approved scale clearly indicating complete plant layouts, ducting and piping layouts, location of wiring and sequencing of automatic controls, location of all concealed piping, valves, controls, dampers, wiring and other services. Each portfolio shall also contain consolidated control diagrams and technical literature on all controls. The Contractor shall frame under glass, in the maintenance room, one set of these consolidated control diagrams.

35.0 Training of Owner's Rrepresentative

Upon completion of work and conclusion of all tests, the Contractor shall furnish necessary skilled labour and helpers for operating the entire installation for a period of thirty working days of eight hours each, to enable the Owner's representative to get acquainted with the operation of the system. During this period, the Contractor shall train the Owner's representatives in the operation, adjustments and maintenance of all equipment installed.

36.0 Correction of Work before Final Payment

The Architects/Consultants/Owner shall conduct a final inspection just before the virtual completion of the work and prepare a final list of materials, equipment and item of work which fail to conform to the contract specifications. The Contractor shall promptly replace or re-execute such items in accordance with the contract and shall bear all expenses of making good all work and the cost of all work of the other Contractor, destroyed or damaged by such replacement or removal.

If the Contractor fails to remove and replace above rejected materials, equipment/ or workmanship within a reasonable time, fixed by written notice, the Owner may employ and pay other persons to amend and make good such defects at the expense of the Contractor. All expenses incurred by the Owner in rectifying the defects including all damages, loss and expense consequent on the defects shall be recoverable from any amount due or which may become due to the Contractor.

37.0 Virtual Completion

The work shall be considered virtually complete only upon fulfillment of the procedure laid down in the preceding clause and when the Consultants and the Owner has certified in writing that the work has been virtually completed. The defect liability period shall commence from the date of such certificate.

38.0 Maintenance during Defects Liability Period

Defects liability period shall commence from the date of virtual completion upon fulfillment of the procedure laid down in clause No.35. Contractor shall include incidental expenses towards necessary maintenance during defects liability period by deputing a skilled technician once in every week. The scope of such maintenance shall be for complete HVAC system but not restricted to the following:

Wet Cleaning of unit filters and fresh air intake filters.

Wet Cleaning of Paper fills and filters of FATU.

Wet Cleaning of cooling coil.

Total water in the sump to be drained, dried and filled with fresh water in regular intervals.

Degreasing of kitchen exhaust duct including extract fan section by using appropriate method (once in every six months).

Checking of fan belts, pulleys etc.

Dry Cleaning of electrical components using air blower.

39.0 Force Majeure

The right of the contractor to proceed with the work shall not be terminated because of any delay in the completion of the work due to unforseable causes beyond the control and without the fault or negligence of the Contractor, including but not limited to acts of God, or of public enemy, restraints of a sovereign state, floods, unusually severe weather.

40.0 Termination of the Contract by the Owner

If the Contractor shall be adjudged bankrupt or if he should make a general assignment for the benefit of his creditors, or if a receiver shall be appointed on account of his insolvence, or if he should persistently or repeatedly refuse to carry on the work diligently or shall fail except in cases for which extension of time is granted, to supply enough properly skilled workmen or proper materials or equipment for the progress of the work, or if he should fail to make prompt payments to sub-contractors for materials or equipment or labour or persistently disregard laws, ordinance, or instructions of the Architect, or otherwise be guilty of a violation of any provision of the contract, or has abandoned the contract, or has failed to commence the works, or has suspended the work, then the Owner upon the certificate of the Architect that sufficient cause exists to justify such action, may without prejudice to any other right or remedy and after giving the Contractor seven days notice in writing, terminate the employment of the Contractor and take possession of the premises and if all materials, equipment, tools and appliances there on and use these as Owners property for the completion of the work. In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the amount due to the Contractor for the work carried out by him as per the Contract terms shall exceed the expenses of finishing the work including compensation for additional management and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor, shall pay the difference to the Owner. The expense incurred by the Owner and the damage incurred through the Contractor's fault, shall be certified by the Architects and his decision on this matter shall be final and binding on the Contractor.

41.0 Delay and extension of time

In the opinion of the Architects/Consultants the works be delayed:

By force majeure.

By reasons of civil commotion, or strike or lockout affecting any of the building trade.

In consequence of the contractor for not having received in due time necessary instructions from the Consultant for which he shall have specifically applied in writing.

By reasons of or Consultant's instructions, the Owner shall make a fair and reasonable extension of time for completion of the contract works.

In case of such strike or lock-out, the Contractor shall as soon as possible give a written notice thereof to the Consultants, but the Contractor shall nevertheless constantly use his endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Architects/Consultants/ Owners to proceed with the work.

42.0 Settlement of Disputes & Arbitration

All disputes and differences of any kind whatever arising out of or in connection with the contract or the carrying out of the works (whether during the progress of the works or after their completion, and whether before or after the determination, abandonment or breach of the contract) shall be referred to and settled by the Architects after hearing the disputing parties. The Architects shall state his decisions with reasons therefore. Such decisions may be in the form of a final certificate or otherwise. The decisions of the Architects with respect to any or all of the following matters shall be final and without appeal:

a) The variation or modifications of the design.

b) The quality or quantity of works or the addition or omission or substitution of any work.

c) Any discrepancy in the drawings and/or specifications and schedule of quantities.

d) The removal and/or re-execution of any works executed by the Contractor.

e) The dismissal from the works of any persons re-employed thereupon.

f) The opening up for inspection of any work covered up.

g) The amending and making good of any defects under defects liability period.

h) Acceptability of materials, equipment and workmanship.

i) Materials, labour, tools, equipment and workmanship necessary for the proper execution of work.

j) Assignment and sub-letting.

k) Delay and extension of work.

l) Termination of contract by the Owner.

But if either the Owner or the Contractor be dissatisfied with the decision of the Architects on any matter, question or dispute of any kind except the matters listed, then and in any such case, either party (the Owner or the Contractor) may within twenty eight days after receiving notice to such decision, give a written notice to the other party through the Architects requiring that such matters which are in dispute or difference of which such written notice has been given and no other shall be and is hereby referred to the arbitration and final decision of a single Arbitrator being a fellow of the Indian Institute of Architects or Institutional of Engineers (India), to be agreed upon and appointed by both the parties or in the case of disagreement as to the appointment of a single Arbitrator to the arbitration of two Architects or Institution of engineers (India), one to be appointed by each party, which Arbitrators shall before taking upon themselves the burden or reference appoint an Umpire, who must also be a fellow of one of the above referred institutions.

The Arbitrator, the Arbitrators or the Umpire shall have the power to open up, review and revise any certificate, opinion, decision, requisition or notice pertaining to the matters referred to them, and to determine the same by his/their award. Upon every or any such references the cost of and incidental to the reference and award respectively shall be at the discretion of the Arbitrator or Arbitrators or Umpire who may determine the amount thereof, or direct the same to be taxes as between Attorney and Client or as between party and party, and shall direct by who and to whom and in what manner the same shall be borne and paid. The award of the Arbitrator or Arbitrators or the Umpire shall be final and binding on the parties.

43.0 Use and Care of Site

Contractor will be permitted to use without charge, the site and the areas shown in the contracts drawing for execution of work and for related activities. The contractor shall not commence any operation on such and except with the approval of the Owner/Architects.

All rubbish shall be burnt or removed from the site as it accumulates. All surface and soil drains shall be kept in a clean sound and workman-like state. All the areas of contractor's operation shall be cleared before returning them to the owner. The contractor shall make good any damages or alternations made to areas, properly or land handed over to him before these are returned.

44.0 Safety Provisions

The contractor shall take full responsibility for the adequate stability and safety of all site operations and methods of construction, subject to provisions of excepted risks and special risks.

The contractor shall at his own expense arrange for the safety in his operations as required. Safety provisions shall be as per the latest safety manuals published by Indian Standard Institution, Statuary Rules, Regulations and Provisions of contract conditions.

45.0 Clearance of Site

The Contractor shall have to remove all malba and other unwanted materials from site of work, before handing over HVAC installation to the Owner. The work shall not be treated as complete in all respects unless these requirements are fulfilled by him. In the event of

the Contractor failing to do so, the Consultants /Architects and the Owner shall have the right to get the site cleared at his expenses.

46.0 After Sales Services

The HVAC Contractor shall ensure adequate and prompt after sales service in the form of maintenance personnel and spares as and when required with a view to minimizing the breakdown period. Particular attention shall be given to ensure that all spares are easily available during the normal life of the installation.

1. AIR HANDLING UNIT

1.1 Double Skin Air Handling Units (Dx Type Compatible With Vrf Odus)

Scope:-

The scope of this section comprises of supply, erection, testing and commissioning of double skin construction air handling units, conforming to these specifications and in accordance with requirements of drawings and schedule of quantities.

Type:-

The air handling units shall be double skin construction, draw-thru type comprising of various sections such as filter section, coil section and fan section factory assembled as elaborated in drawings and schedule of quantities.

Capacity:-

The air handling capacities, maximum motor rating, and static pressure shall be as shown on drawings, appendices and schedule of quantities.

Housing/Casing

The housing/casing of the air-handling unit shall be of double skin construction. The housing shall be so constructed that it can be delivered at site in total/semi knock down conditions depending upon the location.

The framework shall be extruded aluminium hollow sections filled with preformed insulation section. Frames shall be assembled using mechanical joints to make a sturdy and strong framework for various sections.

Double skin panels (each not exceeding 750mm wide) shall be made out of 24 gauge pre painted galvanized steel sheet on outside and 24 gauge plain galvanized sheet inside with 50 mm thick injected PU foam insulation in between. These panels shall be bolted from inside on to the work frame with soft rubber gaskets in between to make the joints air tight.

Frame work for each section shall be provided with thermal break profiles and bolted together with soft rubber gasket in between to make the joints air tight. Suitable doors with pressure die cast aluminium hinges and latches shall be provided for access to

various panels for maintenance. The entire housing shall be mounted on steel channel frame work.

Marine light, view window and proximity switch to be provided in the casing of each Air handling unit.

Drain pan shall be constructed out of 18 gauge stainless steel with necessary slope to facilitate rapid removal of condensate water. Drain pan shall be insulated with closed cell elastomeric insulation material as required. Necessary supports will be provided to slide the coil in the drain pan. Outlet shall be provided from the drain pan in a manner that access panel can be opened without disconnecting the drain pipe connection.

Motor and Drive

Fan motors shall be high efficiency IE-02 suitable for operation on 415 + 10% volts, 50 cycles, 3 phase, squirrel cage, totally enclosed fan cooled with IP-55 protection. Motors shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall be of the oil-resistant type. Minimum efficiency of motors shall be 85%.

The fan shall be forward/backward curved DIDW type. The wheel and housing shall be fabricated in galvanized steel construction as per manufacturer standard. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame and pillow block heavy duty ball bearings. The impeller and fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not be more than 1800 FPM (9.2 MPS). Fan housing with motor shall be mounted on a common steel base mounted inside the air handling housing on anti-vibration spring mounts or rubber turret mounts. The fan outlet shall be connected to casing with the help of fire retardant canvass. Fan shall be selected for high efficiency.

Cooling /Heating Coils

Direct Expansion coils shall have appropriate tube dia. and wall thickness as specified by the VRF System OEM with aluminum 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 air velocity across each coil shall not exceed 500 FPM. The coil shall be pitched in the unit casing for proper drainage. Each coil shall be factory tested at 21Kg/Sqcm air pressure under water. Tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Fin spacing

shall be 11 to 13 fins per inch (4 to 5 fins per cm). The VRF System OEM shall provide the necessary Dx Expansion Valve kits as per system design.

Filters

Each unit shall be provided with factory assembled filter section containing pre –filters having cleanable type synthetic air filters, having anodized aluminum frame. Wherever MERV 13 filters are required to be installed, unit shall be provided with factory fabricated plenum chamber in double skin construction as described above for casing specifications. The media shall be supported with HDPE mesh on one side and aluminum mesh on other side. Filter face velocity shall not exceed 500 FPM (2.54 MPS). Filters shall fit so as to prevent by-pass. Holding frames of aluminum shall be provided for installing a number of filter cells in banks. These cells shall be held within the frames by sliding the cells between guiding channels.

Accessories

The following accessories may be required at air handling units, the detailed specifications are given in individual sections, and quantities separately described in the schedule of quantities.

Thermostatic expansion valves for each 3 row coil set.

Cooling/heating thermostats as per section “Automatic Controls and Instruments" shall be located in return air stream.

Condensate drain piping up to sump or floor drain in air handling unit rooms as described in section "Piping".

Vibration isolation pads for mounting of Air Handling Units on PCC blocks (225 x 225 x 225 PCC blocks shall be provided by other agencies)

Performance Data

Air handling units shall be selected for the lowest operating noise level. Technical submittal of air handling units shall be prepared for Consultant’s approval prior to procurement as mentioned under relevant clause of Special Conditions. Fan performance rating and power consumption characteristics shall be submitted and verified at the time of testing and commissioning of the entire installation.

Testing

Cooling/heating capacity of various air handling unit models shall be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Air flow measurements shall be carried out by an anemometer and temperature measurements by accurately calibrated thermometers. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

1.2 Dx-SPLIT TYPE AIRCOOLED VARIABLE REFRIGERANT FLOW PACKAGES

1.2.1 Scope

The scope of this section comprises of supply, installation, testing and commissioning of self contained air cooled split type variable refrigerant flow packages each comprising of an outdoor and multiple indoor ductable/non-ductable units conforming to these specifications and in accordance with the requirement of drawings and schedule of quantities.

The Energy Efficiency Ratio (EER) for the complete unit shall comply with ASHRAE 90.1-2001 table 6.2.1 B attached as under.

ASHRAE STANDARD 90.1-2001

Electricity Operated Unitary and Applied Heat Pumps-Minimum Efficiency

Requirements.

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure
Air Cooled	<65,000 Btu/hc	All	Split System	10.0 SEER	ARI 210/240

(Cooling Mode)			Single Package	9.7 SEER	
	>65,000 Btu/h and <135,000 Btu/h)	Electric Resistance (or None)	Split System and Single Package	10.1 EER	
		All other	Split System and Single Package	9.9 EER	
	>135,000 Btu/h and <240,000 Btu/h)	Electric Resistance (or None)	Split System and Single Package	9.3 EER	ARI 340/360
		All other	Split System and Single Package	9.1 EER	
	>240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.0 EER 9.2 IPLV	
		All other	Split System and Single Package	8.8 EER 9.0 IPLV	

a. Section 12 contains complete specifications of the referenced test procedure, including the referenced year version of the test procedure.

b. IPLVs are only applicable to equipment with capacity modulation.

c. Single-phase air cooled air-conditioners <65,000 Btu/h are regulated by NAECA. SEER value is those set by NAECA.

1.2.2 Outdoor Unit

Outdoor unit shall be factory assembled, good for outdoor installation, constructed out of heavy gauge MS panels with weather proof painting. The units shall be factory wired with necessary controls duly tested prior to dispatch conforming to the following specifications.

All outdoor units shall consist of minimum two scroll compressors, preferably one with inverter drive, capable to operate even when one compressor is unserviceable.

Outdoor units above 16 HP shall consist of minimum two separate inverter driven compressors.

The units shall be provided with duty cycling arrangement for multiple inverter compressors.

The outdoor unit shall be modular in design to facilitate installation one after another close to each other. Preference would be given to compact units having smaller footprint.

Outdoor units should be rugged of anti-corrosion design.

The outdoor unit shall comprise of sub cooling feature to effectively use the entire coil surface through proper circuit/bridge in order to prevent flushing of refrigerant owing to large length of piping.

The condensing unit shall be provided with state-of-the-art microprocessor based control panel.

The outdoor unit shall be provided with Aero spiral design fan exhibiting low noise level characteristics complete with aero fitting grille to facilitate spiral discharge of airflow to effect reduction in pressure losses. The fan should be capable to respond to external static pressure of 5 mm.

The condensing unit shall be designed to facilitate fail safe operation when connected to multiple indoor units.

Following safety devices shall be integral part of the outdoor unit:

High pressure switch

Fan drive overload protection switch

Fusible plug

Overload relay including overload protection for inverter driven compressor.

1.2.2.1 Scroll Compressor

The scroll compressor shall be an industrial quality rugged, cast iron, direct hermatic compressor with scroll plates, suction & discharge service valves. The compressor shall be complete with straight suction tube, centrifugal oil pump, oil charging valve, oil level sight glass, crank case heater and check valve on the scroll discharge port. The compressor shall be complete with the provision of two-point lubrication for each motor bearing. The compressor shall be completely enclosed in a chamber with no leakage path and providing the capability for scroll plates to separate. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

The compressor shall be capable of functioning with inverter control as well. The inverter driven compressor shall preferably be with reluctance DC inverter for higher efficiency and reliability.

1.2.2.2 Condenser

Condenser shall be air-cooled type, suitable for outdoor installation and shall be suitable for operating at 46 deg C db and 24 deg C wb temperatures. Condenser shall be in copper tube & aluminium fin construction. Condenser coil shall be of minimum 4 rows deep and the fin spacing shall not exceed 2mm. The maximum face velocity across the coil shall not exceed 215 MPM. The condenser frame shall be constructed from heavy duty galvanized steel.

The condenser fan/s shall be of propeller type with 900 RPM variable voltage electric motor complete with IP-55 protection. Motor shall be speed controlled to ensure a stable operation for varying ambient, by a factory fitted direct acting head pressure activated variable speed drive. The condenser shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessories necessary with the equipment supplied.

1.2.3 Anti Corrosion Protective Treatment associated with Condensing Units, piping, Joints and U bends & refrigerant piping between outdoor and indoor units.

All interconnecting piping, joints and U bends within the condensing unit shall be painted with two coats of clear transparent polymer coating for protection against corrosion from ambient air pollution.

Two coats of protective coating shall be applied. Each coat shall have dry film thickness of 35 micron or more. The coating shall be strong, flexible and durable. It shall have good adhesive and abrasion resistance. It shall be resistant to moisture, UV, acid, alkali and other chemicals and capable of functioning between -250 C and 1500 C.

The polymer shall be obtained by the mixing of base / monomer with a hardener / polymerizor. It may brush applied or with the use of a suitable gun.

1.2.4 Indoor Units

The indoor unit shall be basically a fan coil unit suitable for wall, floor and under ceiling installation of various types conforming to the following specifications.

Indoor units shall be either ceiling mounted cassette type, wall mounted type, floor mounted type or ceiling mounted ductable type in conformity with the design drawings and schedule of quantities. Each unit shall be provided with electronic control valve to modulate flow of refrigerant through the cooling coil responding to the space heat load variations.

Each indoor unit shall consist of PID controller for maintaining design room conditions besides microprocessor based thermostat for cooling/heating. The indoor unit shall also be provided with wired LCD type remote controller which shall memorize the latest malfunction code for ease in maintenance. The controller shall incorporate self diagnostic features. Such remote controllers associated with cassette type and hi-wall type indoor units shall incorporate inbuilt feature to be able to change fan speed and angle of swing flap individually as desired by the user.

The ceiling mounted 2 way/ 4 way cassette type indoor units shall comprise of an attractive moulded ABS plastic exterior enclosure provided with four way supply air grilles on the periphery and square return air grill at the centre with filter behind. Each

cassette type indoor unit shall consist of high efficiency paddle type condensate water pump to facilitate forced disposal of condensate water and low gas detection system.

The hi-wall indoor units shall be suitable for installation on the wall preferably at lintel level. The specifications shall otherwise be similar to above.

Ceiling mounted ductable indoor units shall comprise of high static centrifugal fan, direct driven or belt driven through TEFC squirrel cage induction motor suitable for moderate amount of duct work. The housing shall be of light weight construction fabricated out of powder coated galvanized sheet steel single skin panels, internally insulated with 9mm thick closed cell elastomeric insulation material.

1.2.4.1 Cooling coil

Cooling coil shall be of the fin and tube type, having aluminium fins, firmly bonded to seamless copper tubes. Face and surface areas shall be such as to assure rated capacity and the air velocity across the coil shall not exceed 170 MPM. The coil shall be factory tested under water at 21 Kg/Sqcm air pressure.

1.2.4.2 Fan Section

The fan associated with non ductable indoor units shall be dual suction, aero dynamically designed, multi blade type, statically-dynamically balanced to ensure smooth circulation of air exhibiting lower noise level. The fan shall be direct driven type mounted directly on motor shaft supported from the housing.

Fan associated with ductable indoor unit shall be centrifugal double inlet double width forward curved type, preferably with variable pitch pulleys. The fan housing shall be statically-dynamically balanced at works to ensure noise and vibration free operation.

1.2.4.3 Filters

Filters shall be as per ASHRAE standards. The filters shall also be high efficiency long life , cleanable, synthetic fibre media of approved make. Velocity through filters shall not exceed 105 MPM.

1.2.4.4 Commissioning Filters (Only Pre-filters)

Each indoor unit shall be provided with one set of commissioning filters. The filters shall be replaced with pre-filters after commissioning of the system.

1.2.4.5 Insulation

All indoor unit shall be factory insulated with minimum 9 mm thick closed cell elastomeric insulation material towards thermal/acoustic treatment.

Drain pan shall be insulated with minimum 9mm mm thick closed cell elastomeric insulation material. Fixing of coil section and drain pan shall be done in such a way to avoid direct metal contact with any other un-insulated metal part in order to avoid condensation.

Condensate drain piping around the indoor unit shall also be insulated with minimum 9mm thick closed cell elastomeric insulation preferably in tubing form.

1.2.5 Refrigerant Piping

The copper refrigerant piping shall be carried out neatly enclosed between two cable trays to connect outdoor and indoor unit and shall run along with wires/cables suitable for R410a refrigerant. The refrigerant piping shall be carried out using hard drawn copper pipes & readymade copper fittings for pipe diameter exceeding 19mm.

Piping less than 19mm shall be carried out using soft seamless copper pipes. Joints shall be affected by soldering/brazing process using silver rods. Suitable sleeves shall be provided at all wall crossings as required. All pipe sleeves shall be sealed with fire retardant sealant. The refrigerant circuit shall include liquid line and gas shut-off valves besides expansion valve at the end of condenser. The refrigerant piping shall be carefully sized with necessary headers and should consist of accessories including Y-joints.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 350 psig. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum

vacuum equivalent to 500 μ and held for another 24 hours prior to commencement of gas charging.

All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building element by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

All joints of refrigerant pipes shall be identified & marked with paint/tape indicating joints.

The liquid and suction refrigerant lines including all fittings, valves, strainer etc. shall be insulated with 13 mm thick closed cell elastomeric insulation material preferably in tubing form as specified in Schedule of Quantities.

To protect nitrile rubber insulation associated with exposed copper piping from degrading due to ultra violet rays & atmospheric conditions, it shall be covered with polyshield coating. Fiberglass tape shall be helically wrapped & applied with two coats of resin with hardener to give smooth finish.

The recommended wall thickness of copper pipes being used for VRF application using high pressure refrigerant, R 410 a, is as under:

Copper Pipe Outer dia (mm)	Copper tube wall thickness (mm)
	Minimum requirement
Dia 6.4	0.8
Dia 9.5	0.8
Dia 12.7	0.8
Dia 15.9	1
Dia 19.1	1
Dia 22.2	1
Dia 25.4	1
Dia 28.6	1

Dia 31.8	1.10
Dia 34.9	1.21
Dia 38.1	1.32
Dia 41.3	1.43

1.2.6 CENTRALIZED REMOTE CONTROLLER (TOUCH SCREEN TYPE)

A multifunctional compact centralized controller shall be provided with the system.

The Graphic Controller must act as an advanced air conditioning management system to facilitate complete control of VRF air conditioning equipment, It should be user friendly through its touch screen, icon display and color LCD display.

It shall be able to control up to several groups of indoor units with the following

functions:

Starting/stopping of Air-conditioners as a zone or group or individual unit.

Temperature setting for each indoor unit or zone.

Switching between temperature controls modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.

Monitoring of operation status such as operation mode & temperature setting of individual indoor unit, maintenance information and troubleshooting information.

Display of air conditioner operation history.

Daily management automation through yearly schedule function with possibility of various schedules.

The controller shall comprise of wide screen user friendly color LCD display and can be wired by a non-polar 2 wire transmission cable upto a distance of 1 km away from indoor unit.

UNIFIED ON/OFF CONTROLLER

Unified ON/OFF controller shall be supplied as optional accessory.

The controller shall be able to control minimum 15 groups, each group containing maximum 16 indoor units or 128 indoor units with the following functions :

On/Off as a zone or individual unit. Indication of operation condition of each group.

Select one of 4 operation modes.

SCHEDULE TIMER

A schedule timer shall be supplied as an optional accessory. The timer shall be able to set operation schedule for all indoor units. The timer shall be able to set 8 pattern of schedule combined with centralized controller.

1.3 Dx-SPLIT PACKAGES

Scope

The scope of this section comprises supply, installation, testing and commissioning of self contained air cooled split type air conditioning units each comprising of an outdoor and single/twin indoor units conforming to these specifications and in accordance with the requirement of drawings and schedule of quantities.

1.3.1 Outdoor Unit

Outdoor unit shall be an air cooled condensing unit suitable for outdoor installation conforming to the following specifications.

1.3.1.1 Unit Base & Casing

Base panel shall be constructed out of fabricated steel structure of adequate size. Casing panels shall be of 1.2 mm thick, welded construction, removable type to provide easy access to equipment and shall be bonderized and painted. Casing shall be complete with discharge outlets, grilles, space for refrigeration equipment, fans, condenser coil etc.

1.3.2 Compressor

1.3.2.1 Scroll Compressor

The scroll compressor shall be an industrial quality rugged, cast iron, direct hermatic compressor with scroll plates, suction & discharge service valves. The compressor shall be complete with straight suction tube, centrifugal oil pump, oil charging valve, oil level sight glass, crank case heater and check valve on the scroll discharge port. The compressor shall be complete with the provision of two-point lubrication for each motor bearing. The compressor shall be completely enclosed in a chamber with no leakage path and providing the capability for scroll plates to separate. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM. Invertor compressors shall be provided where called for in BOQ.

1.3.2.2 Rotary Compressor

The rotary compressor shall be an industrial quality rugged, cast iron, hermatic/ semi hermatic compressor with capacity control side valve, oil sump heater & differential pressure refrigerant oil flow system. The compressor shall be provided with multiple pressure lubricated rolling element bearing group shall support the rotating assembly. Suitable overload protection shall be provided & necessary isolating valves shall be provided at suction & discharge. The compressor shall be fitted with electrically operated oil heaters with built in thermostats. The heaters shall be shall be automatically actuated when the compressor is stopped. Necessary time delay shall be provided for restart of compressor.

The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM. Invertor compressors shall be provided where called for in BOQ.

1.3.2.3 Condenser

Condenser shall be air cooled in copper tube & aluminium fins construction. Condensers shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessory necessary with the equipment supplied.

1.3.2.4 Condenser Fan

Fan shall be preferably propeller type suitable for fractional horse power drive with IP-55 protection.

1.3.3 Indoor Unit

The indoor unit shall be basically a fan coil unit suitable for wall, floor and under ceiling installation of various types conforming to the following specifications.

Indoor units shall be either ceiling mounted cassette type, wall mounted type, floor mounted type or ceiling mounted ductable type in conformity with the design drawings and schedule of quantities.

Each indoor unit shall consist of PID controller for maintaining design room conditions besides microprocessor based thermostat for cooling. The indoor unit shall also be provided with wired LCD type remote controller which shall memorize the latest malfunction code for ease in maintenance. The controller shall incorporate self-diagnostic features. Such remote controllers associated with cassette type and hi-wall type indoor units shall incorporate inbuilt feature to be able to change fan speed and angle of swing flap individually as desired by the user. The ceiling mounted cassette type indoor units shall comprise of an attractive moulded ABS plastic exterior enclosure provided with four way supply air grilles on the periphery and square return air grill at the centre with filter behind.

Each cassette type indoor unit shall consist of high efficiency paddle type condensate water pump to facilitate forced disposal of condensate water and low gas detection system.

The hi-wall indoor units shall be suitable for installation on the wall preferably at lintel level. The specifications shall otherwise be similar to above.

Ceiling mounted ductable indoor units shall comprise of high static centrifugal fan, direct driven or belt driven through TEFC squirrel cage induction motor suitable for moderate amount of duct work. The housing shall be of light weight construction fabricated out of powder coated galvanized sheet steel single skin panels, internally insulated with 9mm thick closed cell elastomeric insulation material.

1.3.3.1 Cooling coil

Cooling coil shall be of the fin and tube type, having aluminium fins, firmly bonded to seamless copper tubes. Face and surface areas shall be such as to assure rated capacity and the air velocity across the coil shall not exceed 170 MPM. The coil shall be factory tested under water at 21 Kg/Sqcm air pressure.

1.3.3.2 Fan Section

The fan associated with non ductable indoor units shall be dual suction, aero dynamically designed, multi blade type, statically-dynamically balanced to ensure smooth circulation of air exhibiting lower noise level. The fan shall be direct driven type mounted directly on motor shaft supported from the housing.

Fan associated with ductable indoor unit shall be centrifugal double inlet double width forward curved type, preferably with variable pitch pulleys. The fan housing shall be statically-dynamically balanced at works to ensure noise and vibration free operation.

1.3.3.3 Filters

Filters shall be cleanable, synthetic fibre media of approved make. Velocity through filters shall not exceed 105 MPM and pressure drop across filters shall not exceed 5 mm of WG.

1.3.3.4 Insulation

All indoor unit shall be factory insulated with minimum 9 mm thick closed cell elastomeric insulation material towards thermal/acoustic treatment.

Drain pan shall be insulated with minimum 9mm mm thick closed cell elastomeric insulation material. Fixing of coil section and drain pan shall be done in such a way to avoid direct metal contact with any other un-insulated metal part in order to avoid condensation.

Condensate drain piping around the indoor unit shall also be insulated with minimum 9mm thick closed cell elastomeric insulation preferably in tubing form.

1.3.4 Refrigerant Piping

The copper refrigerant piping shall be carried out neatly to connect outdoor and indoor unit/s and shall run along with wires/cables. The refrigerant piping associated with ductable units shall be carried out using hard drawn copper pipes & readymade copper fittings for pipe diameter exceeding 19mm. Piping less than 19mm shall be carried out using soft seamless copper pipes. Joints shall be affected by soldering/brazing process using silver rods. Suitable sleeves shall be provided at all wall crossings as required. The refrigerant circuit shall include liquid line and gas shut-off valves at the end of condenser.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 21Kg/ Sqcm. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum equivalent to 700mm Hg and held for another 24 hours prior to commencement of gas charging.

All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building element by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

The liquid and suction refrigerant lines including all fittings, valves, strainer etc. shall be insulated with 13 mm thick closed cell elastomeric insulation material preferably in tubing form as specified in Schedule of Quantities.

To protect nitrile rubber insulation associated with exposed copper piping from degrading due to ultra violet rays & atmospheric conditions, it shall be covered with polyshield coating. Fiberglass tape shall be helically wrapped & applied with two coats of resin with hardener to give smooth finish.

Testing

Cooling/heating capacity of various air handling unit models shall be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Air flow measurements shall be carried out by an anemometer and temperature measurements by accurately calibrated thermometers. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current

1.4 INDUSTRIAL FANS

1.4.1 CENTRIFUGAL FANS:

Centrifugal fans shall be of high efficiency forward/backward curved approved make DIDW/SISW of specified Class and arrangement complete with access door, squirrel-cage induction motor, V belt drive, belt guard and vibration isolators. Type, direction of discharge / rotation, and motor position shall be as per the Approved for Construction shop drawings. The fan shall be complete with the following:

Housing:

Housing shall be constructed out of heavy gauge galvanized sheet steel welded/bolted construction. Housing for mounting of blower should be strong enough to hold the bearings preferably with twin rib spider arrangement. It shall be rigidly reinforced and

supported by structural angles. Split casing shall be provided on larger sizes of fans, however neoprene packing should be provided throughout split joints to make it air tight.

18 gauge galvanized wire mesh inlet guards of 5 cm sieves shall be provided on both inlets. Housing shall be provided with standard cleanout and door with quick locking tension handles and neoprene gasket. Rotation arrow shall be clearly marked on the housing.

Fan Wheel:

Fan Wheel shall be backward-curved non-overloading type OR forward curved type. Fan wheel and housing shall be statically and dynamically balanced, conforming to standard G 2.5. Fan outlet velocity shall not exceed 2000 FPM (610 MPM) and maximum fan speed shall be 1000 RPM.

Shaft:

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

Bearings:

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

Motors:

Fan motor shall be high efficiency EFF-1 suitable for operation on 415 + 10% volts, 50 cycles, 3 phase AC power supply. The motor shall be TEFC, squirrel cage induction type having two speed and IP-55 protection, provided with class ‘B’ insulation, centrifugal fans, whenever used for smoke venting duty, motor shall be with class ‘H’ insulation. Motor name plate horse power shall exceed brake horse power by a minimum of 20%.

Motor shall be designed especially for quiet operation and motor speed shall not exceed 1450 rpm. The fan and motor combination selected for the particular required performance shall be energy efficient ensuring lowest noise level. The motor shall be of approved make.

Drive

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

Vibration Isolation:

MS base shall be provided for both fan as well as motor, built as an integral part, and shall be mounted on a concrete foundation through vibration isolators of approved make or cushy foot mountings. The concrete foundation shall be atleast 15 cm above the finished floor level or as shown in approved for construction shop drawings.

1.4.2 INLINE FANS

Inline fan shall incorporate approved make SISW direct driven Centrifugal Fan with TEFC motor with IP-44 protection. The fan assembly shall be encased in a sheet metal housing of 22 gauge GSS and with necessary inspection cover with proper gasket assembly. The fan material shall be galvanized sheet steel. Flanges shall be provided on both sides of the Inline fan to facilitate easy connection. Flexible anti-vibration joints shall be provided to arrest vibration being communicated to other equipment connected to the Inline fan. Motor shall be single phase/three phase as per required duty conditions.

All single phase fans shall be provided with speed regulator while all three phase fans shall be provided with opposed blade damper in GSS construction at fan outlet for air balancing. All inline fans shall be internally lined with 15mm thick open cell nitrile rubber insulation to achieve noise level of 40 db.

1.4.3 PROPELLER FANS

Propeller type, Ring/Diaphragm mounted fans shall be equipped with a TEFC Single phase motor with the impeller mounted directly on the shaft. The blades shall be die formed steel. The fan shall be fitted with gravity type louvers. The speed of fan shall not exceed 900 RPM. The fan speed can go up to 1400 RPM only in case of fans having diameter of 305 mm.

Installation

The Contractor shall supply all foundation bolts, base frame wherever required, vibration eliminators etc. and shall ensure that all the above accessories are placed securely in proper position while the foundation is cast.

Vibration eliminators shall be provided with an efficiency of not less than 80% wherever necessary.

Fan inlet and outlet connections shall be affected using new generation with flexible canvas wherever necessary.

Testing

All the fans shall be tested for performance and the following test results shall be furnished:

Air flow rate in CFM.

b. Static pressure at the fan supply end.

Painting

On completion of the erection and testing, the outside of the fans shall be painted with two coats of Synthetic Enamel paint of approved color over and under coat of primer.

1.4.4 AXIAL FLOW FANS:

Fans shall be Vane/ tube axial type of approved make, complete with motor mount, direct driven and vibration isolation type suspension arrangement as per approved for construction shop drawings. The fan shall be complete with the following:

a. Casing:

Casing shall be constructed out of heavy gauge galvanized sheet steel. Fan casing, motor mount shall be of welded steel construction. Motor mounting plate shall be minimum 20 mm thick and machined to receive motor flange. Casing shall be provided with wide hinged door which opens easily for removal of wheel, shaft and bearings. A small inspection door with handle and neoprene gasket shall also be provided.

Casing shall have flanged connection on both ends for ducted applications.

Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Casing shall be bonderized, primed and finish coated with enamel paint.

Vertically mounted fans shall also be installed in the same manner, however, fans shall be equipped with thrust bearings.

b. Rotor:

Rotor hub blades shall be die cast aluminum alloy construction. Blades shall be die formed aerofoil shaped for maximum efficiency and shall vary in twist and width from hub to tip to effect equal air distribution along the blade length. Tip clearance between impeller and fan casing should be 1% of diameter. Fan blades mounting on the hub shall be statically and dynamically balanced. Extended grease leads for external lubrication shall be provided. The fan pitch control may be manually readjusted at site upon installation, for obtaining actual air flow values, as specified and quoted.

c. Motor:

Motor shall be high efficiency IE01/IE02 (where called for in the Schedule of Quantities) of approved make, squirrel cage, totally enclosed, fan cooled standard round frame, constant speed, continuous duty, single winding, suitable for 415 + 10% volts, 50 Hz, 3 phase power supply, provided with Class F/H insulation (where called for in the Schedule of Quantities). Motor name plate horse power shall exceed brake horse power

by a minimum of 15%. Motor shall be specially designed for quiet operation. The speed of the fans shall not exceed 1000 RPM for fans with impeller diameter 300mm, and 1440 RPM for fans with impeller diameter 300mm or more. For lowest sound level, fan shall be selected for maximum efficiency or minimum horsepower. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible metal conduit. The motor should withstand fire up to 2 hours at 250 deg C where called for in the Schedule of Quantities.

All normally operating fans (i.e. excluding emergency only) shall have 6 pole motors only.

d. Vibration Isolation:

The assembly of fan and motor shall be suspended from the ceiling by vibration isolation suspension of rubber in shear type of approved make.

e. Accessories:

The following accessories shall be provided with all fans.

i. Outlet cone for static pressure regain.

ii. Inlet cone.

Fan silencers may be provided where specifically called for in Schedule of Quantities.

Fans shall be factory assembled and shipped with all accessories factory mounted and fan shall be AMCA certified for sound & air performance.

All rotors shall be statically and dynamically balanced as per AMCA 204-05 standard to a minimum of BV-3 level.

The minimum acceptable total efficiency of the fans shall be 70% and the sound pressure should not exceed 80 db(A) at a distance of 3 meters. When measured in a hemispherical surface under reverberant room conditions. Fan performance shall be

based on tests conducted in accordance to AMCA 210 for air performance and AMCA 300 for Inlet sound power levels. These fans shall be licensed to bear the AMCA seal for air and sound performance.

All the High Temperature Fans should either be EN-12101-3 or UL tested for High Temperature (UL Power & Smoke Ventilation listed) for a minimum of 250 Deg C for a minimum of 2 Hrs and should be UL or CE labeled.

1.5 EXTRACT FAN SECTION

The scope of this section comprises of supply, installation, testing and commissioning of packaged type Extract Fan Sections (EFS) of specific capacity set forth in the “Schedule of Quantities”.

The housing/casing of the EFS shall be of double skin construction. The housing shall be so constructed that it can be delivered at site in total/semi knock down conditions depending upon size of the EFS, location & access available.

The framework shall be extruded aluminum hollow sections filled with preformed insulation section. Frames shall be assembled using mechanical joints to make a sturdy and strong framework for various sections.

Double skin panels (each not exceeding 750mm wide) shall be made out of 24 gauge pre-painted galvanized steel sheet on outside and 24 gauge plain galvanized sheets inside with 25 mm thick injected PU foam insulation in between. These panels shall be bolted from inside on to the frame work 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 pressure die cast aluminum hinges and latches shall be provided for access to various panels for maintenance. The entire housing shall be mounted on galvanized steel channel frame work.

Marine light with switch, view window and proximity switch to be provided in the casing of each EFS. Factory Fabricated Plenums shall be provided as shown in design drawings.

The fan shall be forward/backward curved, floor standing, double inlet double width type. The wheel and housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame/spider and self-lubricated sealed eccentric type ball bearings.

The impeller and fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not be more than 2000 FPM (10.1 MPS). Fan housing with motor shall be mounted on a common steel base inside the air handling housing on anti-vibration springs mounts or rubber mounts. The fan outlet shall be connected to casing with the help of fire retardant canvass.

Fans shall be driven by an electric motor as specified in the schedule of quantities. Motor ratings are only tentative and where a fan requires a higher capacity motor, the contractor shall clearly point out the requirement and make his offer accordingly. Motor ratings shall be atleast 20% over limit load plus transmission losses.

Fan motors shall be suitable for operation on 415+10% volts, 50 Hz, 3 phase, AC power supply and shall be EFF1, TEFC squirrel cage induction type totally enclosed, fan cooled with IP-55 protection. Motors shall be especially designed for quiet operation and motor speed shall not exceed 1440 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall be of the oil-resistant type. Provisions of separate GI sheet enclosure to locate the motor in hot air stream free area to be made (applicable for kitchen extract fan sections only).

1.6 FILTERS

1.6.1 Viscous Metallic Filters

Viscous metal filter shall be all metal, washable type. The filter media shall be composed of layers of crimped GI wire mesh. The velocity over face of filter shall not exceed 90 MPM and pressure drop shall not exceed 5mm for 50mm thick filter. The filter shall be of GI and suitable for mounting as required at site.

1.6.2 Synthetic Fibre Filters (EU-3)

Synthetic fibre filter shall be constructed out of 50mm deep non-woven synthetic fibre replaceable media secured with anodized ductile aluminium mesh on one side & 40 sieve HDPE mesh on the other side. All the layers to be duly stitched together & to be housed in 18G Aluminium anodized frame. The filter element shall have 11 folds/Rft. The filter shall have an efficiency of 90% down to 10 microns when tested as per BS: 2831 standard. It shall be suitable for operation under 100% Relative Humidity & 120 degree C temperature conditions. The velocity over the face of filter shall not exceed 105 MPM and the pressure drop across the filter shall not exceed 3 mm WG for 50mm thick filter. The filter frame shall be suitable for mounting in air handling unit as required at site.

1.6.3 Minimum Efficiency Reporting Value Parameters (MERV-13)

ASHRAE Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle size Efficiency, Percentage in Size Range , um		
	Range1 0.30 – 1.0	Range 2 1.0 – 3.0	Range 3 3.0-10.0
01.	n/a	n/a	E3 < 20
02.	n/a	n/a	E3 < 20
03.	n/a	n/a	E3 < 20
04.	n/a	n/a	E3 < 20
05.	n/a	n/a	20 < E3 < 35
06.	n/a	n/a	35 < E3 < 50
07.	n/a	n/a	50 < E3 < 70
08.	n/a	n/a	70 < E3
09.	n/a	E2 < 50	85 < E3
10.	n/a	50 < E2 < 65	85 < E3
11	n/a	65 < E2 < 80	85 < E3
12	n/a	80 < E2	85 < E3
13	E1 < 75	90 < E2	90 < E3

14	75 < E1 < 85	90 < E2	90 < E3
15	85 < E1 < 95	90 < E2	90 < E3
16	95 < E1	95 < E2	95 < E3

1.6.4

Microvee Filters: (EU-7)

Fine filters shall be designed to remove particles down to 3 microns as per BS: 6540 standard.

Filter shall comprise of aluminium sheet duly anodized. Filter element shall be made out of non-woven synthetic supported by anodized ductile aluminium mesh on one side & HDPE mesh not less than 40 sieve size on the other side with 11 folds/Rft of filtration area. All the layers to be dully stitched together. All sides to be sealed with ductile epoxy resin and filters shall be cleanable type using water/detergent. Rubber gaskets to be provided on the flange. Filter element shall be specially treated with antifungal and bacterial reagent to prevent growth of micro-organisms shall be screwed into the frame by means of an aluminium clamp patti and brass screws. They shall comprise of housing made from MS angles/flats epoxy coated of size suitable to receive the required number of filters to handle specified Cfm for each AHU. All filters shall be installed in same plane. No zigzagging shall be allowed by means of threaded bolts.

1.6.5 HEPA Filter:

These filters shall remove particles greater than 0.3 microns with an efficiency of 99.99% when tested with cold DOP test. Filter shall comprise of specially treated glass fiber media, aluminium media separators housed in an aluminium sheet frame provided with double turned flanges and dosed cell neoprene gaskets. The housing shall be designed to install the hepa filter in the terminal location in RCC slab ceiling. It shall be suitable for mounting the HEPA filter. Housing assembly shall comprise of:

Bottom MS tee frame.

Top MS angle frame.

Clamping device for filter tightening.

Provision for connecting manometer across the filter.

Provision for top flexible PVC based connector.

MS tee frame shall be mounted flush on the bottom surface of ceiling. It shall be securely welded at site to top MS angle frame which will be supported by brick masonry up stand all around the slab opening. The contractor shall ensure that the inner surface of the opening is smooth plaster finished and treated with epoxy paint by civil contractor. The top MS angle frame shall have provision to fix SS angle cleats by means of bolts. Cleats shall contain SS press down bolts with lock nuts. Flexible Rexene connectors shall be of suitable size to enable easy insertion and removal of HEPA filter into the terminal opening. The Rexene shall be screwed to supply air duct and MS angle frame in up stand by means of MS clamp patties. All MS components shall be epoxy painted.

1.6.6 Electrostatic Precipitator Section:

Electrostatic precipitator section shall be made of 16 gauge galvanized sheet, High bake epoxy powder coated, Washable type aluminum mesh pre-filter, Washable type aluminum mesh post filter, Stainless steel spiked ionizers to create high voltage DC field, aluminum collector plates which should be alternatively charged positive & negative with large collecting area with 14” deep cell, to work as magnet for charged smoke & oil particles.

An average efficiency of 90-95% in single pass as per DOP test method. Electrostatic Precipitator should be able to charge particles from 0.01 micron to 10 micron through solid state power supply. Collector cell should be of permanent type and slide out facility for easy removal for cleaning. Operating Voltage: 220V/1Ph/ 50Hz, Power consumption: 50 watts each unit. Ionizing Voltage: 12.5 – 13.0 kVDC, Collector Cell Voltage: 6.0 – 6.5 kVDC, System should be fitted with interlock switch for safety, the system should be able connected to a fan section to achieve airflow of 500 FPM across the air cleaner. The filter should have a constant pressure drop.

1.7 VARIABLE FREQUENCY DRIVES

Scope

This section describes the type of frequency converter to be supplied for fan/ pump speed control. The drive shall not be a general purpose product, but should exhibit features acknowledging engineered design applicable to HVAC industry.

The drives shall exhibit IP-55 protection unless otherwise captured in BOQ.

The manufacturer shall demonstrate a continuous period of manufacture and development for at least 25 years.

The frequency converter shall be supported locally by the manufacturer who will provide full technical support, spares holding and troubleshooting capability from his own local facility. A training course shall be organized by the manufacturer for the consultant / contractor / maintenance engineers.

The manufacturer shall provide full technical detail of the product, with catalogues, dimension drawings, weights etc. and each drive shall be provided with a full technical manual.

Equipment supplied must conform to recognized International Standards and be manufactured to ISO 9001, BS 5750 part 1 & 2 and carry the CE Mark on EMC Compliance.

Frequency converters shall be suitable for use in either a 'Stand Alone' mode, complete with all necessary protection or as part of centrally controlled system via a Serial Communication Loop to the main Building Management System (BMS) via in-built RS 485 port.

Technical Requirement

The frequency converter (FC) shall convert Local Voltage V + 10%, 3 Phase, 50/60 Hz utility power supply to an adjustable output voltage and frequency. The FC must be capable of delivering full value of fundamental true RMS output voltage to the motor equal to the mains input voltage to the FC at full load and speed. In the event the FC cannot meet this requirement an oversized motor at least one frame size higher must be selected. The FC manufacturer must document this capability.

The voltage to frequency ratio shall be suitable for fan control. It should not be possible to set a constant V/F ratio, to prevent damage to connected equipment and to optimize energy usage.

The FC shall work in conjunction with any IEC standard design motor and shall not require the motor to be de-rated, or cause the motor temperature to rise above the class ‘B’ rise expected on normal mains operation. The Motor shall not require an external blower even at slow speed running.

When selecting the FC, care shall be taken to ensure that protection against electro fluting of motor bearings and/or damage to the motor windings shall be provided. This shall be provided by the inclusion of:

a) Insulated motor bearings

b) Soft switching IGBT’s in the FC

c) LC Filters fitted to the FC

The FC shall use AMA (Automatic Motor Adaptation) techniques so that operators do not have to input motor characteristic and ensuring proper motor operation, optimize motor performance, improve start capabilities and compensate for motor cable variances.

The FC shall be capable of controlling parallel motors of mixed ratings, and allow disconnection of any machine whilst running without causing tripping. The FC shall be capable of running with no motor connected for service functions.

The FC shall be fully tested at the converter manufacturers works, including motor loading.

Certificates of Compliance should be available on request.

The FC shall be of sufficient capacity to provide a quality wave form so as to achieve full output torque of the motor, without causing additional heat rise.

The operating conditions shall include:

a) Minimum efficiency at 100% load- 96% at 20% load- 92%

b) Rated input voltage (local voltage) ±10%, 3 phase, 50/60 Hz +2 Hz.

c) Working ambient temperature range -10°C to +45°C, humidity to 95% RH, and vibration of 0.7G.RMS in 3 directions

d) Output frequency range - 0.5 to 1000 Hz.

e) Output voltage range 0 to full mains input voltage, 3 phase even at full mains voltage -10% input.

f) The drive shall allow connection of motors one frame size larger and 4 sizes smaller than the nominal converter rating.

g) VFD shall be limited to 110% of rated current for 60 seconds and 160% torque for 0.5 seconds

h) The FC shall accept 0-10 VDC, 4-20 mA, or resistive inputs as a control signal.

The FC shall provide two output relays to provide signals including - ready, run, tripped, and be programmable for other selected information. Two analogue outputs of 4-20 mA or 24 VDC shall be programmable to transmit speed or other parameters to the BMS In addition, 2 x digital outputs shall provide 24Vdc to signal choice of 27 conditions to the BMS.

j) The FC shall log and display “Total kW-hrs consumed” and “Total Hours Run” by the motor without additional instrumentation and the facility to “Reset”.

k) 20 preset speeds shall be available (programmable values) for duties such as night setback, smoke extract and morning boost settings.

l) The FC shall provide 4 skip frequencies of adjustable bandwidth to overcome mechanical or air resonance.

m) A parameter lock shall be incorporated to prevent unauthorized resetting of parameters.

n) The FC shall be capable of running from an external DC source during periods of mains interruption.

Drive acoustic noise shall not exceed 65 dB A at full load and 60 dB A at 50% load.

Drive Design Requirements

The FC shall contain as standard within its enclosure DC Link filtering with both inductive and capacitive elements to control the mains borne harmonics. The document ‘Electrical Supply Industry Recommendation G 5/3 limits for harmonic currents in the UK

or IEEE519, 1992 shall be used for the basis of calculation of THD for the point of common coupling. On request, the FC manufacturer shall provide THD figures for the total connected load. The contractor shall provide details of supply transformer rating, impedance, etc. feeding the FCs to allow this calculation to be made.

The FC shall comply with EMC (Electromagnetic compatibility) (RFI Control) document EN55011 as an integral part of its design, incorporating EMC/ RFI Filters to meet both EN55011 Class 1A (150metres) and Class 1B (50 meters). It shall conform to immunity standard IEC 801 parts 2-5. Must carry the CE Mark of Compliance.

The drive shall be capable of automatically reconnecting to a spinning fan, forward or reverse running, without tripping, following mains interruption or on transfer from bypass running.

The FC design shall comprise of a diode input bridge, fixed voltage DC link section with both inductors and capacitors to form a filter, and inverting bridge comprising IGBT's (Insulated Gate BiPolar Transistors). All equipment must be housed within the FC enclosure.

The inverting bridge shall be controlled by a 32 bit processor and ASIC's (Application Specific Integrated Circuits) to produce a VVC. Plus (Voltage Vector Controlled) enhanced PWM waveform naturally resulting in full motor voltage, torque and sinusoidal current of mains supply quality in the motor circuit. Other forms of current source or 6 pulse converters shall not be acceptable.

The FC shall protect itself against input transients to VDE0160 class W2; loss of mains phase (3 phase measurement); loss of motor phase (3 phase measurement); grounding of any output phase; loss of speed reference (runs at last setting/preset speed/close down-programmable).

The FC shall use overriding frequency fold back control techniques to prevent damage in the event of excessive load during either running or starting.

The FC shall model the motor in its software to predict motor overheating without the use of thermistors in the motor. When overheat is predicted, an alarm or automatic shutdown shall be initiated.

The FC shall exhibit near unity fundamental power factor at all loads and speeds, and should not require the addition of external A.C./D.C. line reactors for power factor improvement, harmonic control or prevention of zero voltage notching.

The output circuit shall be of such a design, as to allow unlimited switching of the motor circuit, at any load/speed without causing damage to the IGBT output stage and without needing auxiliary control switching.

FC shall have self-adjusting modulation frequency control from 2.0 KHz to 14 KHz. The control form shall be such as to allow the FC to deliver full output at all times without de-rating, by optimizing the switching frequency dependent on the output load.

Full galvanic isolation between power and control components shall be incorporated to ensure compliance with VDE 0160 PELV (Protective Extra Low Voltage) to prevent damage to BMS interface and ensure operator safety. Short circuiting of the control terminals shall not damage the control card.

The FC shall include an AEO (Automatic Energy Optimization) circuit to continuously adjust the voltage to frequency ratio and optimize the motor magnetizing current based on the actual torque requirement of the motor at different speeds to optimize motor energy consumption and prevent heating of motor at low speeds.

The design shall include a full 2 zone, 2 setpoint PID controller as standard to provide closed loop control direct from upto 2 signal transmitters without the need for external signal conditioning.

The FC shall not exhibit an inrush current when a ‘start’ signal is given, and current must not exceed 110% at any time to prevent damage to connected equipment.

The FC design shall include a motor preheat circuit to prevent condensation forming in the motor during shutdown periods.

The FC shall not be damaged if it is energized with a ‘start’ signal without a motor connected.

The FC shall provide as standard:

a) Heat sink over-temperature protection.

b) Under-voltage protection.

c) Over-voltage protection.

Display to be in selectable language.

The Local Control Panel (keypad of FC) of FC shall display in 4 line alpha-numeric characters in plain English language, the following operating parameters:

Energy consumed in KW-Hr.

Power consumed by motor in kW

Run time of motor in Hours.

Current drawn by the motor in Amperes.

Voltage applied to motor terminals by FC in Volts

DC link voltage in Volts

Output Frequency in Hz.

Percentage of maximum output frequency in %.

Motor Speed in RPM

Thermal Load on Motor in %

1.8 AIR CURTAINS

Air curtains shall be vertical down throw type and shall comprise of twin centrifugal blowers, statically and dynamically balanced, designed for noiseless and continuous operation, motor etc. The enclosure shall be factory fabricated out of 18 gauge aluminium/CRCA sheet duly powder coated. The outlet shall be carefully designed to create laminar draft providing an invisible air curtain at critical junction isolating clean and semi-clean areas or as required.

2.0 AIR DISTRIBUTION

2.1 SCOPE

The scope of this section comprises of supply, fabrication, installation and testing of all sheet metal ducts and supply, installation, testing and balancing of grilles, registers and diffusers, in accordance with these specifications and the general arrangements shown on various drawings.

MATERIAL

All ducts shall be fabricated either from Galvanised Sheet Steel (GSS) conforming to IS: 277 or aluminium sheets conforming to IS:737. The steel sheets shall be hot dip galvanized with MAT finish with coating of minimum 120 grams per square meter (GSM) of Zinc, GI sheets shall be lead free, eco friendly and RoHS compliant.

The thickness of sheets for fabrication of rectangular ductwork shall be as under. The thickness required corresponding to the longest side of the rectangular section shall be applicable for all the four sides of the ductwork.

Longest side (mm)	Minimum sheet thickness	
	For GSS	For Aluminium
750 mm and below	0.63	0.80
751 mm to 1500 mm	0.80	1.00
1501 mm to 2250 mm	1.00	1.50
2251 mm & above	1.25	1.80

(iii) Thickness of sheet for Round Ducts

Diameter of duct, mm	Thickness of Sheet, mm	
	GI sheets	Aluminium Sheets
150 to 500	0.63	0.80
501 to 750	0.80	0.80
751 to 1000	0.80	1.00
1001 to 1250	1.00	1.50
1251 and above	1.25	1.80

All sheet metal connections, partitions and plenums required for flow of air through the filters, fans etc. shall be at least 1.25 mm thick galvanised steel sheets, incase of G.I. sheet ducting or 1.8 mm thick aluminium sheet, in case of aluminium sheet ducting and shall be stiffened with 25 mm x 25 mm x 3 mm angle iron braces.

Circular ducts, where provided shall be of thickness as specified in IS: 655 as amended upto date.

Aluminium ducting shall normally be used for clean room applications, hospitals works and wherever high cleanliness standards are functional requirements.

Associated Items

Supply/ return air outlets, F.A. grilles and accessories shall be constructed from extruded aluminium sections.

Flanges for matching duct sections, stiffening angles (braces) and supporting angles shall be of rolled steel sections, and shall be of the following sizes.

Application	Duct Width	Angle size
Flanges	Upto 1000 mm	35 mm x 35 mm x 3 mm
-do-	1001 mm to 2250 mm	40 mm x 40 mm x 3 mm
-do-	More than 2250 mm	50 mm x 50 mm x 3 mm
Bracings	Upto 1000 mm	25 mm x 25 mm x 3 mm
-do-	More than 1000 mm	40 mm x 40 mm x 3 mm
Support angles	Upto 1000 mm	40 mm x 40 mm x 3 mm
-do-	1001 mm to 2250 mm	40 mm x 40 mm x 3 mm
-do-	More than 2250 mm	Size and type of RS section shall be decided in individual cases

Hanger rods shall be of mild steel and of at least 10 mm dia for ducts upto 2250 mm size, and 12 mm dia for larger sizes.

All nuts, bolts and washers shall be zinc plated steel. All rivets shall be galvanised or shall be made of magnesium - aluminium alloy. Self tapping screws shall not be used.

CONSTRUCTION

Ducts

Ducts shall be fabricated at site or factory fabricated and shall be generally as per IS: 655 "Specifications for metal air ducts", unless otherwise deviated in these General Specifications.

The interior surfaces of the ducting shall be smooth.

All the ducts upto 600 mm longest side shall be cross broken between flanges by a single continuous breaking. Ducts of size 600 mm and above shall be cross broken by single continuous breaking between flanges and bracings. Alternatively, beading at 300 mm centres for ducts upto 600 mm longest side, and 300 mm centres for ducts above 600 mm size shall be provided for stiffening.

As far as possible, long radius elbows and gradual changes in shape shall be used to maintain uniform velocity accompanied by decreased turbulence, lower resistance and minimum noise. The ratio of the size of the duct to the radius of the elbow shall be normally not less than 1:1.5.

Flanged joints shall be used at intervals not exceeding 2500 mm. Flanges shall be welded at corners first and then riveted to the duct.

Stiffening angles shall be fixed to the sides of the ducts by riveting at

1.25 meters from joints for ducts of size 600 mm to 1500 mm, and 0.6 mm from joints for ducts of size larger than 1500 mm. Bracings for ducts larger than 1500 mm can alternatively be by diagonal angles.

Plenums for filters shall be complete with suitable access door of size 450 mm x 450 mm.

All factory fabricated duct shall be supplied in L sections, the length of any piece shall not be more than 1800 mm for duct with longest side of cross section as 600 mm and above and 3000 mm for rest.

Air Outlet and Inlets (Supply and Return)

All air outlets and intakes shall be made of extruded aluminium sections

& shall present a neat appearance and shall be rigid with mechanical joints.

Square and rectangular wall outlets shall have a flanged frame with the outside edges returned or curved 5 to 7 mm and fitted with a suitable flexible gasket between the concealed face of the flanges and the finished wall face. The core of supply air register shall have adjustable front louvers parallel to the longer side to give upto 22.5 degrees vertical deflection and adjustable back louvers parallel to the shorter side to achieve a horizontal spread air pattern to at least 45 degrees. Return air grilles shall have only front louvers. The outer framework of the grilles shall be made of not less than 1.6 mm thick aluminium sheet. The louvers shall be of aerofoil design of extruded aluminium section with minimum thickness of 0.8mm at front and shall be made of 0.8mm thick aluminium sheet. Louvers may be spaced 18 mm apart.

Square and rectangular ceiling outlets/intakes shall have a flange flush with the ceiling into which it is fitted or shall be of anti smudge type. The outlets shall comprise an outer shell with duct collar and removable diffusing assembly. These shall be suitable for discharge in one or more directions as required. The outer shell shall not be less than 1.6 mm thick extruded section aluminium sheet. The diffuser assembly shall not be less than 0.80 mm thick extruded aluminium section.

Circular ceiling outlets/intakes shall have either flush or anti smudge outer cone as specified in the tender specifications. Flush outer cones shall have the lower edge of the cone not more than 5 mm below the underside of the finished ceiling into which it is fitted. Anti smudge cones shall have the outer cone profile designed to reduce dirt deposit on the ceiling adjacent to the air outlet. The metal sheet used for construction of these shall be minimum 1.6 mm thick extruded aluminium sheet.

Towards fire protection, all kitchen extract ductwork shall be fabricated out of 18 gauge GSS and coated with approved fire retardant surface treatment (on internal and external duct surface) preferably sprayed at factory prior to dispatch in order to capture the flanges, corners and internal joints.These ducts should be finished off with 50mm thick mineral wool on the external surface the duct, enveloped in 0.1mm thick Aluminum foil, and joints sealed off with Aluminum tape.

Duct Installation

All ducts shall be installed generally as per the drawings and in strict accordance with approved for construction shop drawings prepared by the contractor.

The contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of these specifications and drawings. This work shall meet with the approval of the Architect/ Consultants in all its parts and details.

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

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

All duct work shall be independently supported from building elements or as required by the Architect/Consultants. All horizontal ducts shall be rigidly and securely supported, in an approved manner, within hangers formed of wire rope suspension arrangement with hot dipped galvanized (HDG) perforated channel under the ducts. The distance between two successive supports shall not be greater than 2 meter center to center. All vertical duct work shall be supported by structural members at each floor.

Ducting on top of the ceiling shall be supported from the slab above, or from beams with the help of adequate strength dash fasteners, after obtaining approval of the Architect/ Consultant. In no case shall a duct be supported from the ceiling hangers or be permitted to rest on a hung ceiling.

All metal work in dead or closed down spaces shall be erected in time to occasion no delay to other contractors in the building.

All ducts shall be totally free from vibration under all conditions of operations. Whenever duct work is connected to fans, that may cause vibrations in the duct, ducts shall be provided with two flexible connections located close to the unit in mutually perpendicular directions. Flexible connection shall be constructed of fire resistant flexible double canvas sleeves at least 100mm deep, secured properly and bolted at both ends. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation.

The two mating flanges of the ducts being joined with each other shall be made air tight by providing 2mm thick foam rubber insertion fixed on both mating flanges by means of good quality adhesive . Rubber strip shall also be provided between bottom surface of duct and angle iron at each duct support to avoid metal to metal contact.

2.3 FACTORY FABRICATED SPIGOTS

Spigots shall be readymade, circular in shape, fabricated out of 22 gauge galvanized steel sheet through spinning process. The spigot shall be provided with a circular opening with a cylindrical neck with grooves to facilitate fail safe flexible duct connection. Spigot shall have circular flange all around which shall be screwed to the main rigid ductwork.

Readymade gaskets shall be provided between circular flange and surface of rigid ductwork with pre-conceived round opening, and sealant applied to prevent leakage of air.

2.4 Volume Control Dampers

All dampers shall be multi-blade type of robust construction of galvanized steel and tightly fitted. The design, method of handling, and control shall be suitable for the location and service required.

Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation control or setting devices shall be made robust, easily operable and accessible through suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times.

Dampers shall be placed in ducts and at each supply air collar, whether or not indicated on the drawings, for the proper volume control and balancing of the system.

2.5 Fire Cum Smoke Dampers

2.5.1 Bare Dampers

All supply and return air ducts/return air spaces at AHU room crossings and at all floor crossings shall be provided with approved make motorized fire and smoke dampers of at least 90 minutes fire rating as certified by CBRI Roorkee, India as per clause 10 of UL:555-1995. These dampers shall be multi-leaf type -Ruskin.

Fire damper blades and outer frame shall be formed out of 1.6mm (16G) galvanized steel sheet of length as mentioned in the approved for construction shop drawings titled as AHU Room Blow Up. The damper blade shall be pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals shall be provided on top and bottom of the damper housing made of 16 gauge galvanized sheet steel. For preventing smoke leakage, metallic compression side seals shall be provided. Dual side linkage shall be provided for better structural stability. The construction of the fire damper shall allow maximum free area to reduce pressure drop and noise in the air passage. In normal position damper blade shall be held in open position with the help of a 220 V operated electric actuators thereby providing maximum air passage without creating any noise or chatter.

For wall mounted fire dampers retaining MS angles duly painted with black enamel paint shall be supplied and installed by HVAC Contractor as per established installation procedure. Whereas the fire damper is also to be used for Smoke management (Smoke and fire damper) the same shall be as per UL-555 S-Class-II.

Every motorized fire damper/ Smoke and fire damper shall be tested for in the factory and will be certified by the manufacturer in form of the test certificate.

Fire damper shall also be supplied with spring locked fusible link rated for 720 C (UL stamped) to close fire damper in event of rise in duct temperature.

For fire dampers/ smoke fire dampers of size higher than one approved by certifying agency the damper shall be supplied in multiple units of size not exceeding the tested damper by CBRI. All the multiple units shall be housed in a common factory fitted sleeve.

The fire dampers shall be mounted in fire rated wall with a duct sleeve 400mm/500mm long depending upon the wall thickness. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be slip on type. Minimum thickness of galvanized sheet shall be 18 gauge.

The damper shall be installed in accordance with the installation method recommended by the manufacturer.

2.5.2 Actuators

The actuator shall be maintenance free direct coupled spring return type suitable to work on 24 V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open/ close the damper. The selection of actuator size shall be the responsibility of the manufacture of the fire damper. Spring return time shall be 20 seconds or less at ambient temperature. Other features of the damper actuator shall be as under:

Actuator shall have tamper proof housing with IP-54 protection rating.

Actuator shall have mechanical integrity of at least one hour at 9000 C.

Actuator shall have minimum 60000 safe position at rated torque. It shall be capable to withstand temperature of 750 C for 24 Hrs.

Actuator shall have electronic over load or digital sensing circuit to prevent damage to actuator.

Should be capable of changing direction of rotation by changing mounting orientation.

Actuator shall have manual over ride facility.

Damper actuator shall be such that it should close the damper in the event of power failure automatically & open in the same manner in case of power being restored.

2.5.3 Control Panel

The Control panel shall be supplied by damper manufacturer fitted on damper compatible with damper actuators. The control panel shall have at least following features:

Power on lamps with 230 V/ 24 V Transformer.

Damper close and open indication.

Reset push button.

Push button for manual running of actuator for periodic inspection.

Auxiliary contacts 24V & 230V.

Contact points to receive signal from smoke detector/fire alarm panel.

Additional terminal shall be provided to have signal (audio or visual) in central control room.

The control panel shall receive 230 V A/C supply & interconnecting wiring between control panel and actuator shall be carried out using fire proof cables.

The Contractor shall ensure that all electrical connections are suitably terminated. The HVAC Contractor shall also check continuity of electrical circuit as recommended by the manufacture. Fire damper inspection door will be provided in AC duct to facilitate access to the system.

2.6 Supply Air Registers

Supply air registers shall be of approved make and of mild steel construction with individually adjustable bars. Supply air registers shall be double deflection type, with removable key-operated volume control dampers. The outer frame should be made out of 20 gauge and louvers of 24 gauge MS sheet.

All registers shall be selected in consultation with the Consultants. Different spaces shall require horizontal or vertical face bars and different width of margin frames.

All registers shall have a soft, continuous rubber gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers shall not be less than 80 percent.

Registers shall be adjustable pattern as such grille bar shall be pivot able to provide pattern with 0 to 100 degree horizontal arc and up to 30 degree deflection up or down. Bars shall hold deflection settings under all conditions of velocity and pressure.

Bars longer than 450 mm shall be reinforced by a setback vertical member.

Registers shall be given a rust inhibiting prime coat and factory applied enamel finish of approved color.

2.7 Supply Air Diffusers

Diffusers shall be of approved make and of mild steel construction, square in shape with flush fixed pattern or adjustable flow pattern. Diffusers for different spaces shall be selected in consultation with the Consultant.

All supply air diffusers shall be equipped with removable key-operated volume control dampers. Anti-smudge ring may be required in specific applications. The outer shell and diffusing assembly shall be made out of 18 gauge and 24 gauge MS sheet respectively.

2.8 Extruded ALUMINIUM GRILLES & Diffusers

2.8.1 Rectangular/ Square Ceiling Diffusers

Rectangular /square ceiling diffusers shall be fabricated out of extruded aluminum sections powder coated in color approved by Architects/ Consultants. The four directional air flow diffuser shall consist of outer ring fixed to duct collar with concealed screws. Foam gasket shall be provided between outer ring and suspended ceiling. The central core shall be clip fixed to the outer ring. Opposed blade volume control damper in extruded aluminum construction shall be fixed to the neck of diffuser. The damper shall be adjusted after removing the central core. The diffuser shall be equipped with anti-smudge ring.

In case of grid type false ceiling, the entire diffuser assembly with plenum shall be independently hung from the ceiling through adjustable GI wires and the same shall be connected to the main duct through a flexible round duct.

2.8.2 PLAQUE DIFFUSER

The Plaque diffusers shall be constructed out of Extruded Aluminum powder coated sections is designed to integrate with suspended ceiling arrangement preferably grid type.

The diffuser shall consist of a rear pan and a removable heavy gauge front flat panel attached to the rear pan through spring loaded locking posts. The flat panel may be removed whenever need arises to facilitate adjustment of the damper for air balancing.

The front panel shall be aerodynamic in appearance, rigid and preferably in single piece construction and free from any welding or forming blemishes.

The horizontal air discharge pattern shall be 360 0 type. Blank off baffles shall be provided to obtain one, two or three way blow pattern if specifically asked for in the “Schedule of Quantities”.

Diffusers shall be provided with following accessories:

Opposed blade damper

Spiggot to facilitate round duct connection at neck.

The performance criteria shall be in conformity with relevant ANSI/ASHRAE standards.

2.8.3 SWIRL DIFFUSER

The diffuser face shall consist of fixed radically arranged air control blades. The supply air pattern shall permit specifically arranged internal air guidance elements or guide vanes. Such elements are not required for return/extract versions. Due to the rotary swirling motion of the air discharge, induction of room air occurs very quickly, resulting in decay of supply air velocity and temperature differential.

In order to stabilize horizontal discharge, all sizes must be mounted flushed with the suspended ceiling. The minimum height between floor & the diffuser face should be 2.6 M or less. The face plate shall be square. The supply air versions shall be supplied with top/side entry spigot with lip seals and Volume Control Damper.

The diffuser face shall be fabricated out of 1.2 mm thick galvanized steel sheet, pretreated and powder coated white. The spigot shall also be of 1.2 mm thick galvanized steel sheet & lip seal of soft rubber.

The performance criteria shall be in conformity with relevant ANSI/ASHRAE standards.

2.8.4 Multislot Linear Diffuser

Linear ceiling diffuser shall be multi-slot type. The diffuser shall be fabricated out of extruded aluminium sections. Each slot shall be 19mm wide. Each slot shall be equipped with air flow direction control louver mechanically fixed. Integral sliding type hit & miss type volume control damper in extruded aluminium construction shall be provided for each slot for fine control of air flow in supply air portion only. The damper shall be fabricated out of anodized extruded aluminium sections.

Other sections of ceiling diffuser shall be powder coated in color & shade approved by the Consultants/Architects.

The linear diffuser shall be fixed in to a plenum chamber with concealed screws. Side end pieces or corner pieces shall be provided if required.

2.8.5 Multi Louvered Grilles

For supply air double louvered grilles in extruded aluminium construction shall be provided with individually adjusted louvers along with volume control damper in extruded aluminium construction. The

louvers shall be pivoted in Nylon bushes for smooth operation for return air grilles similar to supply air as described above will be provided but without volume control dampers. These grilles shall be painted as per approved powder coated shade.

2.8.6 Linear Grilles

Linear Grilles shall be fabricated out of extruded aluminium sections. Flanges shall be of 1.3mm thick extruded aluminium. Louvers shall be of extruded aluminium sections 3.7mm thick at the front and 2.2 mm at the rear with 15 degree deflection strong enough to withstand site abuse during installation. The sample of grille shall have to be got approved by the consultants before delivery. The linear grilles shall be provided with removable/fixed internal core.

All sections of linear grille shall be powder coated in color/shade approved by the Architects/Consultants.

The linear grilles shall be fixed into a plenum chamber having GI spacers with concealed screws. End pieces or corner pieces shall be provided as required.

2.9 Fresh Air Arrangements

Extruded aluminium construction duly anodized (20 microns and above) fresh air louvers with bird screen and extruded construction dampers shall be provided in the clear openings in the masonry walls of the air handling rooms having at least one external wall. Louvers, damper, pre-filters, ducts and fresh air fan, if required with speed regulator shall be provided as shown on drawings and in schedule of quantities.

Fresh air dampers shall be of the interlocking, opposed-blade louver type. Blades shall be made of extruded aluminium construction and shall be rattle-free. Dampers shall be similar to those specified in "Air Distribution". Fresh air fans and fresh air intake shall be as per the schedule of quantities.

2.10 Air Transfer Door Grille

Air transfer grilles in extruded aluminium construction shall be provided at the door of pantry and toilets wherever required. The air transfer grille shall be complete with matching rear flange. The grilles shall be anodized or powder coated in color and shade as approved by the Architects/Consultants.

2.11 RAIN WATER PROTECTION LOUVERS

Louvers shall be manufactured out of extruded aluminium sections powder coated, outer flange 18mm wide & 45mm deep, louvers also of extruded sections of 1.2mm thickness.

A suitable rat mesh shall be provided using expanded metal mesh preferably aluminium of 1mm thickness having 12mm diamond shaped openings. Fixing screws shall be cadmium coated. The size of such louvers shall be physically measured after openings are internally plastered, often termed as rough opening.

Louvers shall be installed at external building fabric for fresh replenishment or exhaust air.

2.12 PRE-INSULATED FLEXIBLE DUCTS

2.12.1 General:

The scope of this section comprises supply, installation, testing and commissioning of flexible ducting conforming to these specification and in accordance with requirements of drawings and schedule of quantities.

2.12.2 Type:

a. Un-Insulated Flexible ducts

Wherever required, uninsulated flexible ducts shall be made of double lamination, 0.05 mm thick aluminum foil followed by a layer of fire retardant metalized polyester film permanently bonded to a coated spring steel wire helix. Ducts shall be of “tear and puncture resistant” in construction.

Insulated Flexible Ducts

Wherever insulated flexible ducts are incorporated in design, inner core of such an assembly should be made of fiber glass reinforced double layer of metalized polyester film laminate permanently bonded to a coated spring steel wire helix. Blanket of fiber glass insulation exhibiting resistance of R-3.6 (RSI - 0.64 m2K/W) having density not less than 16 Kg/CuM and thickness of 25 mm shall be wrapped over the inner core & covered with “tear and puncture” resistant outer jacket cum vapour barrier made out of preferably 0.05 mm thick aluminum foil.

The pre-insulated flexible duct shall comply with UL 181, BS 476 part VI & Part VII besides Class ‘1’ followed by Class‘O’.

2.12.3 Installation:

Care must be taken to install all the flexible ducts in fully extruded position and bends made with adequate radius as per manufacturer's recommended practices.

Hangers and Supports

The flexible duct must be installed fully extended to produce optimum results. The maximum allowable sag, between any two adjacent suspension points, should not exceed 50 mm per meter.

The distance between any two adjacent suspension points may vary from 150 cm to 300 cm, depending upon the type of flexible duct in use.

Flexible ducts mounted above suspended ceiling should always be independently supported. Ducts mounted in these locations are susceptible to damage whenever ceiling panels need to be periodically interchanged, unless separately supported.

Bending Radius

All bends should be made as large as possible and should have a radius of not less than the diameter of the duct in use. This reduces un-favorable pressure losses and is particularly important for metal based products which are more susceptible to stress rupturing. Double bends should be avoided, however if un-avoidable, ensure that each radius is not less than R = 2 x D.

Flexible Duct to Conventional Duct Connection

Extra care should be taken when making connection to fixed conventional ducts, etc., and ensure that they do not become too stressed. An additional support is recommended to obviate this potential problem. Readymade circular galvanized sheet steel spigots of approved makes shall be used to make such connections.

Metal based flexible ducts are particularly prone to fracturing due to stress caused as a result of sharp connection.

Connections to ceiling illumination "Low Pressure Plenums" should be served in the most direct manner similar to that described for conventional ducts.

Too many bends, when connecting to “Low Pressure Plenums” and / or any other type of air supplying component, may result in excessive pressure loss and the generation of noise.

Longer Length Installation

In the event where extreme length of flexible ducts is to be installed, round duct connectors made of galvanized sheets of at least 30 cm long should be used to connect the duct at every distance of 10 meters. Use metal or galvanized hangers as recommended to support the point where connections are made. Light railing is a good alternative hanging support when using long length of flexible ducts.

Direct Contact with other services

It should be emphasized that the flexible ducts must not be in direct physical contact with un-insulated heating or hot process pipes. If in the event where such situation cannot be avoided, additional 1” thick insulation should be wrapped around pipes that are in contact with the pre –insulated flexible ducts.

2.13 Sound Attenuators

Scope

The scope of this section comprises of supply, installation and testing of rectangular silencers of approved make as shown on the drawings.

Material

a. The outer casing shall be out of min.22 G galvanized steel in accordance with ASHRE (ISI) recommendations for high pressure rectangular duct work. Seams shall be lock formed and mastic filled.

b. Interior elements of silencers shall be out of min. 22 galvanized perforated steel.

c. Acoustic fill shall be inorganic mineral fibre of density sufficient to obtain specified acoustic performance and shall be packed under 10% compression to eliminate voids due to vibration and setting. Material shall be inert, vermin and moisture proof.

d. All materials of construction and acoustic fill shall be incombustible as per IS 3144.

e. Air-tight construction shall be provided by use of duct sealing compound at site by the air conditioning contractor.

Acoustic Performance

Silencer acoustic ratings shall include insertion loss and self-noise power levels and shall meet or exceed minimum performance.

Aerodynamic Performance

Static pressure drop through silencers shall not exceed those listed in the silencer schedule at the indicated airflows.

Transitions

Where transitions are required to adapt silencer dimensions to connecting duct work, they would be supplied by the installing contractor.

Minimum Sound Attenuator Performance Requirement

Sound Attenuator Type		Minimum required Octave Band Centre				Acoustic Frequency Rating (Hz)				Face Velocity (MPS)	Pressure Drop (N/SqM)
		63	125	250	500	1K	2K	4K	8K		
900 mm Long	ILdB	4	7	12	19	25	23	17	11	6	50
	SN	47	36	39	37	34	35	33	25		
dB re 1pW for 0.5 SqM face area											
1500 mm Long	ILdB	6	10	18	30	42	34	23	14	6	50
	S	47	36	39	37	34	35	33	25		

	N										
dB re 1pW for 0.5 SqM face area											

2.14 Testing and Balancing

After completion of the installation of the complete air distribution system, all ducts shall be tested for air leaks.

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

The entire air distribution system shall be balanced using approved anemometer. Air quantities at the fan discharge and at various outlets shall be identical to, or less than 5 percent in excess of, those specified and quoted. Leakage in each air distribution system shall be within 3 percent so that supply air volume at each fan shall be identical to , or no greater than 3 percent in excess of, the total air quantity measured at all supply outlets served by the fan. Branch duct adjustments shall be made by volume or splitter dampers. Dampers shall be permanently marked after air balancing is complete so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted to the Consultants for scrutiny and approval, and six copies of the approved report shall be provided with completion documents.

3.0 INSULATION

3.1 All refrigerant piping, condensate drain piping and floor/ceiling/wall and ductwork shall be insulated in the manner specified here under:

Condensate drain piping, floor/ceiling/wall, refrigerant piping and ductwork under this section shall be insulated with closed cell elastomeric EPDM rubber insulation material of properties as given below:

AVERAGE PHYSICAL PROPERTIES OF INSULATION MATERIAL		TEST METHOD
Cell structure	Closed cell	--
Density (gm/cm3)	(0.04 - 0.07)	--

Thermal Conductivity	0.038 W/M.K at 32 deg C average temperature	--
Service Temperature Limit	(-57 deg C to 125 deg C)	--
Water Vapour Permeability (μ)	Minimum 7,000	DIN 52615
Water Absorption (% by weight)	5	ASTM D 1056
Flammability & Smoke density	Class1 followed by Class 0	BS-476 Part 7 & Part 6 UL 94 ASTM E 84 JIS K 6911 AS 1530
CFC Criteria	CFC free	--
Nitrosamine content	Non-existent	US FDA
Microbial Growth resistance	Should discourage growth	UL 181
Effect on Copper and Stainless Steel	Non-Corrosive	DIN 1988
Crack resistance characteristics	Should not develop cracks	Ozone resistance test, ASTM 1149
Heat Stability— Exposure : 93 deg C – 7 days	Not to exceed 6	ASTM C 534

No insulation shall be applied on pipes until the pipes are satisfactorily tested, as specified in section “PIPING”.

3.1.2 Application of Insulation

Cold insulation on pipes shall be applied as specified below:

Pipes shall be thoroughly cleaned with brush & linen and rendered free from all foreign matter and grease.

b. Apply adhesive on the bare surface of pipes.

c. Closed cell Elastomeric Thermal insulation material preferably in tubing form shall be fixed tightly to the surface. All joints to be sealed properly with vapour barrier compound.

Condensate drain piping and refrigerant piping shall be insulated in the manner specified above.

All valves, fittings, strainers, etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and applied generally in the manner specified above, valves bonnets, yokes and spindles shall also be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

Exposed pipe insulation shall be provided with necessary surface treatment as given here under:

Apply two layers of surface coating as under :

Apply a coat of composition prepared out of synthetic resin, crystalline silica & ethyl alcohol.

Cover the insulated surface with lagging in the form of fire retardant glass fiber cloth, by wrapping it on wet coating.

Subsequently, apply a coat of special composition and allow drying.

Apply second coating thereafter achieving sufficient mechanical strength.

3.1.3 Duct Thermal Insulation

External thermal insulation of ductwork shall be carried out with closed cell elastomeric insulation having thermal properties mentioned above and thickness mentioned in schedule of quantities. The contractor shall ensure availability of all accessories as mentioned under appendices for achieving perfect

workmanship. Insulation of ducts shall be applied strictly as per the recommendations of manufacturers amended from time to time. However, application procedure shall generally be as given hereunder:

Apply adhesive on the bare surface after vigorously cleaning the duct using fresh linen.

Closed cell elastomeric insulation material possessing class “O” properties in specified thickness to be fixed tightly to the surface with joints well butted.

Longitudinal as well as vertical joints shall be sealed with the adhesive forming proper bonding.

Circular ducts shall be insulated internally following procedure as mentioned above. In addition, insulated surface shall be secured with circular GI strips spaced at regular intervals. A sample of insulated duct shall be displayed at site and approval sought prior to application.

3.1.4 Thermal Insulation of ducts exposed to atmosphere

Duct insulation shall be applied as follows:

a. Apply adhesive on the bare surface after vigorously cleaning the duct using fresh linen.

Closed cell elastomeric insulation material of class “O” properties in specified thickness to be fixed tightly to the surface with joints well butted.

Longitudinal as well as vertical joints shall be sealed with the adhesive forming proper bonding.

Apply two layers of surface coating as under:

Apply a coat of composition prepared out of synthetic resin, crystalline silica & ethyl alcohol.

Cover the insulated surface with lagging in the form of fire retardant glass fiber cloth, by wrapping it on wet coating.

Subsequently, apply a coat of special composition and allow drying.

Apply second coating thereafter achieving sufficient mechanical strength.

Insulation for Floor/ Walls

Following procedure towards application of closed cell elastomeric material of properties as mentioned above for floor, ceiling and partition walls shall be adopted:

The underside of the roof slab, floor and wall surface to be thoroughly cleaned with wire brush and rendered free from bitumen or any other coating that exists.

Basic surface preparation using sand paper.

Adhesive to be applied thereafter, preferably in the evening and be left for overnight.

Finally next morning insulation to be applied using adhesive with longitudinal joints left open to facilitate inspection. Thereafter, CSE adhesive based tapes shall be applied on such longitudinal joints.

Area where insulation is to be carried out shall be barricaded & access shall be blocked.

3.1.7 Application of Aluminium foil for Exposed Walls

Following procedure towards application of aluminium foil for walls towards vapour permeation treatment shall be adopted:

Walls shall be thoroughly cleaned with wire brush and rendered free from any foreign material.

Basic surface preparation using sand paper.

A layer of 0.1mm thick aluminium foil to be applied over prepared surface using adhesive. Longitudinal joints shall be sealed with adhesive based aluminium tape.

Finally gypsum board shall be fixed on the treated surface and epoxy paint may be applied thereafter (by other agencies).

3.1.8 Thermal Insulation (UNDERDECK)

Underdeck thermal insulation of slab exposed to sun shall be carried out using fiber glass board having density 32kg/cu.m, & 50mm Thickness laminated WMP-VR on one side and Fiber Glass Tissue on the other side. The contractor shall ensure availability of all accessories as mentioned under appendices for achieving perfect workmanship. Insulation shall be applied strictly as per the recommendations of manufacturers amended from time to time. However, application procedure shall generally be as given hereunder:

Installation:

The 50 mm insulation boards are to be fixed underside of the RCC slab with the help of polyamide based 75-80mm long insulation fasteners (Bossong- CF or Hilti or equivalent). First, the insulation board is to be positioned underside of the RCC slab and then, the insulation slab as well as RCC are to be drilled in such a way that total length of the fasteners can be accommodated (i.e50 mm insulation + 25-30 mm depth of the hole in the RCC slab).The fasteners are to be hammered in and top round face of the fastener will hold the underdeck insulation slab (please see the picture below). The fasteners are to be applied at 450 mm (width side, 2 fasteners) x 525 mm (length side, 3 fasteners) pitch so that one single board can be fixed with 6 fasteners. All the adjacent joints are to be sealed with self-adhesive aluminum foil tape. If there is any false ceiling system has been planned below the insulation, it is advisable to use template to create holes through the insulation boards for false-ceiling-supports. This would reduce rework for additional cutting and filling with insulation scrapes.

3.2 AHU Room Acoustic/ Thermal Lining

Thermal/acoustic lining of walls & ceiling of AHU rooms shall be done using fiber glass board having density not less than 80kg/cu.m, laminated with aluminium foil on one side and three layers of black glass cloth on the other side. The board shall be cut to size and secured onto the walls or ceiling through fasteners as per manufacturer’s recommendations.

Parameter	Technical Specification (Acoustic insulation)
Material	Resin bonded fiberglass wool
Standard/Codes to follow	IS 8183: 93 /IS 3144: 90
Physical form	Standard Board Size : 1200 MM X 600 MM OR 3 M x 1.2 M
Nominal bulk density	70-80 Kg/m3

Thickness	25 mm
R-value in sq.mK/W (at…..mm thickness)	R-0.510
Facings	Factory lamination with one side FSK (Aluminum foil) & other side BGC (Black Glass Cloth)
Thermal conductivity	0.490 mW/cm deg C at 25oC
Parameter	Conformance
Fire Properties	
Non combustibility	Non combustible as per BS 476 part 4
Ignitibility	Class P(Not easily ignitable material) as per BS 476 part 5
Surface Spread of flame	NIL. Class 1 as per BS 476 part 7
Fire propagation	Class 'O', [index I<12, sub-index i1<6].Conforms to BS 476 part 6 and 7.
Toxicity	Non toxic as per BS 6853
Moisture content	<2% .conforms to IS 3144/IS 8183
Shot content	Nil.(<2%). conforms to IS 3144/IS8183
Sulphar /Chloride content	Nil. Conforms to IS 3144/IS 8183
Mould growth	Conforms to IS 3144/IS 8183. Inorganic glass fiber does not support mould growth.
Chemical	Neither acidic no basic, chemically almost neutral. PH value very close to 7.

Installation guideline:

The surface shall be cleaned and put rubber based adhesive on wall and Acoustic Board (on Aluminium facing).

After 10-15 minutes of the coat of adhesive the Acoustic board has to be placed on the wall and it has to be fixed with the help of Anchor/Screw and Washer.

The Acoustic board should be placed in such a way that black glass cloth is visible from inside the AHU room. Complete as required and as per specifications

3.3 DUCT ACOUSTIC LINING

Where specified in the tender specifications, ducts shall be lined internally with acoustic insulation as detailed below:

The Inside surface of duct on which the acoustic lining is to be provided shall be thoroughly cleaned with wire brush and rendered free from all dust and grease.

Then 25 x 25 sq.mm section of minimum 1.25 mm thick G.I. sheet shall be fixed on both ends of the duct piece.

The insulation slabs shall then be fixed between these section of ducts using CPRX adhesive compound and stickpins.

The insulation shall then be covered with Reinforced plastic/ fibre glass tissue with proper overlap, sealing all joints so that no fibre is visible.

The insulation shall finally be covered with minimum 0.5 mm thick perforated aluminium sheet having perforations between 20-40%.

4.0 ELECTRICAL INSTALLATION

4.1 Scope

The scope of this section comprises of fabrication supply, erection, testing and commissioning of electrical control panels, wiring and earthing for all components of the HVAC system.

4.2 General

Work shall be carried out in accordance with the Specifications, local rules, Indian Electricity Act 1910 as amended up to date and rules issued thereunder, regulations of the Local Fire Insurance Association and Indian Standard code of practice No. IS: 732-1963 (revised) including Indian Electricity Rules 1956.

4.3 Wiring System

All power wiring shall be carried out with 650/1100 volts grade PVC insulated, aluminum/copper conductor cables as per “Schedule of Quantities”, sized for starting current and continuous running current carrying capacity and by applying proper derating factor.

4.4 Motor Control Centre

a. Construction Features:

Motor Control Centre (MCC) shall comprise of all the switch gears as detailed in bill of quantities and design drawings. All the switch gears including the bus bar chamber on the same board shall be of the same manufacturer for facility of interchangeability. The motor control shall be metal enclosed sheet steel cubicles, indoor type, dead front, floor mounting type fabricated out of 14 gauge CRCA sheet steel. Removable gland plates shall be 3mm thick sheet. The size of the gland plate shall be sufficient enough to accommodate all cable sizes. The control panel shall be totally enclosed, completely dust and vermin proof. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. The panel shall be in IP-54 enclosure. All doors and covers shall be fully gasketted with foam rubber and/or rubber strips and shall be lockable. All mild steel sheets used in the construction of control panels shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal. All panels and covers shall be properly fitted square with the frame and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with hank nuts. Self-threading screws shall not be used in the construction of control panels. A base channel of 75mmx40mmx5mm thick shall be provided at the bottom.

Knockout holes of appropriate size and member shall be provided in the MCC in conformity with the location of incoming and outgoing cables.

Facility shall be provided for the entry of all types of cables from bottom or top of control panel as per site requirements. Panel shall have independent vertical & horizontal Bus Bar alleys & cable alleys accessible from front as well as back of the panel.

Bus bar chamber shall be made out of sheet steel of thickness not less than 2mm with detachable covers on all sides. The joints shall be continuous welded. The detachable covers shall be secured to the box with sufficient number of cadmium plated iron screws to ensure dust tightness. Bus bar chamber of size upto 900 mm shall have detachable end cover so that the same can be extended.

b. Bus Bars:

Bus bar shall be made out of wrought aluminium alloy or electrolytic copper Grade E91 as the case may be of sufficient cross section so that a current density 100 Amps/Sqcm in case of aluminium and 150Amps/Sqcm in case of copper is not exceeded at nominal rating. The cross section of neutral bus-bar will be the same as that of the phase bus-bar of capacity upto 200Amps. The neutral bus bar should not be less than half the cross section of that of phase bus bar beyond 200Amps. The bus-bars should be suitably insulated with heat-shrinkable PVC sleeving and colour coded. Connections to bus-bars shall be made by the bolting arrangement by the aluminium alloy or the forged brass nuts and bolts, ensuring that the current density of the bus-bars at the point of connection does not exceed permissible limit and there is no heat due to bimetallic contact.

Minimum clearances between bus-bar throughout the panel shall be 32mm between phases and 25mm between phase to earth. Danger plate of approved shape and size be provided on each switch board without any extra charge. The bus-bar shall be supported on DMC/SMC and shall be rated for a fault level of 50KA for 1 sec & temperature rise on full load not to exceed 45 C above ambient i.e, total of 85 C.

4.5 Selection of components in MCC

Contractor shall use only one make of component for ease in maintenance and interchangeability. The rating of other components i.e, contactor, fuse, circuit breaker, overload relay, single phasing preventer etc. shall be as recommended in these specifications.

4.6 Selection of Cables/Wires

The size of cables and wires for individual connection to outgoing MCCB/SFU/Isolator shall be suitably rated. Above 100 Amps. solid links shall be used.

All power wiring shall be carried out with 650/1100 volt grade PVC insulated aluminium /copper conductor cables/wires sized for starting current and continuous rating of motors after applying derating factor as per the “Schedule of Quantities”.

4.7 Cable Compartments

Cable compartment of minimum size of 400 x 400 mm or as shown in drawings shall be provided in the boards for termination of all incoming and outgoing cables entering from bottom or top. Adequate supports shall be provided in cable compartment to support cables. All incoming & outgoing switch terminal shall be brought out to the spring loaded terminal blocks in cable compartments and identified accordingly.

All the outgoing connections shall be brought on spring loaded (Elmex Type CSLT-1) terminals in the cable-alley. Minimum size of terminals for control and power wiring shall be 2.5 & 10 Sqmm respectively. No cable, however shall be terminated in to the switch/isolator/ MCCB/contactor/over load relay, under any circumstances.

4.8 Meters and Indications

All meters shall be housed in a separate compartment or as shown in design drawings and accessible from front only. Lockable doors shall be provided for the metering compartment. All switches, contactors, push buttons, push button stations, indicating lamps shall be distinctly marked with a small description of the service fed.

4.9 Painting

Entire sheet metal works shall undergo seven tank process including passivating, sprayed with a high corrosive resistant primer and baked in oven. The finishing treatment shall be of two coats of synthetic enamel paint of approved color & shade.

Degreasing : Concentration of chemical : 5% - 7% & 40 deg C

Derusting : Concentration of chemical : 25%

Phosphatising : Concentration of chemical : 3.5% & 40-50 deg C

Passivation : Concentration of chemical : 0.05% - 0/1% & 60-70 deg C

Two coats of zinc chromate primer should be applied after the above processing before baking in oven.

Wherever necessary filler putty is applied to make the surface smooth. Properly rubbed surface is to be given a coat of surface and baked in oven.

4.10 Testing

Motor control center shall be tested at manufacturer’s works. The test certificates shall be got approved before dispatch of MCC to site.

4.11 Instrument Compartment

All instrument shall be flush mounted 144 mm square & suitably scaled. Instrument chamber should have sufficient space. Indicating lamps should have minimum 50mm space between them. They shall be accessible for testing and maintenance without any danger of accident and contact with live parts of circuit breaker and bus-bar.

4.12 Control Cables and Terminals

All control wiring shall be with minimum area of 1.5 Sqmm copper conductor. These shall be ferruled coded and identified at both ends as per IS specifications. A horizontal wire way shall be provided along the length of panel for taking the control wiring from one section to another control wiring when terminated, shall be terminated on the terminal block and identified for the duties to be performed. Each terminal shall be separately identified. Minimum 10% spare terminals shall be provided on every terminal block.

4.13 Other Components

4.13.1 Moulded Case Circuit Breaker (MCCB)

The MCCB (moulded case circuit breaker) shall conform to the latest IEC 947-2 & IEC 947-3–1989. The Service Short Circuit Breaking Capacity (Ics at 415VAC) should be as specified at the required level.

The MCCB shall be Current Limiting type and comprise of Quick Make – Break switching mechanism, preferably Double Break Contact system, arc 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 200Amps and above shall have adjustable Magnetic short circuit pick up.

The trip command shall over ride all other commands. The 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 the 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 IEC947-3 indicating the true position of all the contacts. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection.

4.13.2 MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with IEC898 – 1996. The Miniature circuit breakers (MCB) shall be quick make and break type for 230 / 415 VAC 50 Hz application with thermal magnetic releases for over current and short circuit protection. The Breaking capacity shall not be less than 10 KA at 415VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Energy Class–3). MCBs shall be classified (B,C,D as per the IEC 898 standards) as per their Tripping characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP and TPN miniature circuit breakers shall have a common trip bar independent to the external operating handle.

4.13.3 Switch Fuse Units

High rupturing capacity fuse (HRC Fuse) shall carry ISI mark on it and shall be rated for duty as indicated on the drawing/schedule of Quantities. The rating of HRC fuse shall be as per the rating of motor/equipment. The rating of fuse shall be selected so as to provide discrimination.

The switch fuse units shall be three pole double break action with switched neutral. All switch fuse units shall be provided with the hinged doors duly interlocked with operating mechanism so as to prevent opening of the door when the switch is ‘ON’ position and also to prevent energizing the switch when the door is not properly secured. All contacts shall be silver plated and alive parts shall be shrouded. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall have rupturing capacity of not less than 31 MVA at 415 volts. All switch fuse units shall be provided with visible indicators to show that they are in ‘ON or OFF’ position. All switch units shall be of AC-23 category.

4.13.4 Motor Starter

The Motor Starter shall be a combination starter consisting of motor protection circuit breaker and suitable contactor for remote starting.

Motor protection circuit breaker

The motor protection circuit breaker must comply with the latest IEC 947-4 and the corresponding IS 13947-4. The motor protection circuit breaker should be suitable for AC3 duty at 415V. The motor protection circuit breaker should offer built in coordinated overload and short circuit protection. The motor protection circuit breaker should have built in single phase / phase loss preventor. The motor protection circuit breaker should offer separate ON/OFF indication and Fault signal contacts which should be wired onto the panel for indication.

The motor protection circuit breaker should offer Type 2 coordination along with the contactor.

Contactors

The contactor should be suitable for AC3 duty at 415V and should comply to the latest IEC 947-4 and the corresponding IS 13947-4. The contactor should have minimum 10 x IE rated making / breaking capacity as per the latest standard. The same should be suitable for Type 2 coordination along with motor protection circuit breaker. The contactor should have Class H insulation for the coil to prevent heating and to facilitate frequent start / stop function without heating.

4.13.5 Earth Leakage CB/ Residual Current CB

The ELCB/RCCB shall comply with IEC 1008. The ELCB/RCCB shall current operated independent of the line voltage. ELCB / RCCB shall work on the principle of core balance transformer. The ELCB / RCCB shall be rated for current sensitivity of a Min of 30mA and a Max of 300mA at 240 / 415VAC.The terminals shall be protected against finger contact to IP20 degree of protection. The ELCB / RCCB shall have a minimum of 20,000 electrical operations.

Testing Provision for the Earth Leakage Circuit Breaker

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB and the operating handle shall move to the "OFF" position.

4.13.6 Air Circuit Breaker (ACB)

The ACB shall conform to IEC 947-2-1989 & IS 13947 (Part –2). The Service Short Circuit Breaking Capacity shall be as specified and equal to the Short circuit Withstand Values. The ACB shall be provided for controlling the incoming supply feeder or as required and specified in schedule. Shall be available in 3 or 4 pole with modular construction, fixed or draw out, manually or electrically operated versions as specified. ACB shall be capable of providing short circuit, overload and earth fault protection (in absolute values) if required, through microprocessor based control unit sensing the true RMS values to ensure accurate measurement meeting the EMI/ EMC requirement as per the standard.

The breaker should have 3 distinct positions – SERVICE / TEST/ ISOLATED within the cubicle. It should be possible to withdraw the breaker for testing with the door closed. Safety interlock must be provided to prevent the ACB from falling out in a fully withdrawn position. The ACB shall be provided with a door interlock. The contacts should be copper and silver plated only with a feature of contact wear inspection indicating the life of the contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and inaccessibility to live parts. All electrical closing of breaker should be with Electrical motor wound stored energy spring closing mechanism with Mechanical indicator to provide. ON/ OFF status of ACB.

For all ACBs the Operating handle should be provided for charging the spring in continuous action. The spring shall be released with ON / OFF push button command in one operation at the correct speed independent of operator speed. A direct mechanical coupling should indicate the ACB in ON or OFF position thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts. One set of NO / NC potential free contacts to be provided for operation on Building Management System. All accessories like shunt, under voltage motorized mechanism etc shall be front mounted, requiring no adjustments and can be fitted at site. The manufacturer shall provide details of opening time and deration with temperature to ensure discrimination and proper selection for feeder's protection. All ACBs of 4000 A and above shall be a single ACB and Tandom operated will not be acceptable.

4.13.7 SAFETY FEATURES

1. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.

2. It should not be possible to interchange two circuit breakers of two different thermal ratings.

There should be a provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism.

Earthing bolts must be provided on the cradle or body of fixed ACB.

Arc Chute covers should be provided wherever necessary.

5. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, voltmeter and ammeter of size not less than 96mm x 96mm, selector switches, fuses for potential circuit and current transformers.

6. It should be possible to bolt the draw out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.

4.13.8 PROTECTIONS

1. The Electromagnetic and thermal release or Microprocessor based unit should be provided on circuit breaker for short circuit, over current and earth fault protection with adjustable settings.

2. Specific LED indications should be provided for over current and earth fault operation.

3. Relays should be CT operated through shunt trip for short circuit and earth fault protection.

4. Under voltage relays should be provided.

5. Minimum 6 NO and 6 NC auxiliary contacts shall be provided on each breaker. The contacts shall be rated 5 Amps.

6. Rated insulation voltage is 1000 volts AC.

4.13.9 Push Button Stations

Push button stations shall be provided for manual Start & Stop of equipment. Push button shall have ON & OFF indicating lamp in red and green color. Push button shall be fabricated in 16 gauge sheet steel.

These station shall be factory fabricated. ON & OFF operations shall be carried out from front without opening the door. One set of NO & NC contact shall be provided in push button station as spare.

4.13.10 Toggle Switch

The toggle switch shall be of minimum 5 Amps rating.

4.13.11 Thermal Overload

The relay shall be factory calibrated, sealed and suitable for an ambient temperature at site or 50 deg C whichever is higher.

It should provide reliable and accurate protection against overload, single phasing and locked rotor conditions. Relays are to be provided with:

(a) Trip alarm contact

(b) Trip lever for testing

(c) Auto reset facility

Rated insulation voltage shall be 660 volts AC.

4.14 Instruments

a. General :

The specifications hereinafter laid down shall cover all the meters and instruments.

b. Instrument Transformers

(i). Current Transformers

Current transformers shall be in conformity with IS: 2705 (Part I, II, III & IV) in all respects. All current transformers used for medium voltage applications shall be rated for 1 KV. However, the rated secondary current shall be 5 A unless otherwise specified. The acceptable minimum class of various applications shall be as given below:

Measuring : Class 0.5 to 1

Protection : Class 10 p

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 35 MVA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identifications of poles. Current transformers shall be provided with earthing terminals, for earthing chassis frame work and fixed part of the metal casing (If any). Each CT shall be provided with rating plate indicating the following:

i. Name and make

ii. Serial Number

iii. Transformation Ratio

iv. Rated Burden

v. Rated Voltage

vi. Accuracy Class

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 & clean manner.

c. Potential Transformers

Potential transformers shall be provided if specifically called for potential transformers shall comply with the requirements of IS: (Part I,II,III) in all respects.

d. Measuring Instruments

(i) General

Direct reading electrical instruments shall be in conformity with IEC-51, BS:89 or IS :1248. The accuracy of direct reading shall be 1.0 for voltmeters and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The meters shall be suitable for continuous operation between -10 deg C and +50 deg C. All meters shall be of flush mounting type with square pattern. The meter shall be enclosed in a dust

tight housing. The meters shall be provided with white dials and black scale markings. The pointer shall be black in color and shall have zero position adjustment device which could be operated from outside.

ii. Ammeters

Ammeters shall be of moving-iron type. The moving part assembly shall be with jewel bearings. 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 or BS:89. Ammeters shall be instrument transformer operated, and shall be suitable for 5 A secondary.

Upto 30 Amps the ammeter shall be direct operated without current transformer on one phase only. Beyond 30 Amps the ammeter shall be CT operated with selector switch.

iii. Voltmeters

Voltmeters shall be of moving-iron type. The range for 400 volts, 3 phase voltmeters shall be 0 to 500 volts. The voltmeter shall be provided with protection fuse of suitable capacity.

4.15 Earthing

a. General

All non-current carrying metal parts of the electrical installation shall be earthed as per IS-3043. All metal conduits, trunking, cable sheathes, switchgear, distribution boards and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to control panel. Earthing shall meet the requirements of IER 1956.

b. Earthing Conductor

All earthing conductors shall be of high conductivity copper as specified and shall be protected against mechanical damage and corrosion. The size of the earth conductor shall not be less than half of the largest size of the current carrying conductor. The connection of the earth continuity conductor of earth and earth electrodes shall be strong and sound and shall be rigidly fixed to the walls, cable trenches, cable trays or conduits and cables by using suitable clamps made of nonferrous metals. Incoming power supply along with earthing up to MCC/AHU control panel shall be provided by other agency. The panel shall be earthed to building main earthing. The motor shall be double earthed to the panel.

The earthing shall be done with wires/flat as under:

S.No.	Equipment	Size of Earth Wire/Strip GI	Copper
01.	Motors Upto 5 HP	2 Nos 8 SWG	2 Nos. 14 SWG
02.	Motors Upto 15 Hp	2 Nos 8 SWG	2 Nos 12 SWG
03.	Motors Upto 30 HP	2 Nos 4 SWG	2 Nos. 8 SWG
04.	Motors Upto 50 HP	2 Nos 25x6mm Flat	2 Nos. 4 SWG
05.	Motors above 50 HP	2 Nos 32x6mm Flat	2Nos. 5x3mm Flat.

AHU electrical panel shall generally be wall mounted type. Above stated specifications shall also stand good where applicable. The AHU motor shall be double earthed with two independent earth conductors as per the Indian Electricity Rules & Regulations-1956.

4.16 Medium Voltage Cable

a. Type

Medium voltage cables shall be aluminium/copper conductor, PVC insulated, PVC sheathed and steel wire armored or steel tape armored construction.

b. Rating

The cable shall be rated a voltage of 660/1100 volts.

c. Construction

The conductors shall be made of electrical purity aluminium 3/4 or H temper/copper. The conductor shall be insulated with high quality PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanized compound.

Armoring shall be applied over the inner sheath of bedding. Over the armoring a tough outer sheath of PVC sheathing shall be extruded. The armoring shall be of single layer, galvanized steel round wire or flat strip. Wire armor should be used for cable dia. over inner sheath up to 13mm and strip armor to be used for higher dia.

The outer sheath shall bear the manufacturer's name and trade mark at every meter length.

d. Core Identification

Cores shall be provided with the following color scheme of PVC insulation:

Core 1 : Red/Black/Yellow/Blue

Core 2 : Red & Black

Core 3 : Red, Yellow & Blue

Core 4 : Red, Yellow, Blue & Black

e. Current Rating

The current ratings shall be based on the following conditions:

i. Maximum conductor temperature : 70 deg C

ii. Ambient Air temperature : 43 deg C

iii. Ground temperature : 30 deg C

iv. Depth of laying : 75 CM

f. Short Circuit Rating

Short circuit ratings for the cables shall be as specified in IS: 1554-Part I.

g. Selection of Cables

The cables shall be suitable for effectively earthed A/C system 415 volts, 3 Phase 50 Hz.

Cables have been selected considering the conditions of the maximum connected load, switch rating ambient temperature, grouping of cables and the allowable voltage drop. However, the contactor shall recheck the sizes before the cables are ordered and brought to site. Discrepancy if any, shall be brought to the notice of Consultant.

h. Laying of Cables

For laying of cables along building steel structure and technological structures the cables shall be taken by clamping with MS saddles screwed to the MS flat welded to the structure. MS saddles and flats are to be galvanized after fabrication so that there is no rusting during maintenance period.

For laying cables along concrete walls, ceiling etc. . The cables shall be taken by clamping with MS saddles screws to the MS flat welded on to the inserts. Where inserts are not available the saddles shall be directly fixed in the wall using rowl steel plugs of sufficient capacity and MS flat spacers of minimum 2mm thick.

The MS saddles shall be spaced at an interval, not more than 500mm both for horizontal and vertical runs. However, at the bends, it shall be spaced within 300mm and where terminating to the equipment/junction box the cable shall be clamped immediately before such terminations. In the area prevailing with corrosive atmosphere, PVC saddles instead of MS saddles shall be provided.

Underground cables shall be laid not less than 750mm below ground. The width of the trench shall be 300mm minimum for single cable. For additional cables additional width of 150mm for each cable is to be added. The sand should be spread in trench as under.

The cushion of sand to be provided below and above the cable joint boxes etc must not be less than 80mm i.e, total depth of sand shall be 160mm minimum. The sand should be spread in trench as under.

After laying the cable in trench 80mm of sand should be put over the cable. The cable should then be lifted and placed over the sand bed and the balance 80mm of sand put over it.

Where cable is laid in rocky situation extra thick cushioning of sand as may be decided by site in charges shall have to be done without any extra cost.

Filling of trenches shall be done after the sand cushioning and laying of tiles/bricks are carried out to the satisfaction of the engineer.

4.17 Cable Trays

i. Trays shall have suitable strength and rigidity to provide adequate support for all cables.

ii. Shall not have sharp edges, burrs or projections injurious to cable insulation.

iii. Shall be adequately protected against corrosion.

iv. Shall include fittings factory fabricated or other suitable means for change of direction and elevation in run.

4.17.1 Installation of Trays

Trays shall be installed as complete system supported properly and rigidly from the building structure.

Each run of cable tray shall be completed before the installation of cables.

Cable trays shall be accessible.

Noncombustible solid barriers shall be used for segregating the cables of different systems on the same cable tray. Cable trays shall be grounded by 2 Nos. earth strips. Trays shall not be used as equipment grounding conductor.

4.18 Testing

Cables shall be tested as per the requirements of IS 1554. The tests shall be incorporate routine test and acceptance tests. Type test certificate shall be furnished whenever demanded.

Tests shall be carried out at site and submitted to project authorities.

4.19 Cable Identification Tag

Suitable cable identification tag shall be placed along the route of cable at every 10 meters and bends. The tags shall be of size 150mm x 100mm x2mm aluminium sheet. It shall be punched with similar details as given below.

Cable from	MCC or AHP-1
Cable to	CDWP-1 or CT-1
Size of cable	2 Nos 3Cx 6 Sqmm.

4.20 Drawings

Shop drawing for MCC/control panels and wiring of equipment showing the route of cables shall be got approved by the Consultants before starting the fabrication of panel and starting the work.

APPENDIX- I

1. The Contractor shall furnish the following guarantee:

“We warrant that everything supplied by us including all components fitted into the equipment manufactured by others also, shall be in all respects free from all defects and faults in material, workmanship and manufacture and shall be of the highest grade and quality to acceptable standards for all materials of the type ordered and shall be in full conformity with all the specifications, drawings or samples if any and we shall be fully responsible for its efficient performance. This guarantee shall survive inspection for acceptance and payment for the equipment and installation, but shall expire (except in respect of the complaints notified to us) 12 months from the date of issue of completion certificate by the Architect/Consultants. The complaints, workmanship, manufacturer or performance of any of the equipment or part/parts thereof shall be notified by fax within 12 months from the date of issue of such completion certificate”.

2. The Contractor shall replace such of these parts which require replacement under these conditions free of cost, charge and expenses to the purchaser. In addition, the Contractor shall be responsible for a period of 12 months from the date of issue of completion certificate for any defect that may develop or appear under the conditions provided by the Contractor or use thereof arising from faulty material design or workmanship in the equivalent or any part thereof or faulty installation of the equipment by the Contractor but not otherwise and shall correct such defects within one week from the date of notification at his own cost when called upon to do so by the purchaser who shall state in writing in what respect the portion is faulty.

3. Any faulty component replaced or renewed under the clause shall also be guaranteed for a period of six months from the date of such replacement or removal of until the end of the above mentioned period whichever is later.

4. If defects are not rectified within a reasonable time as mentioned in the written notice, the Project Managers/Architects/Owners shall proceed to do so at the Contractor’s risk and cost without prejudice to any other right thereof.

APPENDIX-II

HVAC TENDER DRAWINGS

DRG. No.	DRAWING TITLE
AC-01	HVAC SYSTEM LAYOUT – BASEMENT
AC-02	HVAC SYSTEM LAYOUT – GROUND FLOOR
AC-03	HVAC SYSTEM LAYOUT – FIRST FLOOR
AC-04	HVAC SYSTEM LAYOUT – SECOND FLOOR
AC-05	HVAC SYSTEM LAYOUT – VRF SCHEMATIC
AC-06	MISCELLENEOUS DETAILS

APPENDIX-III

INTERNATIONAL CODES AND STANDARDS

LIST OF BUREAU OF INDIAN STANDARDS CODESIS : 277 - 1992	Galvanized steel sheet (Plain & corrugated) wire for fencing.

IS : 554 - 1985 (Reaffirmed 1996)	Dimensions for pipe threads where pressure tight joints are required on the threads.
IS : 655 - 1963 (Reaffirmed 1991)	Metal air ducts.
IS : 694 - 1990 (Reaffirmed 1994)	PVC insulated (HD) electric cables for working voltage upto and including 1100 volts.
IS : 732 - 1989	Code of practice for electrical wiring.
IS : 780 - 1984	Sluice valves for water works Purposes.
IS : 822-1970 (Reaffirmed 1991)	Code of procedure for inspection of welds.
IS : 1239 (Part - I) - 1990	Mild steel tube
IS : 1239 (Part - II) - 1992	Mild steel Tubular and other wrought steel pipe fittings.
IS : 1255 – 1983	Code of Practice for installation and maintenance of Power Cables upto and including 33 KV rating (Second Revision)
IS : 1554 - 1988 (Part – I)	PVC insulated (Heavy Duty) electric cables for working voltages upto and including 1100 volts.
IS : 1897 - 1983(Reaffirmed 1991)	Copper bus bar / strip for electrical Purposes
IS : 2379 - 1990	Color code for the identification of pipelines.
IS : 2551 - 1982	Danger notice plate

IS : 3043 – 1987	Code of practice for earthing.
IS : 3103 – 1975 (Reaffirmed 1999)	Code of practice for Industrial Ventilation
IS : 3837 – 1976 (Reaffirmed 1990)	Accessories for rigid steel conduit for electrical wiring.
IS : 4736 – 1986 (Reaffirmed 1998)	Hot-dip zinc coatings on steel tubes.
IS : 4894 - 1987	Centrifugal Fan.
IS : 5133 -1969 (Part-I) (Reaffirmed 1990)	Boxes for the enclosure of electrical accessories.
IS : 5312 (Part-I) -1984 (Reaffirmed 1990)	Swing - check type reflux Non return valves for water works
IS : 5424 – 1989 (Reaffirmed 1994)	Rubber mats for electrical purposes.
IS : 5578 & 11353-1985	Marking and identification of conductors
IS : 6392 - 1971(Reaffirmed 1988)	Steel pipe flanges.
IS : 8623 – 1993	Low voltage switchgear and control gear Assemblies (Requirement for type / partly type tested assemblies)
IS : 8623 - 1993	Bus Bar trunking system(Part - II)
IS : 8828 - 1996	Circuit Breakers for over current Protection For house hold and similar installation.
IS : 9537 - 1981(Part II)	Rigid Steel Conduits for electrical wiring

IS : 10810 - 1988	Methods of test for cables.
IS : 13947-1993 (Part-I)	General rules for low voltage switch Gears and control gears.
IS : 13947-1993 (Part-II) IEC 947 – 2	Circuit Breakers
IS : 13947 - 1993 (Part-III)	Switches dis connectors and fuse for low voltage switch gear and control gear.
IS : 13947 - 1993 (Part-IV)	Low voltage switch gear and control Gear for contactors and motor starters
IS : 13947 – 1993 (Part-V)	Control Circuit Devices.
IEC	Relevant Sections.
NBC	National Building Code
ISHRAE	Indian Society for Heating, Refrigerating and Air-conditioning Engineers – ISHRAE 2005 Edition.

Apart from the specific equipment standards and specifications, the following broad certifying agency / standards will be considered while designing the system:

ASHRAE – American Society for Heating, Refrigerating and Air-conditioning Engineers.

SMACNA – Sheet Metal and Air Conditioning Contractors National Association or Indian Standards – 1982 Edition or IS277/655 Standards.

UL - Underwriter's Laboratory, USA

AMCA - Air Movement & Control Association, International

1.5 AHRI - American Heating & Refrigeration Institute

1.6 ANSI - American National Standards Institute

1.7 CSA - Canadian Standards Association

1.8 ISO - International Standards Organisation

1.9 IEC - International Electrochemical Commission

2.0 EUROVENT - European Certification Program

APPENDIX-V

IS : 659 – 1964 (Reaffirmed 1991)	Safety Code for Air Conditioning.
IS : 660 – 1963 (Reaffirmed 1991)	Safety code for Mechanical Refrigeration.
IS : 3016	Code of Practice for Fire Precautions in Welding and Cutting operations.
IS : 818	Code of practice for Safety and Health Requirements in Electrical & Gas Welding and cutting operations.
IS : 5216–1982 (Part-I) (Reaffirmed 1990)	Guide for safety procedure and Practices in electrical work.
IS : 3696	Safety Code for Scaffolds and Ladders.

I.S. SAFETY CODES

APPENDIX-VI

PROFORMA FOR SCHEDULE OF TECHNICAL PARTICULARS

Aircooled Variable Refrigerant Flow System

Outdoor Units

a. Make and model

b. HP of Outdoor Unit

c. Capacity in TR (Nominal)

d. Quantity

e. Type Permissible length of refrigerant piping from ODU to farthest IDU.

g. Type of compressor

h. No. of compressors(Each Outdoor unit)

i. No. of inverter driven compressors (Each Outdoor unit)

j. Air entering temp. condenser in deg C

k. Dimension of ODU in mm

(H x W x D)

l. Are bigger ODUs, above 16 HP, provided with 2 separate inverter compressors for proper duty cycling and higher reliability as specified.

m. Confirm whether dedicated Intelligent touch controller with colored graphic LED display provided to act as BAS for VRF system.

n. Confirm whether inverter driven scroll compressor is DC inverter. Also provide following information :

External static pressure available in ODU. Type of anticorrosion treatment on fins of ODU .

Type of Heat exchanger in ODU Set up availability for Night time db relaxation. Confirm availability of features for reduction in fan noise and pressure loss on ODU

Is it possible to incorporate automatic address setting of each IDU & ODU ? Otherwise specify alternate function available.

Double Skin Air Handling Units

a. Manufacturer

b. Model

c. Type of Unit

d. Overall dimension (mm)

e. Noise Level

f. Material and thickness of casing

g. Material and thickness of drain pan

h. Operating Weight (Kg)

Centrifugal Fan for AHU

a. Manufacturer

b. Model

c. Type of fan

d. Fan speed (RPM)

e. No. of fans

f. Fan wheel diameter (mm)

g. Drive arrangement

h. No. of belts in case of belt driven.

i. Material and thickness of fan

j. wheel and blades

k. Material and thickness of housing Fan outlet area (SqM)

l. Fan Outlet velocity (FPM)

m. Total air quantity (CMH)

n. Static pressure at outlet (M of water)

o. Whether statically and dynamically balanced

p. Type of bearings.

Motor For AHU

a. Manufacturer

b. Type

c. Electrical Characteristics

d. Motor Speed (RPM)

e. Method of Starting

f. Starter Manufacturer

Cooling Coil for AHU

a. Manufacturer

b. Type

c. Material of tubes

d. Material of fin

e. Tube diameter

f. Wall thickness of tubes

g. Fin thickness

h. Method of bonding of tube and fins

i. No. of fins/cm

j. No. of rows deep

k. Total tube surface outside (SqM)

l. Test pressure

m. Coil face area

Air Filters For AHUs

a. Manufacturer

b. Type of filters

c. Filter medium

d. Material of frame work and its thickness (mm)

e. Face area (SqM)

f. Face velocity across filters (MPS)

g. Pressure drop across filters (M of water)

Controls for Air Handling Units

a. Electronic Expansion Valve

i. Make

ii. Model

iii. Details of Motor and Driver assembly

b. Thermostats for AHU

i. Make

ii. Model

iii. Range

iv. Differential

v. Temperature Settings

vi. Electrical Characteristics

Inline Fans

a. Manufacturer

b. Motor Characteristics

c. Whether speed regulator provided for single phase fans

d. Whether Bird Screen provided

e. Whether Gravity Louvers provided

f. Efficiency(%)

Insulation

a. Drain Pipe Insulation

b. Material

c. Manufacturer

d. Density

e. Thermal Conductivity

f. Thickness

NOTE: Make of any other equipment not mentioned above will require approval from the Consultants before execution.

APPENDIX - VIII

LIST OF EQUIPMENT & ACCESSORIES WHICH CONTRACTOR HAS TO BRING, KEEP AND MAINTAIN, AT HIS OWN COST, AT SITE DURING THE CURRENCY OF THE CONTRACT IN GOOD CONDITION.

	PLANT/EQUIPMENT	NUMBER
01.	Floor mounted drill machine	1
02.	Hand drill machine with drill bits	2
03.	Hammer Drill machine with drill bits	2
04.	Lock forming machine for duct fabrication	1
05.	Hand held lock closing machine	1
06.	Electric Pittsburg Seamer for closing pittsburg joints	1
07.	Electric Slitting shear for making cut outs	1
08.	Hand held Collar cutting machine	1
09.	Mechanized saw for cutting angles & channels	1

10. Duct smoke test kit 1

11. For application of closed cell elastomeric insulation

i. 1200 long steel scale 1

ii. 1200x900 size 40mm thick commercial ply board 1

iii. Sharp knives of different sizes 12

12. Tripods with chain pulley blocks 4

and any other equipment required for efficient execution of work within the stipulated period.

HVAC SERVICES

1. All equipment described hereafter shall be in accordance with the specifications.

2. All equipment shall be selected and installed for the lowest operating noise level.

3. Supply of various equipment shall include all expenses for correspondence with manufacturers, submission of shop drawings, documents and their approval by the Consulting Engineer/Project Managers, procurement of equipment, transportation, shipping, payment of all taxes and levies, storage, supply of equipment at the point of installation, furnishing all technical literature required, replacement of defective components and warranty obligations for the individual equipment.

4. Installation of various equipment shall include all material and labour associated with hoisting and lowering of equipment in position, insulation of the components and vibration isolation as required, grouting & anchoring or suspension arrangements and all incidentals associated with the installation as per the specifications and manufacturer's recommendation.

5. Vibration isolators as specified or as recommended by the manufacturer shall be installed with each component. Performance ratings, power consumption and sound power data for each component shall be verified at the time of testing and commissioning of the installation, against the data submitted with the tenders.

6.Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.

7.Testing and commissioning shall include furnishing all labour, materials, equipment, instruments and incidentals necessary for complete testing of each component as per the specifications & manufacturer's recommendations, submission of test results to the Consulting Engineer/Project Managers, obtaining their approval and submission of necessary completion documents & drawings.

8.All ducts shall be fabricated and installed conforming to the relevant Indian Standards, approved shop drawings and the specifications.

9.Duct installation shall include fabricating and installing the ducts, splitter dampers, turning vanes, distribution grids within the ducts in position extruded aluminium hardware fittings such as handles, thunder bolts, hinges, factory fabricated access door and providing , installing , MS hangers with dash

fasteners, foam rubber insertions, nuts, bolts and screws as required. Making all joints air tight using rubber insertions. Multi-louvered manually adjustable dampers shall be provided in various branch ducts as required or shown on drawings for proper balancing of air flow. All primer coated MS hangers, dampers, base frames etc. shall be painted with black enamel paint.

10.All registers and diffusers shall be provided with a soft continuous rubber gaskets between their periphery and the surface on which these have to be mounted.

11.MS registers and diffusers shall be given, at the factory, a rust resistant primer coat and enamel paint finish of approved colour. Aluminium grilles and diffusers shall be fabricated out of extruded aluminium sections.

12.After completion of the installation, the entire air distribution system shall be tested for leaks and balanced in accordance with the specifications.

13.Mode of Measurement

The mode of measurement for the various items, unless otherwise specified, shall be as follows:-

13.1 Ducting

Payment for ducting shall be made on the basis of the external surface area of the ducting including all material and labour for installed duct.

The rates per SqM/Sft of the external surface shall include MS angle iron/ GSS flanges, gaskets for joints, nuts & bolts , duct supports & hangers, vibration isolation pads or suspenders, dash fastners, inspection doors, dampers, turning vanes, major hardware such as thunder bolts, hinges, handles in extruded aluminium construction and any other item which will be required to complete the duct installation except external insulation and acoustic lining.

The external area shall be calculated by measuring the overall width and depth (including the corner joints) in the centre of the duct sections and overall length of each duct section from flange face incase of duct lengths with uniform cross section. Total area will be arrived at by adding up the areas of all duct sections.

In case of taper pieces average width and depth will be worked out as follows:

W1 = width of small cross section

W2 = width of large cross section

D1 = depth of small cross section

D2 = depth of large cross section

$$\text{Average width} = \frac{W1 + W2}{2}$$

$$\text{Average depth} = \frac{D1 + D2}{2}$$

2

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections fitted with angle iron flanges, otherwise at the bottom of the flange where flanges are of duct sheet.

For the circular pieces the diameter of the section mid-way between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface at the taper piece.

For the face length of taper piece shall be the mean of the lengths measured face to face from the centre of the width and depth of flanges.

Duct measurements for calculation of area shall be taken before application of insulation.

For the special pieces like bends, branches, and tees etc. same principle of area measurement as for linear lengths shall be adopted except for bends and elbows, the length of which shall be the average of the lengths of inner and outer periphery along with curvature or angle of the piece.

13.2 Duct Insulation

This item is provided separately for various thickness and shall be paid for on area basis of uninsulated duct. The area of the duct to be insulated shall be measured before application of insulation.

13.3 Grilles & Diffusers

All extruded aluminium grilles and diffusers shall be paid on the basis of actual measurement at site. Area of extruded aluminium diffusers shall be derived from neck size i.e. 225x225, 300x300, 375x375 & 450x450. However, payment of 600x600 diffusers shall be paid based on the actual diffuser size excluding flanges and not the neck size.

13.4 Refrigerant Piping

Refrigerant piping shall be measured on linear length basis including bends and fittings.

1. General

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

2. L.T. Electric Panel Boards

2.1 The main L.T. Panel board shall be extendible type on both sides, having in it all switches, starters & accessories and shall be completely factory prewired. It shall be suitable for voltage systems upto 500 volts, 3 phase, 50 Hz, 4 wire supply capable of functioning satisfactorily in temperatures of 450C and rupturing capacity not below 31 MVA at 415 Volts.

2.2 The boards shall be fabricated from 2.0 mm thick, cold rolled M.S. Sheets. The front opening door panels shall be from 2 mm thick, cold rolled M.S. Sheets. Suitable stiffners shall be used in fabricating the housing. All steel members shall first be degreased, then descaled using dilute sulphuric acid and a suitable phosphating process then the boards shall be given 2 coats of red oxide primer with powder coated finish in siemens grey colour. The switch board shall be dust proof and vermin proof. The panel shall generally conform to IS 8623 (full conformity not called for). It shall be flush in front and back. The panel shall have front and rear access.

2.3 Cable compartment of adequate size shall be provided in the main distribution board for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in cable compartment to support cables. All incoming and outgoing switch terminals shall be brought out to terminal blocks in cable compartments.

2.4 Items such as ammeters, switches etc. shall be located close to the corresponding switchgear and otherwise all items shall be arranged in a neat symmetrical pattern.

2.5 The doors of the switch compartments and cable access shall be hinged type and that of bus bars shall be fixed type.

2.6 The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.

2.7 All panel doors shall have synthetic rubber gaskets with good ageing, compression and resistance characteristics.

2.8 All the breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in OFF position.

2.9 Defeat arrangement shall be provided for deliberate inspection of switch/breaker without having to switch OFF the unit.

2.10 All the units pertaining to a motor shall be incorporated in one cabin i.e switch, starter, CTS ammeter, current operated MPRD-2 single phasing preventor, indicating lamps etc.

2.11 A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enamelled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.

2.12 Every starter/contactor etc. shall be controlled by an isolating device ofadequat rating as listed later.

2.13 A voltmeter and ammeter shall be provided to indicate incoming voltage and alongwith rotary phase selection switches.

2.14 Ammeters shall be provided for incoming current to all motors of 10 HP (7.5 KW) and higher ratings.

2.14.1 Ammeters for all the motors upto 50 HP (37.5 KW) shall be direct reading type.

2.14.2 Ammeters for motors of 50 HP (37.5 KW) and above shall be operated with a selector switch.

2.15 LED type indicating lamps in approved colours shall be provided for the 3 phases and for status of all controlled devices.

2.16 All the switchgear shall be earthed to the earth bus by the A.C./electrical contractor.

2.17 Earth shall be extended for each compartment to the door by means if a flexible, insulated copper conductor with crimped legs on either side.

2.17.1 Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.

2.17.2 Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.

2.18 Etched plastic name plates shall be provided for all the incoming, outgoing switchgears, ammeter, voltmeter etc.

2.19 All the control and auxiliary wiring shall be carried out with PVC insualated copper conductor of proper colour code.

2.20 The power wiring from the circuit/air breakers to the starters shall be carried out using colour coded, PVC insulated copper conductors crimped with lugs.

2.21 The out going wires of starters shall also be pvc insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.

Important Note:- all Panel fabrication drawings shall be got approved, before the start of the fabrication work.

6. Starters

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

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

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

6.1.3 Compressor motor : Above 300 HP (225 KW) Automatic Auto Transformers

(where specified)

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

6.1.5 All starters shall be provided with separate single phasing preventors.

6.2 Direct On-Line Starters

6.2.1 These starters shall have heavy duty air break contactors of suitable rating.

6.2.2 These starters shall be complete with adjustable overload relays on all three phases, single phase preventing device and under voltage release. The starters should be “hand reset” type.

6.2.3 The “No Volt Coil “ of these starters shall be 220 Volts + 10% - 15% (wide band type) whenever any controls on safety devices are connected in the starters circuits, otherwise standard 415 volts coils may be used. There shall be ON-OFF push button for each starter unless remote operation of the starter is required.

6.3 Automatic Star Delta Starters

These starters shall have heavy duty air break contactors of suitable ratings along with an adjustable timer to automatically switch the motor connections from star to delta connections.

6.3.2 Each starter shall be complete with adjustable overload relays on all three phases and under voltage release. The starters should be “hand reset” type.

6.3.3 The “No Volt Coil” shall be of 220 Volts + 10% - 15% (wide band type) rating wherever any controls of safety device are connected in the starter circuit, otherwise standing 415 volts coils may be used. There shall be ON-OFF push button for each starter unless remote operation of the starter is required.

6.4 Automatic Auto -Transformer Starter

6.4.1 These starters will be oil immersed, each one fixed on a separate panel.

6.4.2 Necessary devices shall be provided for the automatic tap setting of the starter.

6.4.3 The starter should have “No Volt Coil” wide band type circuit of 220 volts to be connected to control circuits.

6.4 The Motor starter shall be in accordance with IS 1882. The starter shall be totally enclosed metal clad, dust and vermin proof construction. The starter shall be of continuous rating.

6.5 Contactors shall have the number of poles as required for appropriate duty. The making capacity of the starters shall be suitable for AC 3 duty.

7. Panel Accessories

7.1 All Voltmeters and Ammeters as specified shall be square of 96 mm x 96 mm, flush mounting type.

7.2 The Indicating Lamps shall be of LED type with Low Watt Power. The Lamps shall have translucent covers of following colours.

7.2.1 Red/Yellow/Blue for phase light.

Green/Amber for ON/OFF indication.

7.2.3 Concealed door lock.

8. Subsidiary Panels (With Single Switch)

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

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

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

8.4 Panel fabrication drawings shall be got approved before fabrication.

9. Squirrel Cage Motors

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

9.2 The stator windings shall be with class ‘B’ insulation.

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

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

10. Installation of Motor

10.1 Installation of the motor shall be in accordance with IS-900.

10.2 The motor along with its driven machine or equipment shall be provided with vibration isolation arrangement motors shall generally be provided with slide rails fixed to the base units nuts and bolts to facilitate belt installation and subsequent belt tension.

10.3 Motors shall be wired as per the detailed specifications and drawings all the motor frame shall be earthed with 2 Nos. of earthing conductors.

10.4 Motors shall be tested at works in accordance with the relevant Indian standard specifications and test certificates shall be furnished in triplicate.

Note: Rubber mats of 1100 volts capacity shall be laid in front of panel as per site requirement and no extra shall be paid.

11. Painting

All sheet steel work shall undergo a multi tank process of degreasing, pickling in acid, cold rinsing, phosphating, passivating and then sprayed with a high corrosion resistant primer. The primer shall be baked in oven. The finishing treatment shall be by application of powder coated paint of approved shade and stoved.

Section 10

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, and 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, stiffners and hangers.

Option 1

2. Pre-insulated Ducting

2.1 Duct shall be fabricated from insulation boards faced with aluminum foil on both sides. The board shall be free of any CFC and HCFC material.For all internal ducts within the building and shafts, the board's thickness shall be 20mm with 45kg/m³density. The thermal conductivity shall be 0.020 W/m K. The aluminum foil shall have minimum thickness of 80μ with embossed finish both side. The fire and smoke classification shall comply with Class O BS 476 part 6.7 and Class A ASTM E 84.

2.2 For all external or exposed ducts outside the building, the board's thickness shall be 30mm with 50 kg/m³density. The thermal conductivity shall be 0.020 W/mK. The aluminum foil shall have minimum thickness of 200μ with embossed finish. from outer side and 80 μ from other side with embossed finish. The fire and smoke classification shall comply to Class O BS 476 part 6.7 and Class A ASTM E 84.

Water absorption shall be less than 0.5% by 24 hours immersion test.

Water vapour diffusion: M= infinity resistance. The aluminium foil covering the panel to be maintained intact after installation to ensure vapour barrier continuity.

2.3 The duct shall be coated with necessary epoxy to provide weather resisting capability. The vendor shall show the client and consultant the installed external duct that has completed minimum 5 years to assess the actual performance of these panels in outdoor condition The panel shall be tested and comply with the following standards:

NFPA 101 Life Safety Code Class 'A'

ASTM E84 Class "1"

NFPA 255

UL 723

Toxicity Index shall not exceed 5.7 according to NES 713

Class 'O' according to BS 476 Part 6 & 7

Temperature Range:

No relevant reduction of insulation, chemical or physical characteristics of the panels to be measurable, when conveying air in the temperature range of –35 deg C to +110 deg C.

Pressure Range:

No relevant modification of insulation, chemical or physical characteristics of the panels to be measurable, when conveying air up to the pressure of 1,750 Pascal. Installation shall be supervised & certified by the manufacturer's representative. Minimum 5-years warranty is required for the insulation material characteristics.

Joint System:

The joints between the ducts shall be using tiger connectors or male – female connection system for small sizes up to 500mm and for bigger sizes more than 500mm aluminum / polymer invisible flanges and slide-in-channel to be used and to be connected by special cover corners, having a holding pin, which goes inside the flange and the insulation, to avoid any field connection and to give the system more strength. Ductwork shall be installed, using supports, as described in DW144 & according to manufacturer's requirements. Maximum distance between supports shall not exceed:

- 3000mm for ducts with section not exceeding 1200 x 1000mm.

- 2000mm for ducts with section exceeding 1200 x 1000mm.

The boards shall be either PIR (Poly isocyanurate foam panel) or PUR (Polyurethane foam panel). Quote for both types as explained in BOQ.

The panel accessories shall be used as recommended and supplied by the board manufacturers. Non locally purchased materials will be allowed. The fabrication of ducts shall be executed exactly as per panel manufacturer instructions using the same manufacturers duct accessories.

The silicon sealant shall be applied for all longitudinal joints. The flange joint shall be with aluminum invisible profile.

The vendor shall ensure to fabricate and install the duct to meet LEED requirements and submit necessary certificates required by LEED consultant. The duct system shall be IGBC or USGBC approved

Option 2 (Wherever Applicable)

2. Manual Fabricated Duct Work

2.1 The ducts shall be fabricated from galvanized steel sheets class VIII 120gr/Sqm conforming to ISS:277-1962 (revised) or aluminium sheets conforming to ISS:737-1955 (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 :-

	Size of Duct	Sheet Thickness	Fastner Size	Type of Joints	Bracing if any	Support Angle
2.2.1	Upto 750 mm	0.63 mm	3/8"	G.I. Flange		40x40x3 mm

2.2.2	751 mm to	0.80 mm	3/8”	25x25x3 mm	25x25x3 mm at the rate of 1 M from joints	40x40x3 mm
	1000 mm			Angle iron frame with 8 mm dia nuts & bolts		
2.2.3	1001 mm to	0.80 mm	5/8”	40x40x5 mm	40x40x5 mm at the rate of 1 M from joints	40x40x5 mm
	1500 mm			Angle iron frame with 8 mm dia nuts & bolts		
2.2.4	1501 mm to	1.00 mm	5/8”	50x50x5 mm	40x40x5 mm at the rate of 1.2 M to be Braced from joints.	40x40x6 mm
	2250 mm			Angle iron frame with 10 mm dia nuts & bolts at 125 mm centre.		angle
2.2.5	2251 mm and	1.25 mm	5/8”	50x50x6 mm	40x40x5 mm at the rate of 1.2 M from joints	50x50x6 mm
	above			Angle iron frame with 10 mm dia nuts & bolts at 125 mm centre.		With MS rods
						of 12 mm dia.

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

2.4 Ducts larger than 600 MM shall be cross broken, duct sections upto 1200 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 10 MM (3/8")DIA with M.S. Angle at the bottom. The rods shall be anchored to R.C. Slab using metallic expansion fasteners.

3. Factory Fabricated Duct Work

3.1 Material

All ducting shall be fabricated of LFQ (Lock Forming Quality) grade prime G.I. raw material furnished with accompanying Mill test Certificates. Galvanizing shall be of 120gms/sq.m. (total coating on both sides).

In addition, if deemed necessary, samples of raw material, selected at random by owner's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.

The G.I. raw material should be used in coil-form (instead of sheets) so as to limit the longitudinal joints at the edges only, irrespective of cross-section dimensions.

3.2 Governing Standards

3.2.1 Unless otherwise specified here, the construction, erection, testing and performanceof the ducting system shall conform to the SMACNA-1995 standards ("HVAC Duct Construction Standards-Metal and Flexible-Second Edition-1995" SMACNA)

3.3 Duct Connectors and Accessories

3.3.1 All transverse duct connectors (flanges/cleats) and accessories/related hardware such as support system shall be zinc-coated (galvanized).

3.4 Fabrication Standards

All ductwork including straight sections, tapers, elbows, branches, show pieces, collars, terminal boxes and other transformation pieces must be Rolastar, Ducto-Fab ,Zeco Equivalency will require fabrication by utilizing the following machines and processes to provide the requisite quality of ducts and speed of supply.

Coil lines to ensure location of longitudinal seams at corners/folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along any side of the duct.

All ducts, transformation pieces and fittings shall be made on CNC profile cutters for required accuracy of dimensions, location and dimensions of notches at the folding lines.

All edges shall be machine treated using lock-formers and roller for furning up edges.

Sealant dispensing equipment shall be used for applying built-in sealant in Pittsburgh lock where sealing of longitudinal joints are specified.

Selection of G.I. Gauge and Transverse Connectors

3.5.1 Duct Construction shall be in compliance with 1" (250 Pa)w.g. static norms as per SMACNA.

All transverse connectors shall be the Rolamate 4-bolt slip-on flange system,Techno Fab, Ducto-Fab &Zeco imported makes of similar 4-bolt systems with built-in sealant, if any. To avoid any leakage additional sealant shall be used.

The specific class of transverse connector and duct gauge for a given duct dimensions shall be 1"(250 Pa) pressure class.

Non-toxic, AC-applications grade P.E. or PVC gasketing shall be provided between all mating flanged joints. GaSket sizes shall conform to flange manufacturer's specification.

Duct Construction

3.6.1 Factory Fabricated ducts shall have the thickness of the sheet as follows :

	Size of Duct	Sheet Thickness	Fastner Size	Type of Joints		Bracing with GI tie rods of following sizes	Support Angle
				For Rolastar, Zeco duct and flanges	For Techno Fabriduct&Ducto-Fab flanges		
i	Upto 750 mm	0.63 mm	3/8"	Fabricated out of G.I. sheet of 24 gauge at every 1.2 m internal.	The flanges shall be made out of the same duct sheet and all the four corner shall be fitted for fitting the bolt	Cross tie rods to be fitted with at least 10 mm dia threaded G.I. as per SMACNA rod for each piece of duct	25x25x3 mm
ii	751 mm to 1000 mm	0.80 mm	3/8"	E-24 type flange, shall be fabricated out of 24 G sheet at every 1.2 m internal.			25x25x3 mm
iii	1001 mm to 1500 mm	0.80 mm	5/8"	E-22 type flange, shall be fabricated out of 22 G sheet at every 1.2 m internal.			40x40x5 mm
iv	1501 mm to 2250 mm	1.00 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m internal.			40x40x6 mm

v	2251 mm and above	1.25 mm	5/8”	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m internal.			50x50x6 mm with MS rods of 12 mm dia.

3.6.2 The fabricated duct dimensions shall be as per approved drawings and all connecting sections shall be dimensionally matched to avoid any gaps.

Dimensional Tolerances : All fabricated dimensions shall be within ± 1.0 mm of specified dimension. To obtain required perpendicularity , permissible diagonal tolerances shall be ± 1.0 mm per metre.

Each duct pieces shall be identified by color coded sticker which shall indicate specific part numbers, job name, drawing number, duct sizes and gauge.

Ducts shall be straight and smooth on the inside. Longitudinal seams shall be airtight and at corners only, which shall be either Pittsburgh or Snap Button Punch as per SMACNA practice, to ensure air tightness.

Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Turning vanes or air splitters shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

Plenums shall be shop/factory fabricated panel type and assembled at site.

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

3.6.9 Ducts larger than 600 MM shall be cross broken, duct sections upto 1200 MM length may be used with bracing angles omitted.

3.6.10 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.

3.7 Documentation to Measurements

3.7.1 For each drawing, all supply of ductwork must be accompanied by computer-generated detailed bill of material Indicating all relevant duct sizes, dimensions and quantities. In addition, summary sheets are also to be provided showing duct areas by gauge and duct size range as applicable.

Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

All duct pieces shall have a part number, corresponding to the serial number assigned to it in the measurement sheet. The above system shall ensure speedy and proper site measurement, verification and approvals.

3.8 Testing

3.8.1 After duct installation, a part of duct section (approximately 5% of total ductwork) may be selected at random and tested for leakage. The procedure for leak testing should be followed as per SMACNA- “HVAC Air Duct Leakage Test Manual: (First Edition).

4. Installations

4.1 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.

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

4.3 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 air tight and shall be made in the direction of air flow.

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

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.

4.5 The duct work shall be varied in shape and position to fit actual conditions at building site. All changes shall be subjected to the approval of the Engineer-In-Charge. The contractor shall verify all measurements at site and shall notify the Engineer-In-Charge of any difficulty in carrying out his work before fabrication.

4.6 Sponge rubber or approved equal gaskets of 6 MM maximum thickness 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 wooden member anchored to the building structure with anchor bolts and with the sheet screwed to them.

4.7 Flanges bracings and supports are to be black, mild steel and are to be painted with rust proof primer on all surfaces before erection. 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.

4.8 Joints, seams, sleeves, splitters, branches, takeoffs and supports are to be as per duct details as specified, or as decided by Engineer-In-Charge.

4.9 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 jointing material must have a finish such as cadmium plating or Galvanized as appropriate.

4.10 Fire retarding 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 clip band 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.

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

4.12 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.

4.13 Duct passing through brick or masonary, wooden frame work shall be provided within the opening. Crossing duct shall have heavy flanges, collars on each side of wooden frame to make the duct leak proof.

5. Dampers

5.1 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 the gauge of the large duct and shall be rigid in construction.

5.2 The volume dampers shall be of an approved type, lever operated and completed with locking devices which will permit the dampers to be adjusted and locked in any positions and clearly indicating the damper position.

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 interfere with the operation of dampers, nor cause any turbulence.

5.4 Automatic and manual volume opposed blade dampers shall be completed with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.6 MM GI sheets 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.

5.5 Wherever require for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.

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

5.7 Automatic fire dampers shall be provided wherever shown on the drawings. The damper shall be multi blade louver type. The blades should remain in the air stream in open position and shall be constructed with minimum 1.8 MM thick galvanised sheets. The frame shall be of 1.6 MM thickness. Other materials shall include locking device, motorized actuator, control panel to trip AHU motor etc.

The fire dampers shall be capable of operating automatically on receiving signal from a fire alarm panel. All control wiring shall be provided between fire damper and electric panel.

6. Access panel

6.1 A hinged and gasketed access panel measuring at least 450 MM x 450 MM shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

7. Miscellaneous

7.1 All duct work joints are to be true right angle and with all sharp edges removed.

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

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.

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

7.5 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.

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

7.7 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the Engineer-In-Charge, at no extra cost.

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

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

7.10 All the flanged joints, to have a sponge rubber packing stuck to the flanges with suitable adhesive.

7.11 The G.I. ducts should be lapped 6 MM across the flanges.

7.12 The ducts should be supported by approved type supports at a distance not exceeding 2.0 Metres.

8. Factory Fabricated Plenum for D.G. Air washer (Wherever Required)

The D.G. supply air blowers shall be installed in a G.I. sheet steel fabricated panel of section not exceeding available space complete with structural support, fan mounting frame work inspection doors etc.

The plenum would be made up from 50 mm x 50mmx 6 mm angle iron frame with bracings & supports, bracing shall be of 50x50x6 mm M.S. angle and support shall be of MS channel min. 100x50x6mm.

The plenum frame shall be covered with 16 gauge G.I. sheet from inside and bolted /screwed to the outer angle iron frame casing with 3 mm thick synthetic rubber gasket between them. It would

acoustically lined from inside with 25 mm thick cross linked polyethylene sheet having K valve of not less than 0.035 Kcal./M.hr °C and density net less than 25 Kg./m3.

The lining material should be fire retardant type.

The plenum sheet should be provided with stiffeners of iron angle at a spacing of not more than 1m from outside and be properly welded to the main outer frame. The stiffener should be place such a way so as to provide, space for grilles.

The plenum should have proper provisions for hanging to the R.C.C. slab above using M.S. angle cleats.

All M.S. parts will be coated with 2 coats of led oxide primer and 2 coats of synthetic enamel paint. All G.I. panel will be provided with 2 coats & synthetic enamel paints from outside.

The whole plenum shall be structurally rigid and vibration free, in case extra supports are required the contractors shall provide these at no extra cost.

9. Standard Grilles

9.1 The supply and return air grilles shall be fabricated from extruded aluminium sections. The supply air grilles shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall of aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers. The grilles may or may not be with an outer frame.

9.2 The damper blades shall also be of extruded aluminium sections. The grill flange shall be fabricated out of aluminium extruded section. Grilles longer than 450 MM shall have intermediate supports for the horizontal louvers.

10. Diffusers

10.1 The ceiling type square diffusers shall be of aluminium extruded sections with flush or step down face, as specified with fixed pattern and neck.

10.2 All supply diffusers shall be provided with extruded aluminium dampers, with arrangement for adjustment from the bottom.

10.3 The slot diffusers shall be of aluminium extruded sections with diffusion plate and sliding damper.

11. Linear Diffusers/Grilles

11.1 The linear diffusers/grilles shall be fabricated from Aluminium extruded sections.

11.2 The diffusion blades shall be extruded, flush mounted type with single or double direction air flow.

11.3 The frame shall be of aluminium extruded section and shall hold the louvers tightly in fixed position.

The dampers as described under grilles shall be provided wherever specified.

12. Laminar Flow Diffusers

12.1 The laminar flow diffusers shall be fabricated from aluminium sheets and shall include s upply plenum, perforated face, and deflector plate and air inlet collar.

12.2 The diffusion face shall be fabricated from aluminium sheet of 1.25 mm thickness double folded at the edges and pressed with mechanical perforations (min. 60% free area) of suitable size and at suitable spacing to provide the rated air quantity. The face plate shall be hinged type with locking arrangement.

The supply air plenum shall be fabricated from 1.25 mm thick aluminium sheets with inlet collar and folded edges to support the hinged diffusion face.

12.4 A deflector plate of 1.25 mm aluminium sheet shall be provided between inlet collar and diffusion face and fixed with suitable supports.

12.5 The dampers shall be fabricated from extruded aluminium sections and shaped to form airtight joints. The damper shall be key operated from the face of the diffuser.

13. Exhaust Grilles

The exhaust grilles shall be fabricated from aluminium extruded sections.

13.2 The exhaust grilles shall be horizontal fixed bar grilles with 150 blade inclination.

14. Exhaust/Fresh Air Louvers

The louvers shall be fabricated from aluminium extruded sections.

The blades shall be extruded flush mounted type with single horizontal throw.

The frame shall be of aluminium extruded section and shall hold the louvers in fixed positions.

15. Therma-Fuser Type (VARIABLE AIR VOLUME DIFFUSER - Cooling & Heating with remote adjust option)

15.1 Thermally powered variable air volume modules shall be Therma-Fuser. Each module shall be a complete VAV terminal and thermostat self-contained in a nominal 2’ x 2’ diffuser. External wiring or pneumatics shall not be allowed.

15.2 The modules shall vary the supply air volume to provide both VAV heating and VAV cooling. They shall be thermally powered using two room temperature sensing thermostats and one changeover

thermostat. The room temperature settings for heating and cooling shall be separately adjustable in the field by separately adjusting each of the two room thermostats.

15.3 One room temperature sensing thermostat shall sense room temperature and vary the supply air when cooling. The other room temperature sensing thermostat shall sense room temperature and vary the supply air when heating and shall be biased to offset room temperature stratification.

15.4 Each room sensing thermostat shall have a micrometer type temperature set point adjustment with an indicator that moves along a 70°F/21°C to 78°F/26°C temperature scale. Initial set point shall be factory set at 74°F/23°C.

15.5 The changeover thermostat shall be factory installed and adjusted to engage the heating mode when the supply air temperature rises above 80°F/27°C and return to the cooling mode when the supply air temperature falls below 68°F/20°C. The changeover mechanism shall not extend above the neck of the diffuser.

15.6 Each unit shall have four perimeter dampers to provide 66 linear inches of variable discharge area at the perimeter of the diffuser for maximum Coanda effect and to avoid dumping. Each module shall be factory tested.

15.7 The manufacturer shall warrant that the module shall be free from defects in materials and workmanship for a period of ten years from date of shipment.

15.8 Each module shall have a hinged appearance panel that can be unlatched and folded down to hang allowing hands to be free for adjusting temperature set points. Instructions for the module shall be on the inside of the appearance panel.

15.9 The remote adjust unit shall be capable of adjusting the control level of one master and up to four secondary diffusers. The remote adjust unit shall be suitable for mounting directly onto the wall or onto a standard 2"x4" electrical box . Two push buttons on the unit shall allow adjustment of the room temperature control level set point between 68°F/20°C and 76°F/24°C. Display shall be digital with ‘warmer/cooler‘ indicators and optional numeric set point readout.

15.10 A protocol independent analog 0-2 VDC signal shall be available for both input and output to a building management system.

15.11 The digital wall adjuster unit shall be supplied with 24 VAC ±2 VAC power. Wiring between the master diffuser and the digital wall unit shall be supplied by Acutherm. All other wiring including power wiring to the 24 volt transformer, the 24 volt transformer, wiring from the transformer to the master diffuser, wiring from the master diffuser to the building management system (BMS), and wiring between the master diffuser and any secondary diffuser(s) shall be furnished and installed.

16. Painting and Vision Barrier

16.1 All grilles, and diffusers shall be powder coated, before installation, in approved colour.

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

16.3 The return air and dummy portion of all linear grilles shall be provided with a vision barrier made of 24 gauge galvanized sheets. The vision barrier shall be fixed to the false ceiling frame with self tapping screws and shall be given two coats of black paint in matt finish. Care shall be taken to ensure that the return air path is not obstructed.

17. Testing

17.1 After completion, all duct system shall be tested for air leakage.

17.2 The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final tabulation of air quantity through each outlet shall be submitted to the Engineer-In-Charge for approval.

Section 11 Pipe Work

1. General

All piping work shall conform to quality standards and shall be carried out as per specifications and details given hereunder & shall follow the applicable on relevant Indian standards.

2. Pipes

2.1 All pipes shall be M.S. E.R.W tube (black steel) medium class as per I.S. 1239-79, Part-I with amendment-I of January '81.

3. Fittings

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

3.2 All bends in sizes upto and including 150 MM dia. shall be readymade 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 Butt 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 insertion of rubber gasket 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 stiffners from 50 mm x 50 mm M.S. Heavy angles, for sizes upto 350 MM dia. All ends larger than 400 MM dia. shall have dished ends.

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 as per BS10.

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

4.3 Flanges shall be used as follows :-

4.3.1 Counter flanges for equipment having flanged connections.

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

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

5. Valves

5.1 Butterfly Valves

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

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

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

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

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

5.1.6 All valves 200mm Dia. and above shall be gear operated.

5.1.7 The valve should be suitable for 12 Kg/cm2 working pressure.

6. Ball Valves

6.1 All Valves 40 mm Dia. and below shall be of Gun Metal Ball type Valves with (FPT) female threads conforming to class 2 of IS 778 and mating flanges fitting.

6.2 All Ball valves shall be ISI Marked.

7 Balancing Valves

7.1 The balancing valves upto 80 mm Dia. shall be of gunmetal screwed type conforming to BS 5154 or equivalent specifications.

The valve shall be cast gunmetal ASTM B-62 and complete with non rising spindle. PTFE disc seal cast metal hand wheel.

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

The valve shall be completed with two ports for connections to a mercury manometer, to measure the pressure drop, as well as a drain port.

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

This valve shall be used wherever specified.

8. Duel Plate Check Valves

The body of the check valve shall be made from a single piece casting in cylindrical shape

There shall be two plates, which shall be hinged in the centre of the circle. Both plates shall be have springs attached to them for assisting in closing action of the valve.

8.3 There shall be properly/designed metal to metal seal between the plates and the outer body, to ensure non leaking sealing.

The valve design shall confirm to API 594 or equivalent specifications.

9. Automatic/Dynamic Balancing Valve.

9.1 Automatic Dynamic Balancing Valve shall be of forged brass (upto 40mm dia.) grey iron (above 40mm dia.) construction of 1350K Pa pressure and 120°C temperature rating. The valves shall have precision calibrated, stainless steel to achieve the desired/pre-fixed flow rates irrespective of the pressure fluctuations in the water lines within a range of 10-210 K. Pa. The flow rate within a tolerance of ± 5% will be achieved by automatic adjustment of the open orifice area in response to the pressure differential changes. The end connection upto 80mm dia. should be threaded and for above 80mm dia. it should be flanged.

10. Strainers

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.

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

Pot strainers shall be provided with flanged connections and 'Y' strainers shall be provided with flanged ends.

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

11. Other Valves

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

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

12. 'V' Form Thermometers (Industrial Type)

The body shall be of aluminium alloy with anodized gold colored surface. The casing shall be adjustable side ways for reading from the front. The glass capillary shall be triangular in shape with the blue mercury filled in glass. Scale of reading shall be of the range 00C to 500C/320F to 1200F.

Thermometer shall be suitable for 12 mm connections with long stem, so that thermometer is removable without damaging the insulation. M.S. socket to be welded on pipes shall be provided with thermometer.

13. Jointing

13.1 All pipe lines shall be welded type.

13.2 Square cut plain ends will be welded for pipes upto and including 100 MM Dia.

13.3 All pipes 125 MM Dia. or larger will be bevelled by 35 DEG. before welding.

14. Pipe Supports/Hangers

14.1 Pipe supports shall be provided and installed for all piping 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.

14.2 All vertical pipe support shall be made of 10mm M.S. Rods and the horizontal support shall be of M.S. angles of 50x50x4 mm thick.

14.3 Pipe supports shall be adjustable for height and prime coated with rust preventive paint &finish coated with black paint using approved grade of paint.

The spacing of pipe supports shall not be more than that specified below :-

Nominal pipe size MM	Spacing (Metres)
15	1.25
20 & 25	2.00
32,40,50 & 65	2.50
80,100 & 125	2.50
150 &Above	3.00

14.4 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 wall and ceiling by means of approved metallic dash fasteners.

14.5 Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation, cause condensation. The pipe supports or Saddles shall be of PUF, factory fabricated to suit pipe sizes.

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

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

14.8 Mechanical equipment shall be suspended midway between steel joints and panel points.

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

14.10 Contractor shall make shop drawing for fixing of support for approval.

15. Miscellaneous

15.1 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.

15.2 Provide valves 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.

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

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

15.5 To facilitate the maintenance, repair and replacement:

15.5.1 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.

15.5.2 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.

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

15.5.4 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 CM. 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 CM. 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.

16. Sleeves

16.1 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.

16.2 Where pipes pass through outside walls or foundations, the space between pipe and sleeve shall be filled with rock wool covered with GI sheet.

16.3 The centre of pipes shall be in the centre of sleeves, and sleeves shall be flushed with the finished surface.

17. Arrangement and alignment of piping

17.1 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.

17.2 The piping shall be installed in a uniform manner, parallel 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.

17.3 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.

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

17.5 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.

17.6 Anchors and supports shall be provided wherever necessary to prevent any misalignment of piping.

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

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

18. Testing

18.1 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.

18.2 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 blankoffs or flanges.

18.3 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.

18.4 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/cm2 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.

18.5 All the piping systems shall be tested in the presence of the Engineer-In-Charge or their authorized 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 hinderance in the work of the insulation contractor.

18.6 Miscellaneous piping, tests with air at 10.5 kg/cm2 for a minimum of 24 hours without drop in pressure.

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

18.8 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.

19. Drain Piping

19.1 The drain piping shall be medium class galvanised steel as per IS 1239/1979.

19.2 The fittings shall be of 'R' brand/ "Unik"/Zeolite or equal forged with screwed connections.

19.3 The gate valves shall be of gun metal duly ISI marked on each valve.

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

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

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.

20. Painting

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

20.2 All pipes, which are not to be insulated, shall then be given two coat of finish paint, of a type and colour, as approved by the Engineer-In-Charge.

21. Vacuum Degasser

The vacuum degasser shall be of a solid and a robust construction. It should work on pressure differential deaeration principle. It shall be installed as a bypass to the main CHW line and shall be used for removal of dissolved gases from water to make the water absorptive in order to prevent corrosion as well as remove air locks from the most distant ends of the CHW pipeline, The Degasser shall be of Plug & play type & shall be of automatic operation. The degasser shall be capable of refilling the CHW pipeline with degassed water to compensate the volume of vented gases, The Degasser shall be able to switch itself off when the pipeline achieves desired Pressure & degassed levels of water. It should be with a Multi-stage Centrifugal pump. The Degasser shall be of Carbon Steel with a Brass Automatic Airvent. It should degas the volume from 150 to 300m3 holding capacity.

22. Dirt Separator

The Dirt separator shall be of a solid and robust construction (Mild Steel). It shall be able to remove solid particles upto 5 microns from water at Velocity between 2-3m/s. Removal of dirt shall be through coalescence. All connections, fittings and heads shall be of carbon steel. The medium used to de-aerate and remove dirt shall be manufactured of Steel Tube & a mesh made of copper wire. This medium should be non clogging in nature. The flow should not be obstructed by the dirt collected. A Drain valve should be present at the bottom to remove the accumulated dirt without the need of shutting down the operation of the system. The Dirt Separator shall be insulated depending upon its location (outdoor or indoor). The pressure drop on account of the dirt separator shall not exceed 21 kPa at maximum flow of the chilled water system. The performance of the Dirt Separator shall be confirmed by TNO report.

Section 12 Insulation

1. General

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

2. Materials

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere. The detailed specifications of the materials are listed under respective sub heads.

2.1	Pipe Insulation	:	Glass Wool
2.3	Drain Pipe Insulation	:	Nitrile Insulation
2.4	Duct Insulation	:	Nitrile Insulation
2.5	Acoustic Treatment	:	Open Cell Nitrile
2.6	Equipment Insulation	:	Nitrile Insulation

3. Pipe Insulation

3.1 PIPING INSULATION:

Chilled water and drain piping shall be insulated with rigid Glass wool preformed pipe section. The insulation material shall be confirmed these specifications.

The Fiberglass wool insulating material shall be applied for Chilled Water pipes as under.

Rigid pre-formed molded sections of fiberglass wool having a uniform density of 80 Kg/m3. and thermal conductivity shall not be more than 0.030 W/mK at 25º C mean temperature. The material for piping insulation shall be factory laminated one side with Aluminum foil on the outside, and fused to the insulation material, as specified. The Aluminum foil shall extend by a minimum 50 mm on one side of the pipe section along the length to seal all longitudinal joints. Bonding of insulation material shall be with a cold setting compound. Adhesive used for setting the insulation shall be non-flammable, vapour proof adhesive. The thickness of insulation material shall be selected with diameter of pipe as below. The piping insulaton shall be covered with Star Bond 30-36 thermal insulation protective coating of Cischem, pidilitepolytreat chemicals make or similar to that complete with type 3, grade I roofing felt strip (as per IS:1322 as amended upto date) at the joints repairing of damage to building etc.

Pipe Dia (MM)	Thickness (NB)
20 -100	25
100-150	40
150-250	50
300 -450	65
450 & above	75

METHOD OF INSULATION APPLICATION:

Pipes shall be thoroughly cleaned with wire brush and rendered free from all foreign matter and grease and primer coated as in item piping.

The pipe should be inspected and all joints should be sealed against leakages.

Two coats of rubber based adhesive CPRX compound manufactured by M/s. Shalimar Tar products shall be applied on the cleaned pipe surface.

Fiberglass wool rigid sections shall be fixed tightly to the surface. All joints to be sealed properly. Fixing and sealing compound shall be CPRX. All joints of Aluminum foil shall be sealed properly by means of 75 mm wide self adhesive aluminium tape of approved make.

Wrap 500 gauge polythene sheet secured with 18 SWG G.I. wire.

Fix 24gauges X 12mm hexagonal G.I.mesh and chicken wire mesh tightly over insulation.

Apply total 12mm thick sand cement plaster with in 4:1 ratio in two layers each of 6mm thick.

Pipes finally shall be provided with two coats of enamel paint of approved make.

A SCOPE

The scope of this section comprises the supply and application of insulation conforming to these specifications. The insulation material shall be Closed Cell Elastomeric Nitrile Rubber Foam Insulation.

B MATERIAL

Thermal insulation material for Duct & Pipe insulation shall be Closed Cell Nitrile Rubber insulation. Thermal conductivity as per DIN EN 12667 / EN ISO8497 of the insulation material shall not exceed 0.038 W/moKor 0.212 BTU / (Hr-ft2-oF/inch) at an average temperature of 30oC. Density of the nitrile rubber shall be 40-60 Kg/m3, Theproduct shall have temperature range of -400C to +1050C as per EN 14706, EN 14707 and EN 14304. The insulation material shall be fire rated for Class 0 as per BS 476 Part 6 : 1989 for fire propagation test and for Class 1 as per BS 476 Part 7, 1987 for surface spread of flame test. The material also pass UL 94 Test for Vertical Burning and Horizontal Burning and FM Approved. Water vapour permeability shall be not less than 0.024 per inch (2.48 x 10-13 Kg/m.s.Pa i.e. μ>7000: Water vapour diffusion resistance) as per EN 12086 & EN13469.

For Ducting, the Nitrile Rubber insulation shall be with factory laminated with chemically treated glass cloth of 7mill /0.18mm thickness (in Green Color for Supply Air Ducts and Red Color for Return Air Ducts) and tested for UV Resistance as per EN ISO 4892-2 Method A. The joints shall be properly sealed with self-adhesive nitrile rubber tapes of 3mm with factory laminated chemically treated glass cloth of matching color as the duct insulation.

For Exposed Ducting, the above Nitrile Rubber insulation shall be additionally cladded with non-metallic composite cladding of minimum 230 micron thickness of metallic appearance with aluminum as an intermediate layer and tested for UV resistance as per EN ISO 4892-2 Method A.

For Chilled Water / Hot Water / Drain piping insulation, nitrile rubber insulation shall factory laminated with 3-layered non-metallic composite cladding of minimum 230 micron thickness of metallic appearance with aluminum as an intermediate layer and tested for UV resistance as per EN ISO 4892-2 Method A. The joints shall be sealed with 30mm self-adhesive silver tapes.

The material shall comply to CFC / HCFC free material as per US EPA 5021A-2003. The material shall be Lead, mercury and asbestos free and should have zero Global Warming Potential and Ozone depleting Potential.

Insulation shall be in tube form for pipe nbdiaupto 100mm and above 100mm sheets shall be used for piping.

Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer’s certificate of compliance on the insulation properties as specified. Samples of insulation material from each lot delivered at site may be selected by Owner’s site representative and got tested for thermal conductivity and density at Contractor’s cost. Adhesive used for sealing the insulation shall be rubber based contact adhesive in a blend of solvents free from benzene, non-flammable and with low VOC content (maximum 850 gm/l as per IGBC guide lines) strictly as per manufacturer’s recommendations separately for pipes and duct application.

C DUCT INSULATION

External thermal insulation shall be provided as follows :

The thickness of insulation material shall be as shown on drawings or identified in the schedule of quantity. Following procedure shall be adhered to:

Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell insulation to size with sufficient allowance in dimension. Cutting of insulation sheets shall be done with adjustable blade to make 900cut in thickness of sheet. Hackshaw or blades are not acceptable tools for cutting the insulation.

Material shall be fitted under compression and no stretching of material shall be permitted. All longitudinal and transverse joints shall be sealed by providing 50 mm wide Self Adhesive aluminum tapes / silver tapes as per the insulation material finish as per manufacturer recommendations. The insulation installers shall be certified by manufacture.

Direct contact between Duct and hanger shall be avoided. Hangers shall pass outside the Duct Support. Insulation Manufacturer shall supply duct supports having PET foam as load taking member embedded in flexible elastomeric foam nitrile rubber sheet with outer metal face having aluminium metal) so that the insulation material is joint with insulation material on both side of pipe support for Nitrile and the weight of pipe is transferred to the PET saddle.

D DUCT ACOUSTIC LINING

Open Cell Nitrile Rubber

Duct acoustic lining material shall be Nitrile Rubber open cell foam. Thermal conductivity of the insulation material shall not exceed 0.047 W/moK at an average temperature of 20oC. Density of the nitrile rubber shall be 140 – 180 Kg/m3. The material should withstand maximum surface temperature of +85oC and minimum surface temperature of -20oC. The material should conform to Class 1 rating for surface spread of Flame in accordance to BS 476 Part 7 & HBF, HF 1 & HF 2 in accordance to UL 94, 1996.

Insulation should have antimicrobial product protection, and should pass Fungi Resistance as per DIN EN ISO 846 Method A for fungal resistance and Method C for bacteria resistance.

The insulation should pass Air Erosion Resistance Test in accordance to ASTM Standard C 1071-05 (section 12.7).

Thickness of the material shall be 15 mm thick specified for the individual application and with noise absorption proprieties (NRC ≥ 0.55 for 15mm Thick) as per IS: 8225 / ISO 354 / ASTM423C. The insulation should be installed as per manufacturer’s recommendation.

E ACOUSTIC LINING OF MECHANICAL ROOMS

Open Cell Nitrile Rubber

Two walls and ceiling of air conditioning plant room and air handling unit / fan rooms may be provided with acoustic lining. Material shall be processed from Nitrile rubber open cell foam.

The material should be fibre free. The density of the same shall be 140-180 Kg/m3. The material should have thermal conductivity not exceeding 0.047 W/Mk at an average temperature of 200C. The maximum surface temperature of material shall withstand is 850C. and minimum temp shall be -200C. Thickness shall be as specified. The material should confirm to class 1 rating for surface spread of flame as per BS 476 Part 7 & HBF, HF1 & FH 2 in accordance with UL 94, 1996. Thickness, if not specified, shall be considered as 25mm specified for the individual application and with noise absorption proprieties (NRC ≥ 0.80 for 25mm Thickness) as per IS: 8225 / ISO 354 / ASTM423C.

Insulation should have antimicrobial product protection, and should pass Fungi Resistance as per DIN EN ISO 846 Method A for fungal resistance and Method C for bacteria resistance.

The insulation should pass Air Erosion Resistance Test in accordance to ASTM Standard C 1071-05 (section 12.7).

Surface shall be cleaned and two coats of adhesive recommended by the manufacturer should be applied on the walls. The foam sheets should be cut to required size and a layer of adhesive should also be applied to it. When it is tack dry it is stuck to the walls / ceiling.

All longitudinal and transfer joint shall be covered with 22 gauge 50 mm wide GI strip with screws..

Acoustic lining of walls shall be terminated approximately 15 cm above the finished floor to prevent damage to insulation due to accidental water-logging in plant/AHU / fan rooms.

F UNDER-DECK INSULATION:

The ceiling surface shall be cleaned with brush to remove all dirt, cement etc. If surface is uneven it should be made smooth prior to carrying out insulation work.

A layer of manufacturer’s recommended rubber based contact adhesive should be applied on the ceiling with the help of brush so that all the pores are filled and surface becomes smooth and allow it to dry.

Allow an additional 5 mm to the total dimensions while cutting Insulation sheet. Ensure you measure the cutting dimensions on the top surface of the insulation sheet. This can be identified by the products markings; “they are always on the top surface. This surface is the one you will see after installation.

All Insulation sheet and ceiling surfaces shall have all-over adhesive coverage. Adhesive should be applied on the side that has no product markings and identification printing. This side is the one that curves inwards.

1. General

The electric cable connections of motors and earthing of all equipments shall be carried out, as per specifications, given hereunder.

2. Cabling

2.1 The cabling of various equipment shall be carried using PVC Insulated and armoured cables.

2.2 The PVC armoured power cable for use on 415 volts system shall be 3 or 3.5 Core with aluminium conductors and be of 660/1100 volts grade, as per IS 1554 (Part I) 1964. The cross section of the cable shall be to suit the load and rating of the equipment. The cables shall be of aluminium conductor, PVC insulated, strip armoured with overall PVC sheathing.

2.2.1 The cables shall be laid as per IS-1255/1967, Indian standard code of practice.

2.2.2 The cables shall be laid, as per drawings in the ducts/pipes/trays etc. along a short and convenient route between switch board and the equipment, (either in trenches, on wall or on hangers, supported from the slab). Cable routing shall be checked at the site of work 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.

2.2.3 The radius of bends of the cable should not be less than 12 times the overall dia. of cable in order to prevent undue stress and damage at the bends, the cables should be supported with wooden cleats on M.S. Supports, when laid in trenches, or wall/ceiling suspended hangers. When laid under ground the cables should be covered with fine soft earth and protected with 2nd Class bricks. Suitable G.I. Pipe shall be used wherever cables are laid under the roads etc.

2.2.4 Wooden bushes shall be provided at the ends of pipes through which cables are connected through.

3. Surface Wiring

3.1 The surface wiring shall be cassed in conduits which shall be of 1100 volts grade and conform to IS 9587-1987 (revised to date)

The conduits used shall be of high quality &all joints shall be made with sockets. The bends and elbows shall have inspection covers fixed with grease free screws. The joints shall be water tight. Approved metal saddles shall be used to secure the exposed conduits at a space of 1 meter or less. The connection of the conduits to switches etc., shall be secured by check nuts and ebonite bushes provided at the ends of conduits.

3.1.2 The M.S. conduits shall be heavy duty and rigid type-ISI marked/conforming to IS specifications. The wall thickness shall not be less than 2 mm. For conduits above 32 mm dia. Metallic conduits of 19 mm dia. and below shall not be used. Conduit accessories (Boxes etc.) shall conform to IS-5133-1968 and IS-2667-64 (amended-revised to date). Conduit pipes shall be jointed, wherever necessary by means of screwed couples and screwed accessories only. In Long distance straight, run of conduits inspection type couplers at suitable intervals shall be provided.

3.1.3 Threads on conduit pipes shall be between 13 mm to 19 mm long.

3.1.4 The wiring shall be carried-out as per IS 732-1989 (Amended and revised to date).

3.2 Flush inspection covers shall be provided in case of Concealed, recessed conduits. The staples for the conduits shall not be spaced more than 0.60 meters apart. Before filling up the chase with concrete the conduits should be given a coat of rust proof paint.

3.3 The wires shall be drawn only after all the conduits have been properly fixed in position. Fish wires (steel wire : 16 SWG) shall be laid in conduits for drawing of wires subsequently.

4. Control Cabling/wiring

4.1 Control cables shall be1100 volts grade, as per IS 1554, made from copper conductor of 1.5 Sq mm PVC insulated single Core, strip armoured with an overall PVC sheathing.

4.2 The cables and conduits wiring shall be carried out as per details given under 2.2 and 2.3 above.

5. Earthing

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

Size of phase wire sq.mm Aluminium	Size of G.I. conductor Tape/Wire (Swg)
185	25 mm x 6 mm (strip)
150	25 mm x 6 mm (strip)
120	25 mm x 6 mm (strip)
95	4 Swg
70	4 Swg
50	6 Swg
35	6 Swg
25 to 6	6 Swg
4	6 Swg

Note :- Aluminium earthing conductors of equivalent Size may be used in lieu of GSS conductors mentioned above.

6. Miscellaneous

6.1 The final connections to the equipment shall be through Flexible connections in case of conduit wiring and also 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 conductors shall be Connected from the equipment upto the main switch board panel.

6.4 The branch lines from the main panel to each equipment shall be separated and should not criss cross other lines.

6.5 The entire installation shall be tested as per Electricity rules and I.S.S. 732-1973 with amendments 1,2&3 prior to the commissioning of the plant and a suitable test report furnished by a competent and authorised person. The test report will be obtain by contractor himself at his own expenses.

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

Section 14 Testing and Commissioning

1. General

1. 1 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 in addition to furnish necessary test certificates from manufacturers.

1.2 The system shall then be commissioned, tested and balanced to fulfill the intent and purpose for which it is designed.

1.3 In addition continuous Run Tests shall be carried out during peak weather condition.

2. Compressors Condensers/Chillers/Evaporators/Pumps etc.

2.1 Hydraulic test for various components and assembled equipments at 1.5 times design pressure or double the operating pressure, whichever is higher.

2.2 Pneumatic leak test after assemblies at design pressure

2.3 Static and dynamic balancing on electronic precision machine for rotating parts, links, impellor/ crank shaft assemblies etc.

2.4 Testing of oil passages in compressor at 1.5 times pump discharge pressure.

2.5 Pressure droptestfor condenser, chiller and evaporator.

2.6 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 Dynamic/static balancing of impellers.

3.1.2 Performance test as per applicable codes.

3.2 Coils

3.2.1 Pneumatic test.

3.3 Filters

3.3.1 Test of filter elements as per B.S. 2831 B.S. 1701 as applicable. This is to ascertain filtration efficiency by weight at inlet and outlet.

3.3.2 Manufacturer's test certificates also to be produced for the assembled A.H.U. Final dimensional check will be done. Inspection may be done during assembly of components for quality of workmanship, painting etc.

3.3 Piping

Materials check for specifications and size.

3.4 Valves

Hydraulic./pneumatic test certificates.

3.5 Motors

Manufacturer's test certificate as per motor data sheet.

3.6 Instruments and Controls

Visual examination.

3.7 Special Note

Vendor to note that above procedure is to be followed in addition to the specifications attached with the tender.

4. Associated 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 fittings used for the refrigerant and water and other services.

4.5 Pressure testing, leak testing of complete piping network for chilled water. (Condenser water and refrigerant/services).

4.6 Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of air conditioning plant.

4.7 Checking of calibration of controls and instrumentation

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

4.9 Inspection of complete electrical installation at site.

4.10 Performance testing of complete A.C. Plant as per specifications.

5. Vendor Responsibility

5.1 The above inspection procedure is given for general guidance and information of vendors.The inspection of purchaser/consultant is strictly not limited to these.

5.2 The 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 and when desired by inspection engineer.

5.3 Co-ordination of inspection agency of purchaser/consultant with his factory/subvendor's factory/erection site will be the sole responsibility of successful vendor, subsequent to 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 11 Kg/Cm2(150 PSI) or 1.5 times the design pressure which ever is more unless stated otherwise in the specifications. The prescribed pressure shall be maintained for eight hours. In case leaks are detected, the pressure test will be repeated, after the repair of the leaks.

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. Electrical Equipment

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

8.2 The following tests shall be carried out :

8.2.1 Cables and Wires continuity tests.

8.2.2 Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using a 500 Volts meggar. The meggar reading shall be not less than one megaohm.

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

8.2.4 Phasing out and phase rotation tests.

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

8.2.6 Operating tests on all starters, circuit breakers etc.

9. Plant Audit & Certification work (when given in BOQ)

9.1 The work of plant audit & certification shall be done by an approved outside agency. (Nirvay solutions / BTU Engineers)

9.2 The whole system balancing shall be tested with microprocessor based Hi-tech instruments with an accuracy of ± 0.5%.

9.3 The instrument shall be capable of storing data and then down loading into a PC. The agency shall provide a minimum but not limited to the following instruments.

9.3.1 Microprocessor based velocity calculation meter to measure DB and WB temperature, RH and dew point.

9.3.2 Velocicalc meter to measure air volume and air velocity.

9.3.3 Pitot tube.

9.3.4 Electronic Rotary Vane Anemometer.

9.3.5 Accubalance Flow Measuring Hood.

9.4 The outside agency shall analyse all the data and shall be responsible for the capacity and performance audit and certification of the plant.

9.5 The successful Bidder shall be responsible to provide necessary sockets and connections for fixing of the Testing Instruments, probes etc.

10. Commissioning of the System

The system shall be commissioned by adopting the following procedure.

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 Static pressure in each air duct.

10.1.3 Water flow passing through each condenser, chiller, AHU etc.

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

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

10.1.6 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. Air Balancing

11.1 All air handling/ ventilation equipments, duct work and outlets shall be adjusted and balanced to deliver the specified air quantities, at each inlet and outlet as indicated on the drawings.

11.2 If these air quantities cannot be delivered without exceeding the speed range of the pulley or the available horse power, the architect shall be notified, before proceeding with the balancing of air distribution system.

11.3 A proper record shall be maintained as per Test Proforma given else where.

12. Water Balancing

12.1 The output of water pumps shall be checked using the balancing valves, provided on the pumps, for this purpose, to ensure the output and pressures match the specified requirement.

12.2 Then flow to Condensers/Chillers, Air handling units etc. shall be individually adjusted and balanced to match the flow rate as given in specifications/drawings to meet the requirement.

12.3 The balancing valves, provided on the equipments, shall be used for adjustment.

13. Miscellaneous

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

13.2 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.

13.3 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.

13.4 Any damage resulting from the tests shall be repaired and/or damaged material replaced, to the satisfaction of the architect.

13.5 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 recommenced after the adjustment or repairs have been completed.

3.6 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.

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

13.8 The contractor may be required to repeat the test as required, should the Ambient conditions at the time, do not give, 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.

Section 15 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.

Storage all equipment apparatus and materials.

Insurance of all equipment during Transit, storage, installation and up until handing over to the owner.

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/Diffusersetc.

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 square metres. No extra shall be allowed for lapse and wastages.

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

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

2.2 Grilles/Diffusers

Grilles / Diffusers should be measured as follows :

2.2.1 All measurements of grilles/diffusers shall be of the actual outlet 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, Fabricateditems.

3.1 Pipe

(Including water piping, steam piping, oil piping, LP gas piping, air piping, vacuum piping) etc.

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 if 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 centerline of the pipe and all fittings (e.g. Tees, bends, reducers, elbows, hangers, structural supports 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. Rate quoted shall be inclusive of all supports, hangers etc. and no additional measurement would be taken.

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 2 Nos. of flanges and 2 Nos. 150 MM long M.S. 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 connection 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.

3.2.4 Rates shall be inclusive of insulation, if required.

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 centre line radius between tangent points. If the outer radius is R1 and the inner radius is R2. The centerline 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 as part of the larger size.

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.

4.5 Roof and Wall Insulation & Acoustic Treatment

4.5.1 The unit of measurement for all underdeck roof insulation, wall insulation, wall/roof acoustic panel shall be the uninsulated area of walls, roofs, to be treated, in square metres.

4.5.2 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 completion of the work.

1. IS 659 : (Reaffirmed 1991)

   Safety code for air-conditioning (revised) (Amendment 1).

2. IS 660 : (Reaffirmed 1991)

   Safety code of mechanical refrigeration. (revised).

3. IS 3233: 1965 (Reaffirmed 1992)

   Glossary of terms for safety and relief valves and their parts.

4. IS 12992: 1993, Part I, 1990 Part II

   Safety relief valves.

5. IS 954: 1989

   Functional requirements for carbon dioxide tender for fire brigade use. (2nd revision)

6. IS 1641: 1988 (reaffirmed 1993)

Code of practice for fire safety of buildings (general) : General principles of fire grading and classification. (1st revision)

7. IS 1642 : 1989

Code of practice for fire safety of buildings. (general) : Details of construction (1st revision) (1645 supersedes 1642)

8. IS 1643: 1988 (Reaffirmed 1993)

   Code of practice for fire safety of buildings (general : Exposure hazard (1st revision)

9. IS 1644: 1998 (Reaffirmed 1993)

Code of practice for fire safety of buildings (general) : Requirements and personal hazard.

10. IS 1646: 1982 (Reaffirmed 1990)

    Code of practice for fire safety of buildings (general) : Electrical installation (1st revision)

11. IS 3786: 1983 (Reaffirmed 1991)

Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents. (1st revision)

12. IS 3808: 1979 (Reaffirmed 1990)

Method of test for non combustibility of building materials (1st revision)

13. IS 5311: 1969 (Reaffirmed 1990)

Code of safety for carbon tetra chloride.

14. IS 6382: 1984 (Reaffirmed 1990)

Code of practice for design and installation of fixed carbon dioxide for fire extinguishing system (1st revision)

15. IS 7969: 1975 (Reaffirmed 1991)

Safety code for handling and storage of building materials (Amendment 1)

MAKES OF HVAC EQUIPMENTS

S. No.	Description	Makes
1.	High Side Equipment	
1.1	Air Cooled Chilling Units	Bluestar/ Clivet/ Voltas / Bluebox / Dunhambush/LG/Carrier
1.2	Pumps Coupled	Grundfoss/ Armstrong/ ITT / Kirloskar
1.3	Pumps Monoblock	Grundfoss/ Armstrong/ ITT /Kirloskar
1.4	Pumps Coupled with VFD	Grundfoss/ Armstrong/ ITT / Kirloskar
1.5	VFD with controls	Danfoss/ Siemens/Honeywell/Armstrong /As per OEM
1.6	Cooling Towers	Bell/Coron/Paharpur or As per list of makes attached
1.7	Heat Pump	Bluestar/ Clivet/ Voltas / Bluebox / Dunhambush/LG
2	Air Handling Units	
2.1	Air Handling Units (Floor Mounted / Ceiling Suspended)	Flaktwoods/System Air /Edgetech/Zeco/Eflow/Carrier/BRIA
2.2	Fan Coil Units (Ceiling Suspended)	Flaktwoods/System Air /Edgetech/Zeco/Eflow/Carrier/BRIA
2.3	VAV	Eflow/ Trox / Ultrafresh /SystemAir
2.4	Fresh Air Unit	Flaktwoods/System Air /Edgetech/Zeco/Eflow/Carrier
3.	Inline Fans	Eflow/ Trox / Ultrafresh /SystemAir
3.1	Propeller Fans	Eflow/ Trox / Ultrafresh /SystemAir
3.2	AOP	Ultrapure /VS-Enviropure / Trimed / Aquaair
3.3	Axial Fans	Greenheck/ Eflow/System Air/Kruger
4	Electrical Equipment	
4.1	Electric Panel Board	Tricolite/Adlec/Neptune/Zeniya/ Shivalic/Advance
4.2	Electric Motors	ABB/Siemens/Crompton/Kirloskar

4.3	Starters/Switchgear	Cutler Hammer/ Siemens/English Electric/ L&T/Legrand/MDS
4.4	MCB	Siemens/MDS Lexic Schneider L&T/ Legrand/ABB/Polycap/EE
4.5	MCCB/ACB	Siemens/L&T/EE/Legrand/ABB/ Polycap/Schneider
4.6	Push button starter	Siemens/Cutler Hammer/ L&T/Legrand/MDS
4.7	Auxiliary Relays/ Contactors	Siemens/Cutler Hammer/ L&T/Legrand/MDS
4.8	Line Type Fuse	GEC Alsthom/ Siemens
4.9	Timer	Siemens/Cutler Hammer/ GEC Alsthom/L&T/Schneider
4.10	Terminal Block	Elmex/ Comex/ HMI
4.11	Voltmeter/Ammeter	Siemens/AE/KAPPA/L&T
4.12	Indicating lamps	Siemens/L&T/Cutler Hammer
4.13	Selector Switches	Siemens/L&T/Kaycee/GE
4.14	Change Over Switch	Siemens/L&T/Schneider /Legrand/ABB
5	Cables	
5.1	Control Cables	Finolex/KEI/RR Kabel/Plaza/polycab/Havells
5.2	Power Cables	Finolex/KEI/RR Kabel/Plaza/polycab/Havells
6	Ducting & Grilles	
6.1	Factory fabricated duct	Rolastar/ /Ultrafresh/ Eflow/Zeco
6.2	Pre-insulated Duct	Rolastar/ /Ultrafresh/ Eflow/Zeco
6.3	Thermal diffuser	AcuthermUSA/Trocellene
6.4	Fire Dampers motors	Belimo/Seimens/ Honeywell
6.5	G.I. Sheet Metal Duct	JindalHissar /National/ Tata

6.6	Grilles/Fire Dampers/Diffusers	Tri Star/ Trox / Accutherm
6.7	G.I. Sheets	Jindal Hissar/ SAIL/TATA
6.8	Self adhesive gaskets	"Prima Seal".
6.9	Stick Pins	Prima Seal/Air flow/ Mapro
7	Pipes	
7.1	G.I.	Jindal Hissar /Tata/ SAIL
7.2	M.S. upto 150 mm	Jindal Hissar /Tata/ SAIL
7.3	M.S. 200 To 300	Jindal Hissar /Tata/ SAIL
8	Valves	
8.1	Butterfly Valves	Advance/ Audco/Castle/Sant/Arrow/BRIA
8.2	Non Return Valve	Advance/ Audco/Castle/Sant/Arrow
8.3	Balancing Valves	Advance/ Audco/Castle/Sant/Arrow/FRESE
8.4	Gate/Globe Valves	Advance/ Audco/Castle/Sant/Arrow
8.5	Ball Valves with Strainers	Advance/ Audco/Castle/Sant/Arrow/BRIA
8.6	Motorized Butterfly Valves	Bellimo/Johnson Control/Siemens
9	Accessories	
9.1	Y-strainer	Flowell/Betaflow/Sant/Rapid Cool
9.2	Pressure Gauge	H. Guru/Fiebig
9.3	Thermometer	Fiebig/ H. Guru
9.4	Flow Switch	Rapid Control/Anergy/ Honeywell
9.5	Automatic Air Vent	Rapid Control/Anergy/Honeywell
9.6	Pot Strainer	Betaflow/ Flowell/Advance
9.7	Suction Guide	Sant/Honeywell/Armstrong
10	Air Filters	
10.1	Filters	Ultrapure /VS-Enviropure / Trimed / Aquaair
11	Insulation	
11.1	Glass Wool	Supreme/U.P. Twig/Thermobrake/Armacel
11.2	Closed Cell Elastomeric Insulation	Eurobatex /AFlex/Vedoflex

11.3	Aluminium Tape	Johnson/Birla 3M/Garware
12	Controls	
12.1	PIBCV valve for AHU	TA/Siemens/ Johnson Control /FRESE
12.2	2/3-Way motorized valve for FCU	TA/Siemens/ Johnson Control/BRIA
12.3	Thermostats	TA/Siemens/ Johnson Control/Honeywell/polycab
12.4	Pressure Independent Balancing cum Control Valves	TA/Siemens/ Johnson Control/ Honeywell/FRESE
13	Microprocessor based systems	Siemens/JohnsonControls/Honeywell/
14	Paints	
14.1	Enamel	Asian/ Nerolac/ Berger/Shalimar
14.2	Bituminus	Shalimar/ Asian Paint/ Nerolac
14.3	Tarfelt (for underground chilled water pipe insulation)	Shalimar/ Asian Paint/ Nerolac
15	Miscellaneous	
15.1	Anchor fastners	Hilti/Rawlplug
15.2	Vibration isolator	Resistoflex, Dunlup, Kanwal
16	HDPE Pipe	Polypack/D-plast/Supreme/Rex/Norpack/Indiana
17	EQUIPMENT/UNIT	
17.1	VRV/VRF System	HITACHI/Daikin/ Mitsubishi-Electric / LG/Carrier
18	PIPING	
18.1	Refrigerant Copper Pipe	Mettube/Totaline/RajcoMetals
18.2	PVC Drain Pipe	Jindal/Astral/ Prakash
19	INSULATION	
19.1	Nitrile Rubber	Eurobatex /AFlex/Vedoflex

LIST OF APPROVED MAKES OF MATERIALS FOR ELECTRICAL RELATED WORKS

(For IEI, Lift, & DG)

S.NO.	DESCRIPTION	MAKE
1	AIR CIRCUIT BREAKER	ABB / L & T / SCHNEIDER / SIEMENS / LEGRAND
2	MCCB (MICROPROCESSOR)	ABB / L & T / SCHNEIDER / SIEMENS / LEGRAND
3	MCCB (THERMO-MAGNETIC)	ABB / L & T / SCHNEIDER / SIEMENS / LEGRAND
4	MPCB (MICROPROCESSOR)	ABB / L & T / SCHNEIDER / SIEMENS / LEGRAND
5	MCB / RCCB / RCBO	LEGRAND / SCHNEIDER / HAVELLS/POLYCAB / L&T / ABB
6	SWITCH DISCONNECTOR FUSE UNIT	L & T / SIEMENS / ABB / SCHNEIDER/HAVALLS
7	SWITCH FUSE UNIT WITH HRC FUSES	L & T / SIEMENS / ABB / SCHNEIDER/ HAVALLS
8	CONTACTORS / RELAYS / TIMERS	L & T / SIEMENS / ABB / SCHNEIDER / LEGRAND
9	CAPACITOR	DUCATI / EPCOS / ABB / L&T / SCHNEIDER / LEGRAND/HAVELLS
10	AMMETERS / VOLTMETERS & METERING EQUIPMENTS	L & T / NEPTUNE / LEGRAND/ABB/AE
11	SELECTOR SWITCHS	KAYCEE / L&T/ SIEMENS
12	CT / PT	KAPPA / AE / L&T
13	INDICATING LAMP	L&T / SIEMENS
14	APFC RELAY	L &T / DUCATI / SEIMENS / EPCOS / ABB / SCHNEIDER
15	BATTERIES	EXIDE /AMRON
16	BATTERY CHARGING PANEL	KELTRON / VOLT STAT/CALDYNE/MAHAMAI/AMARAJA
17	PVC / XLPE INSULATED 11 KV CABLES	HAVELLS / FINOLEX / POLYCAB / KEI
18	PVC / XLPE INSULATED 1.1 KV CABLES	HAVELLS / FINOLEX / POLYCAB / KEI
19	DC MINIATURE CIRCUIT BREAKER	SCHNEIDER / SIEMENS / L&T / ABB/ POLYCAB
20	LUGS	DOWELLS / COMET/ASIATIC

21	CABLE GLANDS	SIEMENS / COMET / GRIPPWEL
22	MAIN L.T. PANEL / CAPACITOR PANEL / DISTRIBUTION PANEL / SYNC. PANEL	TRICOLITE / ADLEC / SPC ELECTROTECH / NEPTUNE/ APPLICATION CONTROL/ZENIYA/AVANCE
23	BUS DUCT / RISING MAINS (SANDWITCH TYPE)	LEGRAND / SCHNEIDER / L&T/ SIEMENS/GE
24	CABLE TRAY / RACEWAY	INDIANA / BEC / AKG/CTM/ADTIYA STEEL
25	INDUSTRIAL OUTLET SOCKET	LEGRAND / SCHNEIDER / HAGER / L&T / ABB
26	FIRE EXTINGUISHERS	ZENITH / MINIMAX / NEWAGE
27	ENERGY ANALYSER (WITH RS 485 PORT)	SCHNEIDER / CONZERV / ELMEASURE / LEGRAND
28	DISTRIBUTION BOARDS	HAGER / LEGRAND / L & T / SCHNEIDER / POLYCAB
29	PVC INSULATED COPPER CONDUCTOR WIRES	FINOLEX / RR KABLE / POLYCAB / / KEI / HAVELLS
30	CHANGE OVER SWITCHES	L&T / ABB / SCHNEIDER/POLYCAB
31	TELEPHONE TAG BLOCK	KRONE / TVS R&M
32	MS CONDUITS AND ACCESSORIES	B.E.C. / AKG/SK
33	PVC FRLS CONDUITS AND ACCESSORIES	AKG / BEC / PRECISION / POLYCAB/SUPREME/ANCHOR/INDIANA
34	PVC CONDUITS AND ACCESSORIES	AKG / BEC / PRECISION / POLYCAB/SUPREME/ANCHOR/INDIANA
35	SWITCHES & SOCKETS OUTLETS (MODULAR TYPE)	LEGRAND / CLIPSAL ABB / WIPRO NORTH WEST / MK / SIEMENS/HAVELLS/ANCHOR
36	AVIIATION OBSTRUCTION LIGHT	BAJAJ / WIPRO / PHILIPS
37	CAT-6 WIRE	LEGRAND / POLYCAB / HAVELLS
38	CAT-6A WIRE	LEGRAND / POLYCAB / HAVELLS
39	TELEPHONE WIRES AND CABLES	FINOLEX / RR KABLE / SKYTONE / POLYCAB / DELTON / HAVELLS
40	TELEVISION COXIAL CABLE	FINOLEX / RR KABLE / SKYTONE / POLYCAB / DELTON / HAVELLS
41	TELEPHONE / DATA OUTLET	LEGRAND / SCHNEIDER / SIEMENS / SYSTEMAX / LUCENT
42	DATA RACK	LEGRAND / APW / SIEMENS
43	LIGHT FIXTURE	PHILIPS / HAVELLS / USHA TISVA/WIPRO/ PANASONIC

44	LAMPS	OSRAM / PHILIPS/ USHA TISVA/WIPRO/ PANASONIC
45	CEILING / WALL FAN	HAVELLS / CROMPTON GREAVES / USHA /ORIENT
46	EXHAUST FAN	HAVELLS / CROMPTON GREAVES / USHA /ORIENT
47	CCTV CAMERA	PELCO/ BOSCH / AXIS/ AVIGILON
48	NVR / DVR	PELCO/ BOSCH / AXIS/ AVIGILON
49	LIGHTNING PROTECTION	ERICO / CAPE ELECTRIC / JMV / OBO
50	EARTHING	ERICO / CAPE ELECTRIC / JMV / OBO
51	RCC HUME PIPE	DAYA SPUN PIPE / J K SPUN PIPE / K K SPUN PIPE
52	UPS	SOCOMEC / SCHNEIDER/EMERSON/DELTA/ETON/MICROTEK
53	STREET LIGHT POLE	SHREDER / BAJAJ/VALMOUNT/BPP
54	DESK TOP	HP / DELL / IBM/ACER
55	MAGNETIC LOCK	CAPTURE / TRIMEC / ALGATEC
56	BOOM BARRIER	FAACHUB/KABA/SECURE EYE
57	AUTOMATIC TRANSFER SWITCH	ASCO / SOCOMEC / CUMMINS/ L&T/ SCHNEIDER
58	SYNCHRONIZING RELAY	WOOD WORD / DIEF/ECO MAKE
59	PROFESSIONAL LED PANEL	PANASONIC/SAMSUNG/LG/SONY
60	PLC	SIEMENS / ALLEN BRADLEY / MITSUBISHI / ABB/L&T
61	DUAL MEETRING SYSTEM WITH SOFTWARES	SECURE / CRYSTAL
62	D G SETS	JAKSON / SUDHIR / ASHOK LAYLAND / CATERPILLAR / KIRLOSKER /CUMMINS/GREAVES
63	D.G. SET (ALTERNATOR)	STAMFORD / GREAVES/KIRLOSKAR
64	M.S. PIPE	TATA / JINDAL HISSAR / SAIL
65	EXHAUST FLEXIBLE BELLOW	ALFA FLEXITUBE / KANWAL / PRECISE
66	EXHAUST PIPE INSULATION	LIOYD INSULATION / ROCKWOOL INDIA / UP TWIGA
67	ANCHOR FASTNER	FISHER / HILTI

68	LEVEL CONTROLLER	VEKSLER
69	M.S. ANGLE / CHANNEL	JINDAL/SAIL/TATA
70	H.V. CABLE TERMINAL JOINTS	RAYCHEM / 3 M / CAB SEAL/KABAL CEELPACK
71	ALUMINIUM BUS BAR	HINDALCO / CENTURY / JINDA/NALCO
72	COPPER BUS BARS	RACHNA METAL / LIBU METAL
73	DATA RACK	SUNSHINE / APW / LEGRAND
74	POE SWITCH	CISCO / NETGEAR/LEGRAND
75	EPABX	ALCATEL / SIEMENS / PANASONIC
76	ANY OTHER ITEMS	ON APPROVAL OF CONSULTANT OR ENGG IN CHARGE

NOTE:

Make of any other equipment not mentioned above will require approval from the Consultants before execution.

SPECIAL CONDITIONS OF IEI/HVAC/Lift/UPS/CCTV/DGWORKS

The entire Site where the work has to be executed, must be visited by the contractor before quoting the rates.

The work shall be carried out strictly in accordance with CPWD works manual/ specification for IEI, LIFT, HVAC and DG set and shall also confirm to requirement of Indian Electricity Rules in force as amended up to date.

The works executed by the Contractor shall at all times be open for inspection of Engineer in Charge or his authorized representative at his works/factory.

The contractor shall arrange all tools, ladders, scaffolding etc. including their cartage to and fro within quoted rates. Nothing will be paid extra on this account.

The works executed by the contractor shall be under his charge/custody until they are completely handed over to the department after recording completion of the work.

No compensation for any damage caused to the works or materials by rain, flood or other natural calamities shall be paid to the contractor. It is the responsibility of the contractor to keep all the materials under lock and key and to provide security for that. The contractor has to bear the complete cost to repair/replace the damaged work/material.

All the materials to be provided & fixed for the work will be first checked by the Engineer-in-charge.

All the material/T&P required will be arranged by the contractor himself.

Necessary precaution required for the man-power shall have to be taken by the contractor himself.

NDMC shall not be responsible in case of any mis-happening during execution of work.

Any work not mentioned in the schedule of work and which is essentially required for the completion of the work, has to be completed by the contractor within the quoted amount.

Nothing extra will be paid for such works.

Any damage done to the building during the execution of electrical works shall be made good immediately by the electrical contractor to the satisfaction of Engineer-in-Charge at his own cost. Any expenditure done by the department in this connection shall be recoverable from the contractor and decision of Engineer-in-charge about recovery shall be final.

During the execution of work, all related civil work has to be done by the contractor at their own end.

No advance shall be paid against material and payment shall be made as per Terms & Conditions or after entire completion of works.

The work shall be carried out according to approved drawings however the department reserves the right to change the layout as per requirements at site.

Good workmanship is an essential requirement for compliance with the rules and specifications.

The entire installation shall be at the risk and responsibility of the contractor until these are tested and handed over to NDMC.

Notwithstanding the schedule of quantity, all items of inter-related work considered necessary to make installation complete and operative deemed to be included shall be provided by the contractor at no extra cost.

The materials to be supplied by the NDMC have to be lifted/shifted from NDMC store to sites by the contractor at his own arrangement. Noting extra will be paid for the same.

All the required material/ equipmentsetc shall be procured and brought at site by the contractor only after the approval of engineer in-charge from the attached list of makes in NIT.

Use of water & electricity involved in the work, the same will be provided by the contractor on their own.

The defect liability period will be for one year after commissioning/handed over of the work, hence Bank guarantee in lieu of performance guarantee shall remain stand for defect liability period. The security deposit and Bank guarantee shall be released after satisfactory completion of Guarantee Period. The security deposit shall be deducted from the first running / final bill, however it will be ascertained that 7.5% of bill amount must be reserved in the form of P.G. and S.D.

All the statutory clearance if required from the Government Offices shall be obtained by the bidder.

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

If the main contractor fails to associate agency/agencies for execution of minor components of work within prescribed time or furnishes incomplete details or furnishes details of ineligible agencies even after the tenderer is given due opportunity, the entire scope of such component of works shall be withdrawn from the tender and the same shall be got executed by the Engineer in-Charge at the risk and cost of the main contractor.

In case the main contractor intends to change any of the above agency/agencies during the operation of the contract, he shall obtain prior approval of respective Engineer-in-Charge of the agreement. The new agency/agencies shall also have to satisfy the laid down eligibility criteria. In case Engineer-in-Charge of respective discipline is not satisfied with the performance of any agency, he can direct the contractor to change the agency executing such items of work and this shall be binding on the contractor.

Final bill of whole work shall be finalized and paid by the EE of major component. Other EE will prepare and pass the final bill for their component of work and pass on the same to the EE of major component for including in the final bill for composite work.

Levy of compensation under Clause 2 as well as fair and reasonable extension of time will be granted by the competent authority of the major component in consultation with concerned authority of minor discipline and on receipt of required information in this regard from EE of major discipline as well as concerned of minor discipline. Also EE in charge of major component shall be competent authority to give fair and reasonable extension of time under provision of clause 5.

Mode of payment:

60% of the cost of material brought at site in good condition on pro-rata basis & as assessed by Engineer-in-charge.

80% of the contract amount after completion of installation in all respect.

Balance 20% of the contract amount after testing, commissioning, trial run and handing over to deptt. for beneficial use.

To supersede all such clauses mentioned in this NIT, the contractor shall engage consultant to prepare & submit three sets of shop floor drawings of all minor components taken in bill of quantities (BOQ) i.e. IEI/HVAC/Lift/Solar Power System/CCTV/DG set etc. indicating size & weight of the equipment, location of light/fan points, conduit routing, DB's, electrical panel, ducting, AHU's, Lift & Solar Panels etc. including catalogues etc. to obtain the approval of Architect/Engineer-in-Charge prior to start of the execution/installation for which nothing extra shall be paid to the contractor. The Consultant shall visit the site weekly to keep look on the executed work by the agency and make amendment, direction/advice if found necessary in the Shop Drawings/ Heat load calculations etc. if any.All major items/equipments i.e. Lift, DG Set, Chillers, HT/LT Panels etc. shall also be insured and warranted for 12 months from the date of commissioning..

Completeness of tender:

All sundry equipment, fittings, unit assemblies, accessories, hardware items, foundation, bolts, termination lugs for electrical connections, and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work shall be deemed to have been included in the tender irrespectively of the fact whether such items are specifically mentioned in the tender documents or not.

For the item/equipment requiring initial inspection at manufacture's works the contractor will intimate the date of testing of equipments at the manufacturer's works before dispatch. The department also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make the arrangements for the same. The successful tenderer shall give sufficient advance notice regarding the dates proposed for such tests/inspection to the department and facilitate the same. The travelling charges etc. shall be borne by the department for the inspection. The separate storage accommodation shall be provided by the department. Watch and ward of the stores and their safe custody shall be the responsibility of the contractor till the final taking over of the installation by the department.

In case of composite tender, the successful contractor will submit the list of minimum four electrical/HVAC contractors registered with NDMC / any govt. deptt. under class I/II ,if they themselves are not registered in NDMC or not having electrical license of Designated authority. The department will select the firm for execution of work as per their performance.

Executive Engineer (E)

Construction Division-III

FIRE DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL

GENERAL CONDITIONS

1. The word Executive Engineer mentioned in the conditions of contract may be read as Fire Officer.
2. The contractor shall visit the site and familiarize himself with the actual site conditions.
3. The contractors are advised to inspect the site before quoting their rates in order to familiarize themselves with nature/scope of their work.
4. The rates quoted by the contractors shall be for complete item of work and nothing extra shall be payable on this account.
5. Rates quoted in this tender shall be inclusive of cost of materials labour, supervision, tools and plants, services, wastage all such expenses as may be necessary and required to complete all the items of work in perfect working order to the entire satisfaction of Fire Officer.
6. The work shall be carried out strictly in accordance with the IS standards and specifications as mentioned in the nomenclature of the items and to the entire satisfaction of Fire Officer.
7. The joints of pipes shall be butt welded as per directions of Fire Officer.
8. The system shall be got tested in the presence of Fire Officer to ensure perfect functioning of the system.
9. The contractor shall have to remove all the malba from the site and nothing extra shall be paid on this account.
10. The dismantled material if any shall have to be deposited with Fire Deptt. of NDMC.

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

FIRE DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL

Fire Fighting System

Special conditions of contract: -

1. All wiring and earthing shall confirm to IE Rules and regulations amended up to date.
2. The work shall be carried out strictly in accordance with ISI/BIS specifications to the entire satisfaction of the Fire Officer.
3. The contractors shall make his own arrangement for watch and ward & storage of the material supplied at site in co-operation with incharge/caretaker/security officer of the building.
4. The contractor shall be required to produce manufacturer's test certificates for the particular batch of material supplied by him.
5. The tests shall be carried out as per relevant ISI /BIS and the testing charges shall be borne by the contractor.
6. The contractor shall be responsible against any manufacturing/execution defects for a period of 12 months.
7. All guarantee cards/tests certificates/hydraulic test certificates and performance test certificates as per code of practice of the material supplied shall be submitted to Fire Officer.
8. The contractor has to furnish copy of license issued by the Bureau of Indian standards (BIS) for the items supplied by them.
9. The contractor shall be responsible for any loss/damage to the materials / building by his staff deployed during execution of work.
10. The Contractor shall produce the Employee State Insurance Certificate and ESI certificate of the employees working under them.
11. Any other instructions issued by the Fire Officer/Engineer in charge related to the above mentioned work shall also be complied with.
12. All the components of fire alarm system shall be provided in manufacturer's original new and unopened packing bearing manufacturer's name and label.
13. Laminated wiring diagram shall be posted at a suitable place in Fire Control Room by the contractor.
14. The contractor shall be fully responsible for any miss happening at the site during execution of work.
15. The contractor shall be required to produce manufacturer's test certificates for the particular batch of material supplied by him.
16. Each water type (Gas Cartridge) extinguisher shall be supplied with hydraulic tests certificate/gas cartridge make and capacity.
17. Each DCP extinguisher must be accompanied with hydraulic test certificate for cylinder and gas cartridge make with capacity.
18. Each Mechanical Foam (AFFF), CO2 Fire Extinguisher must meet the requirement of ISI and Indian Explosive Rules/Indian Cylinder Rules etc.
19. Contractor shall supply the extinguishers only of approved makes as per the list of makes attached.

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

FIRE DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL

2 Hours Fire Rated G.I Steel Fire Check Doors Specifications

1. Manufacturer: - The Fire / Smoke check doors shall be procured from approved Manufacturer viz: Navair International/ Aadhunic/ Godrej / ASES/Indian Fire Equipments.

2. Stability: - The Fire Check door should not collapse during the rated period of 2hours fire rating under the specified fire conditions. The fire check doors shall provide safe access to the escape routes and provide compartmentation in the Buildings namely protected Corridors, Lift lobby, Electrical Room, DB room, Main and Fire Escape Staircases, AHU, LV Shaft, Electrical Shaft, Kitchen, Ramps, Refuge Area, Terrace etc.

3. Integrity: - The Fire Check doors should not allow the passage of hot gases or the flames through the rebate or the gap between the door frame and shutters for the duration of 2 Hrs. fire rating.

The Fire / Smoke check door assembly being offered shall be as per proto-type tested at CBRI Roorkee / Government Department approved laboratory for the prescribed fire-rating as per BS: 476 part 20 & 22 / IS: 3614 Part-II, IS: 3609 amended upto date. Test report from approved lab, shall be submitted for approval before executing the work. The tenderer shall employ specialized agency or manufacturers of the fire check door assembly, having their own manufacturing facilities and such agency shall be got approved from the Engineer in charge. Door Frame and shutters shall in general be fabricated as per Manufacturer specifications besides satisfying the Specifications as per nomenclature of the item of the work and recommendations of the specialized Agencies as approved by the Engineer-in-charge.

4. The single simple assembly provides the essential requirements of the resistant and mechanical strength for successful fire requirements. When further provided with external cladding in either plywood or sheet metal, it forms a stressed skin panel assembly with markedly superior qualities of durability and strength in comparison to other form of the door constructions.

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

FIRE DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL

List of Approved Makes for Fire Fighting System

01	PUMPS	KIRLOSKAR / MATHER & PLATT / BEACON
02	MOTORS	GE / SIEMENS / CROMPTON GREAVES / KIRLOSKAR
03	MOTOR CONTROL SWITCHES / STARTERS	L&T / SIEMENS / ABB / GE
04	PRESSURE SWITCH / SPRINKLER FLOW SWITCH	INDFOSS / SWITZER / MOBREY / SYSTEM SENSOR / CASTLE / RAPID CONTROL
05	PRESSURE GAUGE	FIEBIG / H GURU / PRICOL
06	CABLES, WIRES	NATIONAL / HAVELLS / RALISON / ECKO / SKYTONE / KALINGA / GLOSTER (ISI MARKED)
07	CI / MS PIPES	TATA / JINDAL (HISSAR)
08	BUTTERFLY VALVES & CHECK VALVES	SANT / ZOLLOTO / KARTAR / CASTLE
09	GUN MENTAL / BRONZE GATE VALVES	ZOLOTTO / SANT
10	HYDRANT VALVE, BRANCH PIPES, HOSE REELS PIPES WITH DRUM / NOZZLES	SUPEREX / SAFEGUARD / PADMANI / LIFEGUARD / AGNI DEVICES
11	HOSE PIPES WITH CUPLING	MINIMAX / / PADMANI / LIFE GUARD / SUPEREX
12	HOSE BOXES	LIFEGUARD OR EQUIVALENT LOCALLY FABRICATED AS PER SPECIFICATION WITH THE CONSULTANTION OF FO
13	FIRE BRIGADE INLET	SUPEREX / MINIMAX / SUPEREX / LIFE GUARD
14	SPRINKLERS, ALARM VALVE-UL listed	Tyco / H.D.
15	ANNUNCIATION PANEL	VIJAY / MINIMAX / SAFEWAY / AGNI / ASES
16	SUCTION STRAINER	SANT / KIRLOSKAR / ZOLOTTO / KARTAR / CASTLE
17	RUBBER HOSE REEL	NEWAGE / JAY SHREE / DEEP JYOTI / DOZZ / PADMINI / LIFEGUARD
18	FIRE EXTINGUISHERS	MINIMAX / LIFE GUARD / NEWAGE / BHARAT / CEASEFIRE
19	INDICATING LAMPS	SIEMENS / L&T / GE POWER CONTROLS / VAISNO
20	CONDUITS	BEC / STEELKRAFT - ISI MARKED
21	BATTERY	EXIDE / AMRON / LUMINOUS
22	ELECTRICAL CONTROL PANEL	MILESTONE SWITCHGEAR / KANISHKA POWER CONTROLS / AGNI SURAKSHA / STANDARD / TRICOLITE / MARK
23	FIRE RESISTANT PAINT	LEXUS / FR-881
24.	LANDING VALVE ISI MARK SINGLE HEADED	SUPREX / NEWAGE / MINIMAX / LIFE GUARD
25.	HOSE REEL DRUM ISI MARK	NEW AGE / SUPEREX / MINIMEX / LIFE GUARD
26.	SLUICE VALVE – IS : 14846 (ISI MARKED)	KIRLOSKAR
27.	NON RETURN VALVE – IS : 5312	KIRLOSKAR

28.	C.I. FOOT VALVE	KIRLOSKAR / KARTAR / CASTLE
29.	HOSE PIPE 50MM	NEW AGE / PADMINI / OMEX / GUARDS / LIFE GUARD
30.	REDUCING COUPLING 63X50MM & 50MM	GUARDS/PADMINI/MINIMAX/NEW AGE/LIFE GUARD
31.	STAINLESS STEEL FLAX DROP PIPE	AGNI DEVICES / LIFEGUARD / SUPEREX
32.	AIR RELEASE VALVE	LIFEGUARD / SANT / ZOLOTO
33.	AIR VESSEL	LIFEGUARD OR EQUIVALENT
34.	BALL VALVE	LIFEGUARD / SANT / ZOLOTO
35.	PVC TANK	SINTEX / SHEETAL / ECELCTROPLAST / LOTUS / STAR
36.	DELUGE VALVE	HD / TYCO
37.	WATER CURTAIN NOZZLE	HD / TYCO
38.	WRAP COAT	IWL OR EQUIVALENT
39.	FIRE BUCKET & STAND	LIFEGUARD OR EQUIVALENT
40.	SIREN	LIFEGUARD / ASES / AGNI DEVICE
41.	ENERGENCY LIGHT	LIFEGUARD / ASES / AGNI DEVICE
42.	SIGNAGE	LIFEGUARD / ASES / AGNI DEVICE

NOTE: The contractor shall get the samples of all the items covered or not covered in the list, approved from the Fire Officer before commencing the supply/installation

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

FIRE DEPARTMENT
NRE DELHI MUNICIPAL COUNCIL
Schedule of make for Fire Detection and Alarm System

S. No.	Description	Make
1	PVC Insulated Armoured copper conductor cables / wire of 1.1 KV grade	Havells / Polycab / Finolex / Gloster / Kalinga
2	Optical / Photo electric type Smoke Detectors with Base	Bosch / Notifier / Siemens
3	Heat Detectors	Bosch / Notifier / Siemens
4	Manual call box	Bosch / Notifier / Siemens
5	Fire Alarm Panel	Bosch / Notifier / Siemens
6	Electronics Hooter	Bosch / Notifier / Siemens
7	Response Indicator	Agni Devices / Bosch / Notifier / Siemens
8	M.S. Conduit	AKG / BEC / Steel Kraft – ISI Marked / NIC
9	Beam Detector	Bosch / Notifier / Siemens
10	Central Graphical Fire Alarm Management System	Bosch / Notifier / Siemens
11	Fire Control Module	Bosch / Notifier / Siemens

NOTE: The contractor shall get the samples of all the items covered or not covered in the list, approved from the Fire Officer before commencing the supply / installation.

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

FIRE DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL
List of approved makes for Smoke Check Doors

S. N.	Item	Make
1	Steel Fire Check Door	Navair/ Aadhunic / Godrej / ASES/ INDIAN FIRE EQUIPMENTS
2	Mechanical / Chemical Anchor Fasteners	Bose / Hilti / Fischer
3	Imported Fire Rated Door Hardwares	Hafele / Geze / Assa Abloy / Yale / Dorma
4	Panic Bars	Hafele / Geze / Assa Abloy / Yale / Dorma
5	Fire Rated Clear Glass of 2hours rating	Schott / Pyran / Glaverble / Fire light
6	Fire Sealant	Lexus / 3M / Bostic / Essrbond / Lorient / Schott – Kerafix
7	Fire Retardant Paint	Lexus / FR-881
8	Fire and Smoke Seal	Lexus / Falcon / Schott – Kerafix / Lorient
9	Tower Bolt / Flush Bolt	Guardian / Yale / Hafele / Geze / Dorma / Supreme / Wuyinghao
10	External Trim	Hafele / Geze / Assa Abloy / Yale / Dorma
11	Door Coordinator	Hafele / Geze / Dorma / Assa Abloy / Yale
12	Door closer	Hafele / Geze / Dorma / Assa Abloy / Yale
13	Mortice Latch & Lock	Hafele / Geze / Dorma / Assa Abloy / Garg / Loctec / Dorma
14	Buffer	Garg / Suzu / Hafele / Assa Abloy / Dorma
15	SS Ball Bearing Hinges	Assa Abloy / Hafele / Garg / Suzu / Dorma

NOTE: The contractor shall get the samples of all the items covered or not covered in the list, approved from the Fire Officer before commencing the supply/installation.

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

FIRE DEPARTMENT
NEW DELHI MUNICIPAL COUNCIL

Eligibility Criteria for Fire Fighting works

E.E. (Spl. Project) is requested to incorporate the following conditions in respect of Fire Fighting works irrespective of other conditions in NIT:

1. The similar work means **"Any type of Fire Fighting works".**

   a. The copy of definite proof from the appropriate authority which shall be to the satisfaction of the competent authority of having successfully completed three similar works each of value not less than 40% or two similar work each of value not less than 60% or one similar work of value not less than 80% of estimated cost of tender in last 7 years ending last day of the submission of tender/bid. The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum, calculated from the date of completion to the last date of submission of bid

Fire Officer **A.E. (C) Fire** **J.E. (C) Fire**

Signature Not Verified
Digitally signed by WILLIAM PARASHAR
Date: 2022.10.20 19:06:01 IST
Location: NCD of Delhi-DL