



**HINDU COLLEGE, UNIVERSITY OF DELHI,
DELHI-110007**

TENDER FOR

**CONSTRUCTION OF BOYS HOSTEL AT HINDU COLLEGE
COMPRISING OF STILT +5 FLOORS
FOR 566 STUDENTS INCLUDING STRUCTURAL WORKS, FINISHING
WORKS, PART INTERNAL WATER SUPPLY, PART SANITARY, PART
STORM WATER DRAINAGE ELECTRICAL INSTALLATIONS INCLUDING
FIRE ALARM , WI-FI & PA SYSTEMS AND PART EXTERNAL
DEVELOPMENT WORKS**

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PART A-1:
NOTICE INVITING TENDER (NIT)

1. Tender Details

- 1.1 Principal, HINDU COLLEGE invites ONLINE Item rate composite Tender for the following work from the eligible firms /contractors in Two Part Bid System:

NIT No.	NIT No.: HINDU COLLEGE/
Name of Work & Location	CONSTRUCTION OF BOYS HOSTEL AT HINDU COLLEGE COMPRISING OF STILT +5 FLOORS FOR 566 STUDENTS INCLUDING STRUCTURAL WORKS, FINISHING WORKS, PART INTERNAL WATER SUPPLY, PART SANITARY, STORM WATER DRAINAGE, ELECTRICAL INSTALLATIONS INCLUDING FIRE ALARM, WI-FI & PA SYSTEMS AND PART EXTERNAL DEVELOPMENT WORKS
Estimated cost put to tender	
i) Major Component (Civil works)	Rs. 306178680
ii) Minor Component (E&M Works)	Rs. 42291109
iii) Total	Rs. 348469789
iv) GST is included in rates	Rs. 000
v) Grand Total	Rs. 348469789
Earnest Money Deposit	Rs. 45,00,000.00
Tender Fee	Rs.5,000/-
Period of Completion	18 Months

1.2 Scheduled Dates

- Date of Notice to Inviting the Tender: 30.01.2024
- Last date for submission of Tender (including EMD):13.02.2024 (03:00PM)
- Time and date of opening of Technical bid:**22.02.2024 (2.30 PM)**
- Time and date of opening of financial bid: Shall be intimated later

2. Brief Particulars of the work for which Tenders are invited:

Hindu College is situated in North Campus, Delhi University. The campus is fully functional. Following is the brief detail of work under present tender. However, this scope is indicative only and not exhaustive.

2.1 Project Description:

The total area to be constructed is 18,354.0 Sq.Mt. or 1,92,353.0 Sq.Ft.

The total planned student accommodation is 556. Besides this accommodation for 10 nos. Resident tutors and 2nos. 3 BHK homes for wardens are also planned.

Scope of Work: - The proposed building will be Stilt +5 stories. The Dining hall, Kitchen and a common room will be on Stilt level. The hostel will have 4 wings on each floor from Ground floor to Fourth floor. Each wing will be separately approachable by Lift and staircase. Toilet blocks are common between two wings. The sanitary provisions as per bye laws have been made.

All floors will have double height terraces with provision of greenery. Four floors shall have individual common rooms for social interaction, recreation, gym and Computer/printer facilities.

700-Seater auditorium and halls available at stilt shall allow entertainment, social interactions and hobby activities.

Courtyard at stilt shall have several features for creating pleasant ambience. Water fountains to cool the building and lawns surrounding it are planned for lively hostel life.

SCHEDULE OF ACCOMMODATION									
Redevelopment of Boys' hostel, Hindu College									
S.N o.	Facility	Stil t	Ground floor	First Floor	Second floor	Third floor	Fourth floor	Total	Total Streng th
1	Two bedded rooms		49	45	64	60	60	278	556
2	Resident tutor room with attached toilet		2	2	2	2	2	10	10
3	Kitchen	4000 sq.ft.		-	-	-		4400 sq.ft.	
4	Dining hall	9170 sq.ft.		-	-	-		9950 sq.ft.	
5	Common rooms	2670 sq.ft.	auditorium	auditorium	1590 sq.ft.	1590 sq.ft.	-	24030 sq.ft.	
6	Pantry	-	1	1	2	2	2	9	
7	Laundry	-	1	1	2	2	2	9	
8	Toilet blocks	2	2	2	2	2	2	12	
9	Staircases	6	6	5	4	4	4	4 on all floors	
10	Wardens quarter, 3 BHK	-	1		-	-		1	
11	Astt. Warden's quarter	-		1	-	-		1	
12	Auditorium hall including stage		11820 sq.ft						
13	Auditorium Foyer		6845 sq.ft.	5025 sq.ft.					
14	Double height terrace		2 nos.	2 nos.	2 nos.	2 nos.			
Proposed Total student strength of Boys hostel									566

2.2 Definitions

2.3

In this document the following words and expressions have the meaning hereby assigned to them.

- (a) Employer/Owner Means the Principal, Hindu College,
- (b) Bidder Means the individual proprietary firm, firm in partnership, limited company private or public or corporation.
- (c) Year means “Financial Year” unless stated otherwise.
- (d) Composite Work means work includes, in addition to building work, all other construction works and services such as sanitary and water supply, drainage, electrical, mechanical, development works like retaining walls, horticulture, roads and paths, furniture etc.
- (e) Major Works means the construction scope of Civil, Structural, Plumbing and External development Works.
- (f) Minor Works means the construction scope of Mechanical, Electrical, minor Airconditioning and Mechanical ventilation works.
- (g) Composite Tender means the Tender for Composite Work which includes the construction, scope of Major and Minor Works including specialised works.

3. Instructions and Information to the Bidders

- 3.1 For any queries, send an Email to Principal, Hindu College
- 3.2 Venue for all personal interactions related to this Tender: Office of Principal, Hindu College, Delhi. The bid forms and other details can be obtained from website <https://hinducollege.ac.in/>
- 3.3 Entire bid document shall be submitted in total Two parts, Besides online submission Hardcopies of Tender fee, EMD and Technical bid shall also be submitted in Hard Copies also. The Financial Bids shall be only Online.
- 3.4 Last Date & time for submitting EMD and other documents to the Accounts Section of Hindu College, or before the date as per Para 1.2 above.
- 3.5 Online Technical bids to be opened on the mentioned date & time (refer Para 1.2 above) in the office in presence of the Bidder representatives who may be present at Principal, Hindu College ,office, Hindu College , University of Delhi, North Campus, Delhi 110007.
- 3.6 General Guidelines
 - a. Letter of Transmittal and forms for Prequalification are provided in Para 4.30.1
 - b. 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 column, a “nil” or “no such case” entry should be made in that column. If any particulars / 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 bidder being summarily disqualified. Bids received late will be rejected.

- c. The bid should be type written / neatly hand written. The bidder should sign each page of the bid.
- d. Over writing should be avoided. Correction, if any, should be made by neatly crossing out, initialing, dating and rewriting. Pages of the pre-qualification document are numbered. Additional sheets, if any, added by the Contractor, should also be numbered by him. These should be submitted as a package with signed letter of transmittal.
- e. References, information and certificates from the respective clients, certifying suitability, technical know-how or capability of the bidder should be signed by an officer not below the rank of Executive Engineer or equivalent.
- f. 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 pre- qualification document unless it is called for by the Employer.

3.7 Method of Application

- a. If the bidder is an individual, the bid shall be signed by him above his full typewritten name with current address.
- b. If the bidder is a proprietary firm, the bid shall be signed by the proprietor above his full typewritten name and the full name of his firm with its current address.
- c. If the bidder is a firm in partnership, the bid shall be signed by all the partners of the firm above their full typewritten 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 bid. In both cases a certified copy of the partnership deed and current address of all the partners of the firm should accompany the application.
- d. If the bidder is a limited company or a corporation, the bid shall be signed by a duly authorized person holding power of attorney for signing the bid accompanied by a certified copy of the power of attorney. The bidder should also furnish a copy of this memorandum of Articles of Association duly attested by a public Notary.

3.8 Final decision-making Authority

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

3.9 Opening of Financial Bids

After evaluation of Technical Bids, a list of short-listed Bidders 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 presence of qualified bidders or their representatives. The bid shall remain valid for a period of 75 days from the due date of submission / extended date of submission.

3.10 Award Criteria: The employer reserves the right, without being liable for any damages or obligation to:

- a. Amend the scope and value of Contract to the bidder.
- b. Reject any or all the applications without assigning any reason.
- c. Any effort on the part of the bidder or his agent to exercise influence or to pressure the employer would result in rejection of his bid. Canvassing of any kind is prohibited.

- 3.11 Agreement shall be drawn with the successful bidders on prescribed standard forms. Bidder shall quote his Item rate and amount thus worked out shall be as per various terms and conditions of the said form which will form part of the agreement.
- 3.12 The time period for carrying out the work shall be as per the Para 1.2 under this Section which shall be from the date of start as defined in schedule 'F' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the tender documents.
- 3.13 The site for the work is available. Preliminary architectural and structural drawings for the work are available; however, Good for Construction (GFC) drawings shall be issued soon after award of the work.
- 3.14 The Bid documents / Tender documents consisting of plans, specifications, schedule of quantities of various types of items of work to be executed, specifications and the set of terms and conditions of the Contract to be complied can be downloaded from the Central Public Procurement Portal (CPPP) website <https://eprocure.gov.in/eprocure/app> and <https://hinducollege.ac.in/> free of cost.
- 3.15 Copy of certificate of work experience and other documents as specified in this Tender document shall physically be submitted in the office of Principal, Hindu College, Financial bid shall be opened only of those bidders meeting the Eligibility Criteria and declared qualified by HINDU COLLEGE.
- 3.16 The bid submitted are liable to become invalid if:
- The bidders are found ineligible.
 - The bidder does not submit EMD
 - The bidder does not submit all the documents (including GST registration) as stipulated in the bid document.
- 3.17 EMD amount as specified in Para 1.1 is to be submitted along with the Bid documents in any of the following forms:
- Banker's Cheque of a Commercial Bank
 - Account Payee Demand Draft (DD) of a Commercial Bank
 - Fixed Deposit Receipt (FDR) of a Commercial Bank
 - A part of earnest money is acceptable in the form of Bank Guarantee including e- Bank Guarantee also. In such cases 50% of earnest money or Rs. 20 lakh 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.
- 3.18 After opening of the Technical Bid documents, the deficiencies found in the bid of each bidder vis -a -vis requirements as per NIT will be communicated to individual bidders by email with a request to furnish required documents within Three working days of receipt, failing which it will be presumed that the individual bidder do not have any further documents to furnish and decision on bids will be taken accordingly.
- 3.19 The Bidder whose tender is accepted will also be required to furnish by way of Performance Guarantee for the fulfilment of his Contract, an amount equal to 5% of the tendered value of the work as per Clause 1A of the Conditions of the Contract.
- 3.20 The original EMD receiving authority will release the EMD to unsuccessful bidders after the expiry of stipulated bid validity period or immediately after acceptance of the successful bidder, whichever is earlier. EMD shall be refunded to the successful Bidder on receipt of Performance Guarantee submitted on award of the work.

- 3.21 BG / Bankers Cheque / Pay Order/ DD / FDR / Bonds shall be drawn in favour of Principal Hindu College, Payable at Delhi.
- 3.22 The Bidder whose bid is accepted shall also 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 subcontractors, if any engaged by the Contractor for the said work within the period specified in Schedule F.
- 3.23 The Bidder whose bid is accepted will also be required to furnish Program Chart (Time and Progress using PRIMAVERA / MS Projects) within the period as specified in Schedule F.
- 3.24 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 of conditions and rates at which stores, tools and plant, etc. will be issued to him by the HINDU COLLEGE and local conditions and other factors having a bearing on the execution of the work.
- 3.25 The competent authority on behalf of Principal HINDU COLLEGE 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.
- 3.26 The Bidder shall not be permitted to bid for works in the HINDU COLLEGE, in which his near relative is posted as Accountant or as an officer in any capacity . 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 the HINDU COLLEGE. Any breach of this condition by the Contractor would render him liable to be removed from the approved list of contractors of this College /HINDU COLLEGE.
- 3.27** The bid for the works shall remain open for acceptance for a period of **75 days** from the date of opening.
- 3.28 This notice inviting Bid shall form a part of the Contract document. The successful bidders / 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 The Notice Inviting Tender, all the documents including Additional Conditions, Additional and Special Conditions, Specifications and Drawings, etc. forming part of the bid as uploaded at the time of invitation of bid and the rates quoted at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.
- 3.29 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 the Engineer-in-Charge.
- 3.30 GST or any other tax applicable in respect of inputs procured by the Contractor for this Contract shall be payable by the Contractor and it is deemed to be included in the item rates quoted by the Contractor and HINDU COLLEGE will

not entertain any claim whatsoever in respect of the same.

- 3.31 The Contractor whose tender is accepted, will be required to furnish performance guarantee of 5% (Five Percent) of the tendered amount within the period specified in Schedule F. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs. 10,000/-) or Deposit at call receipt of any scheduled bank/Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank.
- 3.32 The contractor whose tender is accepted will also be required to furnish by way of Security Deposit for the fulfilment of his Contract, an amount equal to 2.5% of the tendered 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 cash or in the shape of Government Securities. Fixed Deposit Receipt of a Scheduled Bank or will also be accepted for this purpose provided confirmatory advice is enclosed.
- 3.33 Performance Bank Guarantee and Security Deposit Bank Guarantee as per the Clause 1 and Clause 1A of Clauses of the Contract respectively shall be drawn in favour of Principal, Hindu College ,
- 3.34 The tender submitted shall be treated as invalid if the Bidder does not quote Item rates of all items.
- 3.35 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.
- 3.36 Forfeiture of Earnest Money
1. (i) If any tenderer withdraws his tender or makes any modification in the terms & conditions of the tender which is not acceptable HINDU COLLEGE within 7 days after last date of submission of bids, then the HINDU COLLEGE shall without prejudice to any other right or remedy, be at liberty to forfeit 50% of earnest money absolutely irrespective of letter of acceptance for the work is issued or not.

(ii) If any tenderer withdraws his tender or makes any modification in the terms & conditions of the tender which is not acceptable to the department after expiry of 7 days after last date of submission of bids, then the HINDU COLLEGE shall without prejudice to any other right or remedy, be at liberty to forfeit 100% of the earnest money absolutely irrespective of letter of acceptance for the work is issued or not.
 2. If contractor fails to furnish the prescribed performance guarantee within the prescribed period, the earnest money is absolutely forfeited to the HINDU COLLEGE automatically without any notice.
 3. In case of forfeiture of earnest money as prescribed in Para (1) and (2) above, the bidder shall not be allowed to participate in the re-tendering process of the work.
- 3.37 For Composite Bids
- a. Entire work under the scope of composite bid including major and all minor components shall be executed under one agreement.
 - b. The Contractor has to associate agency(s) for minor component(s). Name of the agency(s) to be associated shall be approved by Principal, Hindu College ,
 - c. In case the Contractor intends to change any of the above

agency/agencies during the operation of the Contract, he shall obtain prior approval of Principal, Hindu College ,.

- d. The 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 Principal, Hindu College, In case of change of associate contractor, the Contractor has to enter into agreement with the new contractor associated by him.
- e. The Contractor shall prepare detailed execution programme of the work which forms part of his agreement with the HINDU COLLEGE in the event of the award. He shall indicate in the programme, the time/stage of the work when the agencies of specialized components of works will be deployed by him.
- f. Running payment for the works done and measured shall be made by Principal, Hindu College ,to the Contractor on basis of Quoted Item rates and discounts.
- g. The composite work shall be treated as complete when all the components of the work are complete. The completion certificate of the composite work shall be recorded by Principal, Hindu College after record of completion certificate of all other components.
- h. Final bill of whole work shall be finalized and paid by the Principal, Hindu College ,
- i. The completion certificate of the work shall be recorded by Principal, Hindu College ,
- j. All requirements shall be as per the NIT provisions.

3.38 List of the documents to be submitted in hard copies besides online submission by the Bidders within the period of bid submission listed as below:

- 1. Envelope No 1: EMD amount as specified in Para 1.1 to be submitted in a separate envelope superscribed 'EMD' in the form elaborated in Para 3.20.
- 2. Envelope No 2: Shall consist of Eligibility and Technical documents and superscribed as such listed below:
 - (a) Letter of transmittal.
 - (b) Certificate of Registration for GST and acknowledgement of up-to-date filled return.
 - (c) Certified copy of the partnership deed & current address of all the partners of the firm and certified copy of the power of attorney for signing the application/copy of memorandum of Articles of Association duly attested by a Public Notary and certified copy of the power of attorney for signing the application (If applicable).
 - (d) Details of the similar works carried out as per the Para 4.3 under this Section.
 - (e) Bidding Capacity.
 - (f) Balance sheet for Last three Financial Years.
 - (g) Certificates of Financial Turnover from Chartered Accountant (Form A).
 - (h) Bank Solvency Certificate (Form B).

- (i) Certificates of Work Experience (Form C & D).
- (j) Structure & Organisation (Form E)
- (k) Affidavit for “Proforma of Affidavit for Non-Black Listing” (Form F).
- (l) Any other document specified in the public notice.
- (m) List of works executed for the last 7 years (Project name, date of start, scheduled and actual date of completion, Work Order value, final value of the work upon completion, name of the Client, etc.).
- (n) List of work in Hand (progress) with date of start, scheduled date of completion, Value of work, status of work, name of the Client etc.) in the following form:

Name of work	Client who awarded the work	Ordered the Value of work	Started Date	Scheduled Completion Date	Percentage of work completed	Remarks
1.	2.			3.	4	5.

3. Envelope No 3: Price bid only to be submitted online

a. Part D1 :- BILL OF QUANTITIES WITH QUOTED ITEM RATES

4. Eligibility Criteria

- 4.1 Tenders shall be considered from eligible contractors who have satisfied eligibility criteria as specified in the tender, vide documents to be submitted in Envelope-2 of the Tender subject to producing 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 hereinafter.
- 4.2 Joint ventures and Special Purpose vehicles are not accepted.
- 4.3 Should have completed the works as mentioned below during the last ten (10) years ending previous day of last date of submission of tenders.
 - a. Three similar works each costing not less than Rs. 13.93 Cr.
 - b. Two similar work costing not less than that Rs. 20.90 Crores
 - c. One similar work each costing not less than Rs. 27.87 crores
 - d. One construction work of any nature either from the above or separately carried out of which cost is not less than Rs. 20.0 Cr. with any Central or State Government / Central or State Autonomous Body/ Central or State Public Sector Undertaking/ Reputed University/ College.

The value of work shall be brought to current cost after applying 7% compounding cost factor.

Similar work shall mean ‘the building consisting of RCC Framed Structure having minimum 4 (four) storeys or minimum 15.0 meters height (above plinth level) including Finishing works, internal Water Supply & Sanitary installations,

Internal Electrical Installation, etc., all executed under one agreement / contract’.

Bidder shall also shall have completed at least one building work involving HVAC or Mechanical Ventilation covering at least 2000 Sq.M of carpet area.

Bidders are advised to submit copy of Completion certificate issued by an officer not less than Executive Engineer rank as proof of their proposed completed work (s) which conforms to the definition of similar work.

In case of private works, the same shall be supported by TDS certificate for the work(s) under consideration.

- 4.3A Since this project is based on Exposed brick work, Exposed RCC and Exposed Delhi quartz work, the bidder should have completed at least one work with at least 50% elevation in exposed RCC and exposed brick work of covered area not less than 600 sq.mt. The College reserves the right to get this work inspected through its representatives before accepting the Technical bid. The Technical bid may be rejected if the finishes are not to be of acceptable standards.
- found
- 4.4 Should have average annual financial turnover of Rs 4.0 Cr. on construction works during last 3 years ending 31st March 2023.
- 4.5 Should not have incurred any loss (profit after tax should be positive) in more than two years during the last five years ending 31st March, 2023. Also, shall not have incurred loss during the last financial year.
- 4.6 Should have a solvency of Rs 6.0 Cr.
- 4.7 deleted
- 4.8 Financial Information
- Bidder shall furnish Annual financial statement for the last five years (in the Form “A”) and solvency certificate (in form “B”).
- 4.8 A Experience in Works, highlighting the experience in Similar Works.
- List of eligible similar nature of work successfully completed during the last Ten years(In the Form “C”, “C1”, “C2”, “C3”).
- 4.9 Performance report of works referred in form “C” shall be submitted in the form of ‘Form “D” and “D1” signed by officer not below the rank of Executive Engineer /Project Manager or equivalent.
- 4.10 Organisation information: Bidder shall submit information in respect to his organization (in the Form “E”).
- 4.11 Eligibility Letter of Transmittal shall be submitted in the format provided in Para 4.32.1.
- 4.12 The value of executed works shall be brought to current costing level by enhancing the actual value of work at Compounding rate of 7% per annum, calculated from the date of completion to previous day of last date of submission of tenders.
- 4.13 Bids of those Bidders who meet the eligibility criteria para 4.1 to 4.15 above will be evaluated for Quality / safety / schedule / performance evaluation of completed /ongoing works etc. by an Evaluation committee constituted by the Principal, Hindu College, University of Delhi, Delhi based on the following parameters. The bidder shall get minimum 60% of the allocated marks for each category of the following parameters and also shall get over all 75% overall to qualify for opening of Financial Bid.
- a. Quality/safety performance based one similar completed work -20 marks.

- b. Quality/safety performance based on one similar ongoing work – 20 marks.
- c. Schedule performance of the current and past works, in the last 5 works – 20 marks.
- d. Resources including manpower, equipment software etc. with the agency to be made available for deploying at site - 20 marks.
- e. Demonstration of capabilities of having undertaken similar projects under local by-laws / working environment using local resources etc. - 20 marks

The bidder shall submit documents/report detailing each of the above signed by the authorized signatory and should be part of the bid.

- 4.14 The bidder shall submit documents/report detailing each of the above signed by the authorized signatory and shall be part of the bid.
- 4.15 To become eligible for issue of bid, the bidders shall have to furnish an affidavit as Under:

“I / We 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 Principal, Hindu College, then I/We shall be debarred for tendering in HINDU COLLEGE in future forever. Also, if such violation comes to the notice of Principal, Hindu College before date of start of work, the Principal, Hindu College shall be free to forfeit the entire amount of EMD / Performance guarantee.”
- 4.16 The intending bidder must read the terms and conditions as spelt out in this NIT document. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required.
- 4.17 All the taxes as applicable including GST shall be borne by the Contractor himself. The Bidder shall quote his tendered amount considering all such taxes and hence their tendered amount should be inclusive of all the tax components. Goods and Service tax (GST) shall be included in the rates.
- 4.18 Information and Instruction for bidders posted on website shall form part of bid document.
- 4.19 The bid document consisting of plans / drawings, 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 the Contractor whose bid may be accepted, and other necessary documents can be seen on <https://hinducollege.ac.in/>

and on Central Public Procurement Portal (CPPP) website
<https://eprocure.gov.in/eprocure/app>

- 4.20 Tender should be submitted along with original EMD. EMD should be submitted in separate envelope super scribed 'EARNEST MONEY DEPOSIT'.
- 4.21 Certificate of Financial Turn over: At the time of submission of bid, Bidder has to Submit Affidavit/Certificate from CA mentioning Financial Turnover of last 5 years and further details if required may be asked from the Bidder after opening of eligibility bids. There is no need to submit entire voluminous balance sheet.
- 4.22 Tenderer shall ensure to quote Item rates of all BOQ items.
- 4.23 The Eligibility bid shall be opened first on due date and time as mentioned above (Referto Para no. 1.2 above). The time and date of opening of financial bid of tenderers qualifying the eligibility bid shall be communicated to them at a later date.
- 4.24 The building is targeted for minimum 3 Star GRIHA rating from TERI. The bidders shall provide all necessary support and required facilities in order to secure this rating. Nothing extra on this account shall be payable.
- 4.25 HINDU COLLEGE reserves the right to reject any prospective Tender without assigning any reason and to restrict the list of qualified Tenderers to any number deemed suitable by it, if too many bids are received satisfying the laid down criterion.
- 4.26 EMD amount as specified in Para 1.1 in the form elaborated in Para 3.20, shall be drawn in favour of Principal, Hindu College ,
- 4.27 It will be obligatory on part of the tenderer to sign the tender documents for all the components (Schedule of Quantities, General Terms & conditions, Special Terms & Conditions and Performa Schedules etc.).
- 4.28 Information pertaining to any additions, changes, modifications etc. shall be uploaded on the official websites and no separate communication shall be made in this regard. Bidders are advised to regularly check websites for further Information/Communication.

4.29 FORMS / FORMATS

4.30.1 Format for Information Regarding Eligibility Letter of Transmittal

To:

Principal, Hindu College ,
Hindu College Delhi-110007

Sub: Construction of Boys Hostel at Hindu College , University of
Delhi, Delhi.

Respected Madam,

Having examined the details given in **Notice inviting tender and bid document** for the above work, I/We, hereby submit the relevant information.

1. I / We, hereby certify that all the statements made, and information supplied in the enclosed form "A" to "F" accompanying statements are true and correct.
2. I/We have furnished all information and details necessary for pre-qualification and have no further pertinent information to supply.
3. I / We, submit the requisite certified solvency certificate and authorize the Principal, Hindu College, to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/We, also authorize Principal, Hindu College, to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4. I/We, submit the following certificates in support of our suitability, technical know-how 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 in case any information furnished by me/us found to be incorrect.

Enclosures:

Date of Submission:

Signature(s) of

Bidder(s) Seal
of the Bidder

4.30.2 FORMS 'A' to 'F'.

i. Form A – FINANCIAL INFORMATION

Financial Analysis – Details to be furnished duly supported by figures in balance sheet / Profit and Loss account for the last five years duly certified by the Chartered Accountant as submitted by the Bidder to the Income–Tax department(Copies to be attached).

Year	2018-19	2019-20	2020-21	2021-22	2022-23
Gross Annual Turnover of Construction works					
Profit/loss					

Signature(S) Of Bidder(s)
with Seal

Signature of Chartered Accountant
with Seal

**ii. FORM “B”: FORM OF BANKER’S CERTIFICATE FROM A SCHEDULED BANK
(Not more than three months old)**

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 ofRs (Rupee.....only).

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

Address ☺Signature) for the Bank

NOTE:

1. Banker’s certificates should be on letter head of the Bank addressed to tendering authority.
2. In case of partnership firm, certificate should include names of all partners as recorded withthe Bank.

iii. **FORM "C":**

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

S. No	Name of work/ project and locatio n	Owner or sponsori ng organizati on	Cost of work in crores of rupees	Date of commen cement as per contract	Stipulate d date of completi on	Actual date of completi on	Litigation/ arbitratio n cases pending/ in progress with details*	Name and address / telephon e number of officer to whom referenc e 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(s)of Bidder(s)

FORM 'C'-1

PROJECTS UNDER EXECUTION

S. No	Name of work/ Projec t and locatio n	Owner or sponsori ng organizati on	Cost of work in crores of rupees	Date of commen cemen t as per contract	Stipulate d date of completi on	Up to date percent age progres s of work	Slow progress if any and reasons thereof	Name and address / telepho ne number of officer to whom referen ce may be made	Remark s
1	2	3	4	5	6	7	8	9	10

Signature(s)of Bidder(s)

FORM 'C'-2
DETAIL OF ONE WORK IN SUPPORT OF HAVING SUCCESSFULLY
COMPLETED WITH THE STRUCTURAL SYSTEM TECHNOLOGY
PROPOSED TO BE USED IN THE WORK

S. No.	Name of work/ project and location	Owner or sponsoring organization	Contract value in crore of rupees	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Type of structural system used	Litigation / Arbitration cases pending / in progress details	Name and address/ telephone number 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	11

Signature(s) of Bidder(s)

FORM 'C'-3
Calculation of bidding capacity
Details of existing commitments and ongoing works.

S. No.	Name of work/ project and location	Owner or sponsoring organization	Contract value in crore of rupees	Date of commencement as per contract	Stipulated date of completion	of work	Remaining work in percentage (100-column 7)	Existing commitment Column 4 x Column 8 /100	Name and address/ telephone number of officer to whom reference may be made	Remarks
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= {[A×N×1.5]-B}

Certificate:

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

Signature(s) of Bidder(s)

iv. FORM "D":

PERFORMANCE REPORT OF WORKS REFERRED IN FORM 'C'

1. Name of Work/Project and Location:
2. Agreement No.
3. Estimated Cost:
4. Cost of the project done:
 - i. Tendered Cost:
 - ii. Value of work done:
5. Date of start
6. Date of completion
 - i. Stipulated date of completion:
 - ii. Actual date of completion:
7. i. Whether case of levy of compensation for delay has been decided or not:
Yes/No ii. If decided, amount of compensation levied for delayed completion if any
8. Amount of reduced rate items, if any
9. Performance Report:
 - (i) Quality of Work : Outstanding/ Very Good/Good/Poor
 - (ii) Financial Soundness : Outstanding/Very Good/Good/Poor
 - (iii) Technical Proficiency : Outstanding/ Very Good/Good/Poor
 - (iv) Resourcefulness : Outstanding/ Very Good/Good/Poor
 - (v) General behaviour : Outstanding/Very Good/Good/Poor

Signature: (Executive Engineer OR

Equivalent) Date:

Note: If Name of Work is not clearly defining scope of work as specified in the definition of similar work, bidders are advised to upload copy of Agreement/ final bill or any other relevant document in support of their proposed completed work conforming to the definition of similar work.

FORM D1**ASSESSMENT OF QUALITY FOR COMPLETED AS WELL AS ONGOING WORKS**

Name of work: -

Date of Inspection:

-

Date of submission of the report: -

A. General Observations and Operational Aspects									Yes/No
1	Availability of approval from local bodies in case of construction of private buildings.								
2	Availability of approved structural drawings.								
3	Observation on seepage/ leakage in the building								
4	Whether line and level maintained								
5	In case of basement, observation on seepage, if any.								
6	Any structural defects/ distress observed. If yes give details								
7	Whether safety measures adopted at site as per CPWD safety code and or govt. guidelines are adequate or not.								
8	Whether the welfare facilities provided to labour as per clause 19 H of GCC for CPWD works/ and or govt. guidelines are adequate or not.								
9	Whether AHU getting automatically switched off and fire dampers closed in case of fire signal								
10	Whether thimbles used for termination of wires in DBs, EBDs and panels?								
B	Quality of Work							Marks Assessed	
1	Quality of plaster/finishing								
2	Quality of RCC/CC work								
3	Quality of flooring								
4	Quality of wood work								
5	Quality of steel work / aluminium work								
6	Quality of plumbing and sanitary installation								
7	Quality of workmanship								

A. General Observations and Operational Aspects					Yes/No
8	Quality of water proofing				
9	If cladding done, observation on efficiency/ quality of cladding / brickwork				
10	Quality of internal electrification work				
11	Quality of DBs, EBDs and panels?				
12	Quality of E&M equipment, panels and feeder pillar.				
13	Quality of fire alarm system/ fire-fighting system				
14	Quality of Air conditioning work.				
15	Quality of Sub-Station based on complete live diagram, capacitor panel, power factor, insulating materials, cleanliness, cable termination, earthingpits, earthing of transformer /DG sets.				
16	Any other aspect (To be elaborated)				

Average Marks (To be awarded out of 100 Marks based on average of marks assessed on each attribute mentioned at B above).

Note:

1	All the above parameters may be considered for assessing the overall quality of work executed by the contractor.
2	In case, any attribute is not applicable, the same may not be included in assessment and mentioned are not applicable (N/A).
3	The works as assessed above shall be converted on a scale of 25/15 marks for completed/ongoing works respectively.
4	In case of eligible completed works as well as ongoing works being more than one the maximum marks assigned for completed works and ongoing works will be equally distributed among the works.

FORM “E”: STRUCTURE AND ORGANISATION

1. Name and 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)
 - i. An individual
 - ii. A proprietary Firm
 - iii. Affirm in Partnership
 - iv. A limited company or Corporation
4. Particulars of registration with various Government bodies (Attach Attested Photocopy) Organisation /Place of Registration no.
 - 1.
 - 2.
 - 3.
5. Names and Titles of Principals and Officers with designation to be concerned with thiswork.
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 has been convicted by the court of Law? If so, give details.
8. In which field of Civil Engineering Construction and MEP Works the bidder hasspecialization and interest?
9. Any other information considered necessary, but not included above.

Signature(s)
ofBidder(s)

v. FORM “F”: PROFORMA OF AFFIDAVIT FOR NOT BLACK LISTING

I/we undertake and confirm that our firm/partnership firm has not been blacklisted by any State/Central/ COLLEGE s/PSUs/Autonomous bodies during the last 7 years of its operations. Further that, if such information comes to the notice of the HINDU COLLEGE then I/we shall be debarred for bidding in HINDU COLLEGE in future forever. Also, if such information comes to the notice of HINDU COLLEGE on any day before date of start of work, Principal, Hindu Collegeshall be free to cancel the agreement and to forfeit the entire amount of Performance Guarantee (Scanned copy of this notarized affidavit to be uploaded at the time of submission of bid)

NOTE: Affidavit to be furnished on a ‘non-Judicial’ stamp paper worth Rs.100/-.

Signature of
Bidder(s) or an
authorized Officer of
the firm with stamp

Signature of Notary with seal

4.30.3 Form of Earnest Money Deposit -Bank Guarantee Bond

WHEREAS, Contractor..... (Name of Contractor) (herein after called "the Contractor") has submitted his tender dated.....(Date) for the construction of..... (name of work) (herein after called" the Tender").

KNOW ALL PEOPLE by the represents that we.....(name of bank) having our registered office at.....(herein after called "the Bank") are bound unto Principal, Hindu College , (herein after called Principal the sum of Rs.....(Rs. In words.....) for which payment welland truly to be made to the said Engineer-in-Charge the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this.....day of ... 20.... THE CONDITIONS of this obligation are:

- (1) If after Tender opening the Contractor withdraws, his tender during the period of validityof the Tender (including extended validity of Tender) specified in the Tender;
- (2) If the Contractor having been notified of the acceptance of his tender by the Principal, Hindu College :
 - (a) Fails or refuses to execute the Form of Agreement in accordance with the Instructionsto Contractor, if required.OR
 - (b)Fails or refuses to furnish the Performance Guarantee, in accordance with theprovisions of Tender document and Instructions to the Contractor,

We undertake to pay at Delhi to the Principal, Hindu College , either up to the above amount or part thereof upon receipt of his first written demand, without the Principal, Hindu Collegehaving to substantiates his demand, provided that in his demand the Principal, Hindu Collegewill note that the amount claimed by his is due to him owing to the occurrence of one or any of the above conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date*..... after the deadline for submission of Tender as such deadline is stated in the Instructions to Contractor or as it may be extended by the Principal, Hindu Collegenotice of which extension(s) to theBank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

Date.....Signature of the Bank with Seal

Witness.....

(Signature, Name and Address)

*Date to be worked out on the basis of validity period of 75 days from last date of receiptof tender including extension, if any.

*Date to be worked out on the basis of validity period of 75 days from last date ofreceipt of tender including extension, if any.

5. Item rate Tender and Contract for Works:

- a. I/We have read and examined the notice inviting tender, schedule A, B, C, D, E & F Specifications applicable, Drawings & Designs, Conditions of Contract , Clauses of Contract with amendments up to the last date of submission of tenders, Technical Specifications as per CPWD, General Conditions of the Contract, Special conditions of the Contract, Schedule of Rate & other documents and Rules referred to in the Conditions of the Contract and all other contents in the Tender document for the work “construction of boys hostel at Hindu College

Comprising of stilt +5 floors

For 566 students including structural works, finishing works, internal water supply, sanitary, storm water drainage, electrical installations including fire alarm , wi-fi & pa systems and external development works”

- b. I/We hereby tender for the execution of the work specified for the HINDU COLLEGE within the time specified in Schedule ‘F’ in accordance in all respect with the specifications, designs, schedule of quantities, drawing and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of Contract with amendments up to the last date of submission of tenders and with such materials as are provided for ,by, and in respect of accordance with, such conditions so far as applicable.
- c. We agree to keep the tender open for Seventy-Five (75) days from the date of opening of bids and not to make any modification in its terms and conditions.
- d. A sum of Rs_____is hereby forwarded in cash/receipt treasury challan/deposit at call receipt of a scheduled bank/fixed deposit receipt of scheduled bank/demand draft of a scheduled bank/bank guarantee issued by a scheduled bank as earnest money EMD.
- e. If I/We, fail to furnish the prescribed performance guarantee within prescribed period, I/We agree that the said HINDU COLLEGE, shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I/We fail to commence work as specified, I/ We agree that HINDU COLLEGE shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said performance guarantee absolutely. The said Performance Guarantee shall be a guarantee to execute all the works 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 contained in Clause 12.2 and 12.3 of the General Conditions of the Contract.
- f. Further, I/We agree that in case of forfeiture of Performance Guarantee or committing such breach as aforesaid, I/We shall be debarred for participation in the re-tendering process of the work.
- g. I/We 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 HINDU COLLEGE, then I/We shall be debarred for tendering in HINDU COLLEGE in future forever. Also, if such a violation comes to the notice of HINDU COLLEGE before date of start of work, Principal, Hindu College ,shall be free to forfeit the entire amount of Performance Guarantee.
- h. 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:.....

Signature of the Bidder:.....

Address:

Postal Address:.....

Position:

Witness Signature:

Witness name and address:

(Blanks to be filled by the Bidder)

5.3 HINDU COLLEGE Acceptance

The above tender (as modified by you as provided in the letters mentioned here under) is accepted by me for an on behalf of Principal HINDU COLLEGE for a sum of Rs.

.....(Rupee.....).

The letters refer red to below shall form part of this Contract agreement:

(a)

(b)

For & on behalf of

Signature.....

Dated:

Designation.....

(Blanks to be filled by Principal, Hindu College)

Part A1-

6 :- Online Bidding Conditions

1. Information and Instructions for bidders posted on website shall form part of bid document.
2. 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://eprocure.gov.in/eprocure/app> in free of cost.
3. 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
4. The intending bidder must have valid class-III digital signature to submit the bid.
5. On opening date, the contractor can login and see the bid opening process. After opening of bids he will receive the competitor bid sheets.
6. Contractor can upload documents in the form of JPG format and PDF format.
7. Contractor must ensure to quote rate of each item, while selecting any of the cells a warning appears that if any cell is left blank the same shall be treated as "0". Therefore, if any cell is left blank and no rate is quoted by the bidder, rate of such item shall be treated as "0" (ZERO).
8. In e-Tendering intending bidder can quote his rates in figures only. The rates in words against amount of each item and total is generated automatically. Therefore, the rate quoted by the bidder in figures will be taken as final.
9. The bid can only be submitted after uploading the mandatory scanned documents such as Demand Draft or Pay order or Banker's Cheque or Deposit at call Receipt or Fixed Deposit Receipts and towards cost of EMD in favor of **Principal, Hindu College** to be deposited with <http://eprocure.gov.in/eprocure/app> / NEFT facility.
10. The physical EMD of the scanned copy of EMD uploaded shall be deposited by the lowest tenderer before opening of financial bid failing which the tender shall be rejected.
11. **Copy of enlistment order and certificate of work experience and other documents as specified in the Press Notice / web notice shall be scanned and up-loaded to the e-Tendering website within the period of bid submission. However, certified / original copy of all the scanned and up-loaded documents as specified in press notice web / notice shall have to be submitted by the lowest bidder physically in the office of e-tendering authority and it shall be sole responsibility of lowest bidder.**

12. **Online bid documents submitted by intending bidders shall be opened only of those bidders, who has deposited EMD and other documents scanned and uploaded are found in order.**
13. **The bid submitted shall become invalid if:**
 - a. The bidder is found ineligible if he fails to upload documents
 - b. The bidder does not upload all the documents (including GST registration) as stipulated in the bid document
 - c. If any discrepancy is noticed between the documents as uploaded at the time of submission of bid and hard copies as submitted physically by the lowest tenderer in the office of tender opening authority.
 - d. If the bidder does not deposit physical EMD before opening of Technical Bid.
 - e. The Bidder does not upload ESI & EPF Registration.
14. Bid validity shall be **75 days** from last date of submission of bid.
15. Rate of bidders shall be considered inclusive of GST.

List of Documents to be scanned and uploaded within the period of bid submission:

1. Demand Draft/Pay order or Banker`s Cheque /Deposit at Call Receipt/FDR of any Scheduled Bank against EMD and tender fee.
2. Enlistment order of contractor.
3. Certificates of work experience.
4. Certificate of Registration for GST and acknowledgement of up to date filed return of GST.
5. Acceptance to execute INTEGRITY PACT.
6. ESI & EPF registration.
7. FORM "F" (Duly filled with all required details).
8. Tender Fee of Rs. 5000/- in favour of Hindu College.
9. In case of Partnership firm if all the papers of tender not signed by all the partners than a power of attorney authorizing the person who has signed the tender paper must be uploaded with the tender documents.
10. Annexure-I (duly filled & signed by the bidders)
11. Annexure-II (duly filled & signed by the bidders)
16. Details of criteria for eligibility As Indicated in "INFORMATION AND INSTRUCTIONS FOR CONTRACTORS FOR e- TENDERING FORMING PART OF NIT AND TO BE POSTED ON WEBSITE"
17. To become eligible for issue of tender, the tenderer shall have to furnish an affidavit as under:-
I/We undertake and confirm that eligible similar works(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 tendering in Hindu College in future forever. Also, if such a violation comes to the notice of Hindu College before date of start of work, the Principal, Hindu College shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee. (Scanned copy to be uploaded at the time of submission of bid)
18. 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 except Standard General Conditions of Contract Form can be seen from the web Site <http://eprocure.gov.in/eprocure/app> or iitd.ac.in or e-procure.gov **free** of cost.
19. After submission of the bid the contractor can re-submit revised bid any number of times but before last time and date of submission of tender as notified.
20. While submitting the revised bid, contractor can revise the rate of one or more item(s) any number of times (he need not re-enter rate of all the items) but before last time and date of submission of tender as notified.
21. If it is desired to submit revised financial bid then it shall be mandatory to submit revised financial bid. If not submitted then the tender submitted earlier shall become invalid.

A part of earnest money is acceptable in the form of bank guarantee also. In such case, 50% of earnest money or Rs. 20 lakh, whichever is less, will have to be deposited in shape prescribed above, and balance in shape of Bank Guarantee of any scheduled bank which is to be scanned and uploaded by the intending bidders.

Interested contractor who wish to participate in the bid has also to make following payments in the form of Demand Draft/Pay order or Banker's Cheque of any Scheduled Bank and to be scanned and uploaded to the e-Tendering website within the period of bid submission:

<http://eprocure.gov.in/eprocure/app>.

22. The time & date of submission & opening of financial bid of contractors qualifying the **criteria as per Tender Notice** shall be communicated to them at a later date.
23. The contractor whose bid is accepted, will be required to furnish performance guarantee of 5% (Five Percent) of the tendered and accepted of the bided amount within the period specified in Schedule F. This guarantee shall be in the form of cash (in case guarantee amount is less than Rs. 10000/-) or Deposit at Call receipt of any scheduled bank/Banker's cheque of any scheduled bank/ Demand Draft of any scheduled bank/Pay order of any Scheduled Bank of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities or Fixed Deposit Receipts or irrevocable Bank Guarantee Bonds of any Scheduled 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.
24. This notice inviting Tender shall form a part of the contract document. 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 consisting of:-
 - a) The Notice Inviting Tender, all the documents including additional conditions, specifications and drawings, if any, forming part of the tender as uploaded at the time of invitation of tender and the rates quoted online at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.
 - b) Standard CPWD Form - 8 as mentioned.
25. In case 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 Principal, Hindu College, then the bid submitted shall become invalid.

Part A-1.

7

Instructions for Online Bid Submission:

As per the directives of Department of Expenditure, this tender document has been published on the Central Public Procurement Portal ([URL: http://eprocure.gov.in/eprocure/app](http://eprocure.gov.in/eprocure/app)). The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at:

<http://eprocure.gov.in/eprocure/app>

REGISTRATION

- 1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal ([URL: http://eprocure.gov.in/eprocure/app](http://eprocure.gov.in/eprocure/app)) by clicking on the link "Click here to Enroll". Enrolment on the CPP Portal is free of charge.
- 2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
- 3) Bidders are advised to register their valid email address and mobile numbers as part of

the registration process. These would be used for any communication from the CPP Portal.

- 4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / TCS / nCode / eMudhra etc.), with their profile.
- 5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSCs to others which may lead to misuse.
- 6) Bidder then logs in to the site through the secured log-in by entering their userID / password and the password of the DSC / eToken.

SEARCHING FOR TENDER DOCUMENTS

- 1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, organization name, location, date, value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as organization name, form of contract, location, date, other keywords etc. to search for a tender published on the CPP Portal.
- 2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.
- 3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

PREPARATION OF BIDS

- 1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- 2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.
- 3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF formats. Bid documents may be scanned with 100 dpi with black and white option.

- 4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use “My Space” area available to them to upload such documents. These documents may be directly submitted from the “My Space” area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

SUBMISSION OF BIDS

- 1) Bidder should log into the site well in advance for bid submission so that he/she upload the bid in time
i.e., on or before the bid submission time. Bidder will be responsible for any delay due to other issues.
- 2) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
- 3) The bidder has to select the payment option as “on-line” to pay the tender fee / EMD as applicable and enter details of the instrument. Whenever, EMD / Tender fees is sought, bidders need to pay the tender fee and EMD separately on-line through RTGS (Refer to Schedule, Page No.2).
- 4) A standard BoQ format has been provided with the tender document to be filled by all the bidders. Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

OR

In some cases Financial Bids can be submitted in PDF format as well (in lieu of BOQ).

- 5) The server time (which is displayed on the bidders’ dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.
- 6) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done.
- 7) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 8) Upon the successful and timely submission of bids, the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
- 9) Kindly add scanned PDF of all relevant documents in a single PDF file of compliance sheet.

ASSISTANCE TO BIDDERS

1. Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.
2. Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk. The contact number for the helpdesk is 1800 233 7315.

General Instructions to the Bidders

- 1) The tenders will be received online through portal <http://eprocure.gov.in/eprocure/app> . In the Technical Bids, the bidders are required to upload all the documents in .pdf format.
- 2) Possession of a Valid Class II/III Digital Signature Certificate (DSC) in the form of smart card/e-token in the company's name is a prerequisite for registration and participating in the bid submission activities through <https://eprocure.gov.in/eprocure/app>. Digital Signature Certificates can be obtained from the authorized certifying agencies, details of which are available in the web site <https://eprocure.gov.in/eprocure/app> under the link "Information about DSC".
- 3) Tenderer are advised to follow the instructions provided in the 'Instructions to the Tenderer for the e- submission of the bids online through the Central Public Procurement Portal for e- Procurement at <https://eprocure.gov.in/eprocure/app>.

Tender Documents may be downloaded from Central Public Procurement Portal <http://eprocure.gov.in/eprocure/app>. Aspiring Bidders who have not enrolled / registered in e- procurement should enroll / register before participating through the website <http://eprocure.gov.in/eprocure/app> . The portal enrolment is free of cost. Bidders are advised to go through instructions provided at 'Instructions for online Bid Submission '.

Tenderers can access tender documents on the website (For searching in the NIC site, kindly go to Tender Search option and type 'Hindu College'. Thereafter, Click on "GO" button to view all Hindu college Delhi tenders). Select the appropriate tender and fill them with all relevant information and submit the completed tender document online on the website <http://eprocure.gov.in/eprocure/app> as per the schedule given in the next page.

No manual Financial bids will be accepted. All quotes (Financial bids should be submitted in the E-procurement portal.

**<< Organization Letter Head >>
DECLARATION SHEET**

We, _____ hereby certify that all the information and data furnished by our organization with regard to this tender specification are true and complete to the best of our knowledge. I have gone through the specification, conditions and stipulations in details and agree to comply with the requirements and intent of specification.

This is certified that our organization has been registered as per Tender Notice & NIT & Hindu College form 8 Tender. We further certify that our organization meets all the conditions of eligibility criteria laid down in this tender document.

We, further specifically certify that our organization has not been Black Listed/DeListed or put to any Holiday by any Institutional Agency/ Govt. Department/ Public Sector Undertaking in the last three years.	NAME & ADDRESS of the Vendor/ Manufacturer / Agent
1. Phone	
2. Fax	
3. E-mail	
4. Contact Person Name	
5. Mobile Number	
6. GST Number	
7. PAN Number	
8.(In case of on-line payment of Tender Fees) UTR No. (For Tender Fee)	
9.(In case of on-line payment of EMD) UTR No. (For EMD)	

(Signature of the Tenderer)

Name:

Seal of the Company

Signature

re of Bidder Name: _____

Designation: _____

PART A-2 : CONDITIONS OF THE CONTRACT

GENERAL CONDITIONS OF THE CONTRACT

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6. GENERAL CONDITIONS OF THE CONTRACT:

6.1 Definitions

The **Contract** means the documents forming the tender and acceptance thereof and the formal agreement executed between the competent authority on behalf of the Chairman , Governing Body Hindu College and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Principal, Hindu college and all these documents taken together, shall be deemed to form one Contract and shall be complementary to one another.

1. In the Contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them: -
 - a. 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.
 - b. 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 or where work is to be executed under the Contract or any adjacent land, path or street which may be temporally allotted or used for the purpose of carrying out the Contract.
 - c. 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, for the successors of such firm or company and the permitted assignees of such individual, firm or company.
 - d. The word 'President' may be read as 'The Chairman, Governing Body of The **HINDU COLLEGE**'. **College** means Hindu College a constituent college of University of Delhi.
 - e. The **Principal** means Principal, Hindu College and her successors.
 - f. The word '**Engineer-in-charge**' may be read as The Principal, Hindu College, who shall supervise and be in charge of the work and who shall sign the Contract on behalf of Chairman, Governing Body , HINDU COLLEGE as mentioned in Schedule 'F' hereunder.
 - g. The **Architect/ Architectural consultant** means the consulting agency appointed by Principal, Hindu College ,for comprehensive architectural design of the building.
 - h. Accepting Authority shall mean the authority mentioned in Schedule 'F' for acceptance of the Tender.
 - i. **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 HINDU COLLEGE of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to HINDU COLLEGE faulty design of works.

- j. **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 overheads and profits shall be payable on the part(s) of work assigned to other agency(s) by the Contractor as per terms of the Contract.
 - k. **Schedule(s)** referred to in these conditions shall mean the relevant schedule(s) annexed to the tender documents or the standard Schedule of Rates of the government mentioned in Schedule "F" hereunder, with the amendments thereto issued up to the date of receipt of the tender.
 - l. **The word Department may be read as 'HINDU COLLEGE'** which invites tenders on behalf of Chairman, Governing BODY of Hindu College as specified in schedule 'F'.
 - m. Tendered value means the value of the entire work as stipulated in the letter of award.
 - n. 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.
 - o. GST shall mean Goods and Service Tax Central, State and Inter State
2. Scope and Performance
- a. 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.
 - b. 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.
 - c. 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 documents. None of these documents shall be used for any purpose other than that of this Contract.
3. Works to be carried out
- The work to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labourers, 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.
4. Sufficiency of Tender
- 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
5. Discrepancies and Adjustment of Errors
- The several documents forming the Contract 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.

- i. In the case of discrepancy between the schedule of Quantities, the Specifications and/ or the Drawings, the following order of preference shall be observed: -
 - a. Drawings
 - b. Description of Schedule of Quantities.
 - c. Particular Specifications and Special Conditions, if any
 - d. Specifications of Contract / CPWD specifications
 - e. Indian Standard Specifications of B.I.S.
 - ii. 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.
 - iii. Any error in description, quantity or rate in Schedule of Quantities or any omission therefrom 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.
6. Signing of the Contract
- The successful tenderer, 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 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 Form as mentioned in Schedule 'F' consisting of:
 - a. Various standard clauses with corrections up to the date stipulated in Schedule 'F' along with annexures thereto.
 - b. C.P.W.D. Safety Code/ Contract Safety Code/Safety Code.
 - c. Model Rules for the protection of health, sanitary arrangements for workers employed by CPWD or its contractors.
 - d. CPWD Contractor's Labour Regulations.
 - e. List of Acts and omissions for which fines can be imposed.
- Note: The above formats and documents, even though form part of the HINDU COLLEGE Contract, they have been derived as standard formats from CPWD.
- iii. No payment for the work done will be made unless the Contract is signed by the Contractor.

6.2 CLAUSES OF THE CONTRACT:

Clause 1: Performance Guarantee:

- i. The Contractor shall submit an irrevocable Performance Guarantee of 5% (Five percent) of the tendered amount in addition to other deposits mentioned elsewhere in the Contract for his proper performance of the Contract Agreement, (not withstanding and/or without prejudice to any other provisions in the Contract) within period specified in 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 Accounts Payee Banker's Cheque/Demand Draft/Pay Order of any scheduled Bank

or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the form annexed hereto. In case a fixed deposit receipt of any Bank is furnished by the Contractor to the HINDU COLLEGE 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 HINDU COLLEGE to make good the deficit.

- ii. The Performance Guarantee shall be initially valid up to the stipulated date of completion plus minimum 6 months beyond that. If the same is submitted by the agency on scheduled format-I as per GCC. In case the time for completion of work gets enlarged, the Contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the Contractor, without any interest. However, in case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.
- iii. The Engineer-in-Charge shall make a claim under the performance guarantee except for amounts to which the Principal, Hindu College is entitled under the Contract (not withstanding and/or without prejudice to any other provisions in the Contract agreement) in the event of:
 - a. Failure by the Contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Engineer-in-Charge may claim the full amount of the Performance Guarantee.
 - b. Failure by the Contractor to pay Principal of HINDU COLLEGE any amount due, either as agreed by the Contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-Charge.
- 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 forfeited in full and shall be absolutely at the disposal of the Principal, HINDU COLLEGE.
- 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 recorded 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 of the Contract.

This provisional completion certificate shall be recorded by the concerned Engineer-in-charge. 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 work, 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/persons whose tender(s) may be accepted (hereinafter called the Contractor) shall permit HINDU COLLEGE 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 2.5% of the tendered value of the work. Such deductions will be made and held by HINDU COLLEGE 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 or fixed deposit receipts. In case a fixed deposit receipt of any Bank is furnished by the Contractor to the HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 Scheduled Banks or Government Securities (if deposited for more than 12 months) endorsed in favour of the Engineer-in-Charge, 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 scheduled 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: Government 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 Government paper would be ascertained by the Engineer-In-Charge at the time of collection of interest and the amount of interest to the extent of deficiency in value of the Government paper will be withheld if necessary.

Note-2: Government 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 HINDU COLLEGE on account of such breach, pay as compensation the amount calculated at the rates stipulated below as the authority specified in schedule 'F' may decide on the amount of accepted 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.

- a. 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 HINDU COLLEGE. In case, the Contractor does not achieve a particular milestone mentioned in Schedule F (Clause 5), 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 any other rights or remedy against the Contractor in respect of any delay, not following safety norms, 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 HINDU COLLEGE 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 HINDU COLLEGE.
- vi. If the Contractor shall enter into a Contract with HINDU COLLEGE 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 HINDU COLLEGE 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.
- xii. When the Contractor has made himself liable for action under any of the cases aforesaid (i) to (xi) , the Engineer-in-Charge on behalf of, Hindu College 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, 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 HINDU COLLEGE.

- 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 3 A

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

If the Tendered value of work is up to Rs. 1 Crore: 15 days.

If the Tendered value of work is more than Rs. 1 Crore

and up to Rs.10 Crore: 21 days

If the Tendered value of 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) 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 work 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 HINDU COLLEGE 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 milestone. 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 (Clause 5) 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 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 College or for any reason / event, for which the College is responsible, the authority as indicated in Schedule 'F' shall, if justified, give a fair and reasonable extension of time and reschedule the milestones 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.
- 5.4 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 the 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 milestones. Engineer -in- Charge shall finalize/ 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.
- 5.5 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.

Clause 6: Computerized Measurement Book

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

- 6.2** 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 HINDU COLLEGE so that a complete record is obtained of all the items of works performed under the Contract.
- 6.3** 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.
- 6.4** 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.
- 6.5** 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 College. Thereafter, the MB shall be taken in the Principal, Hindu College 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 Principal, Hindu College 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.
- 6.6** 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 Principal, Hindu College Office and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.
- 6.7** 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.
- 6.8** 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.
- 6.9** 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.

- 6.10** 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.
- 6.11** 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 defect's liability period.

Clause 7: Payment on intermediate certificate to be regarded as Advances

- 7.1** No payment shall be made for work, estimated to cost Rs. Twenty lakhs 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 lakhs 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.
- 7.2** 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.

- 7.3 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.

Payments in composite Contracts

In case of composite tenders, running payment for the major and minor components shall be made by Principal, Hindu College to the Contractor.

In case main Contractor fails to make the payment to 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, Principal, Hindu College, shall serve the show cause to the Contractor and if reply of the Contractor either not received or found unsatisfactory, he may make the payment directly to contractor associated for minor component as per the terms and conditions of the agreement drawn between the Contractor and associate contractor fixed by him. Such payment made to the associate contractor shall be recovered by Engineer-in-charge from the next Running Account Bill / final bill due to the 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 8: Completion Certificate and Completion Plans:

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 of 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 8 A: Completion Plans 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 plans 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 in 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 and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within Six months period, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his authorized Engineer, complete with account of materials issued by the College and dismantled materials.

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 HINDU COLLEGE or his signature on the bill or other claim preferred against HINDU COLLEGE 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 vis-a-vis the Principal, HINDU COLLEGE.

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 HINDU COLLEGE as per [Appendix F](#).

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 tests. The lab shall be equipped at least with the testing equipment as specified in schedule F.

Clause 10 B: Secured Advance on Materials

- (i) The Contractor, on signing an indenture in the form to be specified by the Engineer-in-Charge, shall be entitled to be paid during the progress of the execution of the work up to 75% of the assessed value of any materials or an amount not exceeding 75% of the material element cost in the tendered rate of the finished item of the work, whichever is lower, which are in the opinion of the Engineer-in- Charge non-perishable, non- fragile and non-combustible and are in accordance with the Contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered/deducted from the next payment made under any of the clause or clauses of this Contract.

Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of the Engineer-in-Charge provided the Contractor provides a comprehensive insurance cover for the full cost of such materials. The decision of the Engineer- in-Charge shall be final and binding on the Contractor in this matter. No secured advance, shall however, be paid on high-risk materials such as ordinary glass, sand, petrol, diesel etc.

Mobilization advance

- (ii) Mobilization advance not exceeding 10% of the tendered value may be given, if requested by the Contractor in writing within one month of the order to commence the work. Such advance shall be in two or more instalments to be determined by the Engineer-in- Charge at his sole discretion. The first instalment of such advance shall be released by the Engineer-in-charge to the Contractor on a request made by the Contractor to the Engineer-in-Charge in this behalf. The second and subsequent instalments shall be released by the Engineer-in-Charge only after the Contractor furnishes a proof of the satisfactory utilization of the earlier instalment to the entire satisfaction of the Engineer-in-Charge.

Before any instalment of advance is released, the Contractor shall execute a Bank Guarantee Bonds not more than 6 (six) in number from Scheduled Bank for the amount equal to 110% of the amount of advance and valid for the period till recovery of advance. This (Bank Guarantee from Scheduled Bank for the amount equal to 110% of the balance amount of advance) shall be kept renewed from time to time to cover the balance amount and likely period of complete recovery.

Interest & Recovery

- (iii) The mobilization advance in (ii) above bear simple interest at the rate of 10 percent per annum and shall be calculated from the date of payment to the date of recovery, both days inclusive, on the outstanding amount of advance. Recovery of such sums advanced shall be made by the deduction from the contractors bills commencing after first ten percent of the gross value of the work is executed and paid, on pro-rata percentage basis to the gross value of the work billed beyond 10% in such a way that the entire advance is recovered by the time eighty percent of the gross value of the Contract is executed and paid, together with interest due on the entire outstanding amount up to the date of recovery of the instalment.
- (iv) If the circumstances are considered reasonable by the Engineer-in-Charge, the period mentioned in (ii) and (iii) for request by the Contractor in writing for grant of mobilization advance may be extended at the discretion of the Engineer-in-Charge

Clause 10 C

Payment on Account of Increase in Wages due to Statutory Order(s)

If after submission of tender, if the wages of labour increases as a direct result of the coming into force of any fresh law or statutory rule or order (but not due to any variation of rate in GST) beyond the wages prevailing at the time of the last stipulated date of receipt of tenders including extensions, if any, for the work during Contract period including the justified period extended under the provisions of clause 5 of the Contract without any action under clause 2, then the amount of the Contract shall accordingly be varied.

If after submission of the tender, the wages of labour as prevailing at the time of last stipulated date of receipt of tender including extensions, if any, is decreased as a direct result of the coming into force of any fresh law or statutory rules or order (but not due to any variation of rate in GST), HINDU COLLEGE shall in respect of the labour engaged on the execution of the work after the date of coming into force of such law, statutory rule or order be entitled to deduct from the dues of the Contractor, such amount as equivalent to the difference between the wages as prevailed at the time of the last stipulated date for receipt of tenders including extensions if any for the work and the wages of labour on the coming into force of such law, statutory rule or order. This will be applicable for the Contract period including the justified period extended under the provisions of clause 5 of the Contract without any action under clause 2.

Engineer-in-Charge shall call books of account and other relevant documents from the Contractor to satisfy himself about reasonability of increase in wages.

The Contractor shall, within a reasonable time of his becoming aware of any alteration in the wages of labour, give notice thereof to the Engineer-in-Charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in position to supply.

For this purpose, the labour component of 85% of the value of the work executed during period under consideration shall not exceed the percentage as specified in Schedule F, and the

increase/decrease in labour shall be considered on the minimum daily wages in rupees of any unskilled Mazdoor, fixed under any law statutory rule and order. The cost of work for which escalation is applicable (W) is same as cost of work done worked out as indicated below except the amount of full assessed value of secured Advance.

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

- (i) 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 (fresh paid in this quarter) = (D)
 - (e) Full assessed value of Secured Advance 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 $M = C + F + I - J$

Cost of work for which escalation is applicable: $W = 0.85 M$

Clause 10 D: Dismantled Material HINDU COLLEGE Property:

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

Clause 11: Work 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 12.1 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-Charge² Deviation, Extra Items and Pricing.

12.2 Deviation, Extra Items and Pricing

In the case of extra item(s) (items that are completely new, and are in addition to the items contained in the Contract), which are available in the standard schedule of rates specified in Schedule F, shall be paid as per the said schedule rate plus/minus percentage above/below worked out on basis of cumulative total amount of scheduled items as per rates quoted by the agency and cumulative amount of these scheduled items as per applicable DSR for that Sub-Head.

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

The rates of the extra items so determined by the Engineer-in-charge shall be final and binding on the contractor, and shall not be arbitrable.

In the case of substituted items (items that are taken up with partial substitution or in lieu of items of work in the Contract), and which are not available in the standard schedule of rates, the rate for the agreement item (to be substituted) and substituted item, shall also be determined in the manner as mentioned in the following para.

- (a) If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the Contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).
- (b) If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the Contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).

Deviation, deviated Quantities, Pricing

All the deviated quantities shall be paid at agreement rates.

The prescribed time limit for finalizing rates for Extra Item(s), Substitute Item(s) and Deviated Quantities of Contract items is within 45 days after submission of proposal by the Contractor without observation of the Engineer-in-Charge.

12.3. The provisions of the preceding paragraph shall also apply to the decrease in the rates of items for the work in excess of the limits laid down in Schedule 'F', and the Engineer-in-Charge shall after giving notice to the Contractor within one month of occurrence of the excess and after taking into consideration any reply received from him within fifteen days of the receipt of the notice, revise the rates for the work in question within one month of the expiry of the said period of fifteen days having regard to the market rates.

12.4 For the purpose of operation of Schedule "F", the following works shall be treated as works relating to foundation unless & otherwise defined in the Contract:

- (i) For Buildings: All works up to 1.2 metres above ground level or up to floor 1 level whichever is lower.
- (ii) For abutments, piers and well staining: All works up to 1.2 m above the bed level.
- (iii) For retaining walls, wing walls, compound walls, chimneys, overhead reservoirs/ tanks and other elevated structures: All works up to 1.2 metres above the ground level.
- (iv) For reservoirs/tanks (other than overhead reservoirs/tanks): All works up to 1.2 metres above the ground level.
- (v) For basement: All works up to 1.2 m above ground level or up to floor 1 level whichever is lower.
- (vi) For Roads, all items of excavation and filling including treatment of sub base.

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

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) HINDU COLLEGE shall have the option to take over the 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 HINDU COLLEGE 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 HINDU COLLEGE, 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 HINDU COLLEGE 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 HINDU COLLEGE 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 amount and initially valid up to the extended date of completion or stipulated date of completion if no extension has been granted plus minimum 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 the 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 working 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 working 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 HINDU COLLEGE, 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 HINDU COLLEGE 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 HINDU COLLEGE in completing the partwork/ part incomplete work of any item(s) or the excess loss of damages suffered or may be suffered by HINDU COLLEGE as aforesaid after allowing such credit shall without prejudice to any other right or remedy available to Government 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 contractor's' 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 HINDU COLLEGE or where it affects whole of the works, as an abandonment of the works by HINDU COLLEGE, 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 HINDU COLLEGE, 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 unskilful 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 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 sufficient portion thereof. The security deposit of the Contractor shall not be refunded before the expiry of twelve months 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.

Clause 18: Contractor to Supply Tools & Plants etc.

The Contractor shall provide at his own cost all materials 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 Workman's Compensation Act. 1923, HINDU COLLEGE is obliged to pay compensation to a workman employed by the Contractor, in execution of the works, HINDU COLLEGE will recover from the Contractor ,the amount of the compensation so paid: and without prejudice to the rights of the HINDU COLLEGE under sub- section(2) of section 12 , of the said Act, HINDU COLLEGE 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 HINDU COLLEGE to the Contractor whether under this Contract or otherwise. HINDU COLLEGE 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 HINDU COLLEGE full security for all costs for which HINDU COLLEGE might become liable in consequence of contesting such claim.

Clause 18B: 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, HINDU COLLEGE 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 Rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by HINDU COLLEGE. Contractors, HINDU COLLEGE 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 HINDU COLLEGE under sub-section(2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, HINDU COLLEGE 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 HINDU COLLEGE to the Contractor whether under this Contract or otherwise HINDU COLLEGE 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 HINDU COLLEGE full security for all costs for which HINDU COLLEGE might become liable in contesting such claim.

Clause 19: Labour Laws to be complied by the Contractor.

The Contractor shall obtain a valid license under the Contract Labour (R&A) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work.

The Contractor shall also 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 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 fulfil 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 19B: 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 wage 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.
- (v) The Contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workman'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 there under from time to time.

- (vi) The Contractor shall indemnify and keep indemnified HINDU COLLEGE against payments to be made under and for the observance of the laws aforesaid and the CPWD. 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 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 as decided by the authority mentioned in Schedule F 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 19D

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: -

- (a) the number of labourers employed by him on the work,
- (b) their working hours,
- (c) the wages paid to them,
- (d) the accidents that occurred during the said for night showing the circumstances under which they happened, and the extent of damage and injury caused by them, and
- (e) the number of female workers who have been allowed maternity benefit according to Clause 19 F and the amount paid to them.

Failing which the Contractor shall be liable to pay to HINDU COLLEGE, a sum as decided by the authority mentioned in Schedule F for each default or materially incorrect statement. The decision of the Engineer-In-Charge 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 Government from time to time for the protection of health and sanitary arrangements for workers employed by the Central Public Works Department and its contractors.

Clause 19F

Leave and pay during leave shall be regulated as follows: -

1. Leave:

- (a) 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,
 - (b) in the case of miscarriage - up to 3 weeks from the date of miscarriage.
2. Pay:
- (a) 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.
 - (b) 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 19G

In the event of the Contractor(s) committing a default or breach of any of the provisions of the Central Public Works Department, 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 HINDU COLLEGE a sum as decided by the authority mentioned in Schedule F for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of 'he Contractor(s) defaulting continuously in this respect, the penalty may be enhanced to as decided by the authority mentioned in Schedule F per day for each day of default subject to a maximum of 5 percent 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 C.P.W.D. 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 a "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 remodelled 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 19H

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.

- (a) The minimum height of each hut at the eaves level shall be 2.10 m (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 1.80 m x 1.50 m '6"5') 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.
- (e) 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 kutchra 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.
- (f) The Contractor(s) shall provide each hut with proper ventilation.
- (g) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.
- (h) There shall be kept an open space of at least 7.2 m (8 yards) between the rows of huts which may be reduced to 6 m (20 ft.) according to the availability of site with the approval of the Engineer-in-Charge. Back-to-back construction will be allowed.
- (i) 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.
- (j) (j) The site selected for the camp shall be high ground, removed from jungle.
- (k) 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.

- (l) Drainage – The Contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.
- (m) The Contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.
- (n) 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 contractor's' 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 19J: 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 College /Industrial Training College / National College of construction Management and Research (NICMAR)/ National Academy of Construction, CIDC or any similar reputed and recognized College managed/ certified by State/Central Government. The number of such qualified tradesmen shall not be less than 20% 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 recognized College 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 specified in schedule 'F' per such tradesman 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.

For work costing more than Rs. 10 Crores and up to Rs. 50 Crores, the Contractor shall arrange on site training as per National Skill Development Corporation (NSDC) norms for at least 20% of the unskilled workers engaged in the project in co-ordination with the CPWD Regional Training College & National Skill Development Corporation (NSDC) for certification at the level of skilled/semi-skilled tradesmen.

For works costing more than Rs. 50 Crores, the Contractor shall arrange on site training as per National Skill Development Corporation (NSDC) norms for at least 30% of the unskilled worker engaged in the project in co-ordination with the CPWD Regional Training College & National Skill Development Corporation (NSDC) for certification at the level of skilled/semi-skilled tradesmen. The cost of such training as stated above shall be borne by the Contractor. The

necessary space and workers shall be provided by the Contractor and no claim what so ever shall be entertained.

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 which shall NOT be reimbursed by the Hindu College to the contractor.

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 there under 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 in solvency

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 HINDU COLLEGE 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 Principal, HINDU COLLEGE shall have power to adopt the course specified in Clause 3 hereof in the interest of HINDU COLLEGE 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 HINDU COLLEGE 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 1 (One) year 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 3 days, then action for debarring of the agency shall be taken by the appropriate authority.

Clause 25: Settlement of Disputes by Arbitration

Except where otherwise provided in the Contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in before mentioned and as to the quality of workmanship or materials used on 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 these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter:

- (i) If the contractor considers any work demanded of him to be outside the requirements of the Contract, or disputes any drawings, 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 is disputed, such party shall promptly within 15 days of the arising of the disputes refer such disputes and amount claimed for each dispute to the Conciliator (Chairman, Building Committee of Hindu College) in the proforma prescribed in Appendix XVII mentioned in schedule F, under intimation to other party.
- (ii) If the decision of the Conciliator is not acceptable to any party, either party shall promptly request to Chairman, Building Committee, HINDU COLLEGE hereinafter referred to as Arbitration Appointing Authority as indicated in Schedule F, for appointment of arbitrator on prescribed proforma as per Appendix XVIII under intimation to the other party.

In 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 the Arbitrator.

- (a) Number of Arbitrators:- If the contract amount is less than Rs. 100 Crores , the dispute shall be referred for adjudication by a sole Arbitrator.
- (b) It is also a term of this Contract that member of the Arbitration Tribunal shall be a Graduate Engineer with experience in handling public works engineering contracts, and further he shall have earlier worked at a level not lower than Chief Engineer/ equivalent (i.e. Joint Secretary level of Government of India). This shall be treated as a mandatory qualification to be appointed as arbitrator.
- (c) Parties to select Arbitrator: Based on the criteria specified above, a list of empaneled Arbitrators has been prepared in CPWD, and the parties shall have option to select an Arbitrator from the list sent to them.

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 CPWD Empanelled Arbitrators forwarded to them , the Arbitrator Appointing Authority shall himself select and appoint Arbitrator from the list.

Dispute or difference shall be referred for adjudication through arbitration by a Tribunal

having sole arbitrator where claimed amount is Rs 100 Crore or less. Where claimed Value is more than Rs. 100 Crore, Tribunal shall consist of three Arbitrators. The requirements of the Arbitration and Conciliation Act, 1996 (26 of 1996) and any further statutory modification or re-enactment thereof and the rules made there under and for the time being in force shall be applicable.

It is a term of this Contract that the party invoking arbitration shall give a list of disputes with amounts claimed, if any, in respect of each such dispute along with the notice for appointment of arbitrator.

Parties, before or at the time of appointment of Arbitral Tribunal may agree in writing for fast-track arbitration as per the Arbitration and Conciliation Act, 1996 (26 of 1996) as amended up to date.

It is also a term of the Contract that fees payable to arbitral tribunal shall be as approved by HINDU COLLEGE, this fee shall be shared equally by parties.

The place of arbitration shall be as mentioned in Schedule F. In case there is no mention of place of arbitration, the arbitral tribunal shall determine the place of arbitration.

The venue of the arbitration shall be such place as may be fixed by the Arbitral Tribunal in consultation with both the parties. Failing any such agreement, then the Arbitral Tribunal shall decide the venue.

The Arbitral Tribunal shall adjudicate on only such disputes as are referred to it by the Arbitral 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/-

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 HINDU COLLEGE against Patent Rights

The Contractor shall fully indemnify and keep indemnified the Principal HINDU COLLEGE 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 partthereof included in the Contract. In the event of any claims made under or action brought againstHINDU COLLEGE 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 toindemnify the Principal HINDU COLLEGE 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: Lumpsum 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 manufacture's specifications, if not available then as per state/ 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:

- (a) 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE will be kept withheld or retained as such by the Engineer-in-Charge or HINDU COLLEGE 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 HINDU COLLEGE 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.

- (b) HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE to the Contractor, without any interest thereon whatsoever.

Provided that the HINDU COLLEGE 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 Engineer-in-charge on the one hand and the Contractor on the other under any term of the Contract permitting payment for work after assessment by the Engineer-in-charge.

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 HINDU COLLEGE or any other contracting person or persons through Engineer-in-Charge against any claim of the Engineer-in-Charge or HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE will be kept withheld or retained as such by the Engineer-in-Charge or the HINDU COLLEGE 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 29B: Employment of coal mining or controlled area labour not Permissible

The Contractor shall not employ coal mining or controlled area labour falling under any category whatsoever on or in connection with the work or recruit labour from area within a radius of 32 km (20 miles) of the controlled area. Subject as above the Contractor shall employ imported labour only i.e., deposit imported labour or labour imported by contractors from area, from which import is permitted.

Where ceiling price for imported labour has been fixed by State or Regional Labour Committees not more than that ceiling price shall be paid to the labour by the Contractor.

The Contractor shall immediately remove any labourer who may be pointed out by the Engineer in-Charge as being a coal mining or controlled area labourer. Failure to do so shall render the Contractor liable to pay to HINDU COLLEGE a sum calculated at the rate of Rs.10/- per day per labourer. The certificate of the Engineer-in-Charge about the number of coal mining or controlled area labourer and the number of days for which they worked shall be final and binding upon all parties to this Contract.

It is declared and agreed between the parties that the aforesaid stipulation in this clause is one in which the public are interested within the meaning of the exception in Section 74 of Indian Contract Act, 1872.

Explanation: - Controlled Area means the following areas:

Districts of Dhanbad, Hazaribagh, Jamtar – - a Sub-Division under Santhal Pargana Commissionery, Districts of Bankura, Birbhum, Burdwan, District of Bilaspur.

Any other area which may be declared a Controlled Area by or with the approval of the Central Government.

Clause 30: Water for Works

The Contractor(s) shall make his/their own arrangements for water required for the work as per the rules of Local authorities and nothing extra will be paid for the same. This will be subject to the following conditions.

- (a) That the water used by the Contractor(s) shall be fit for construction purposes to the satisfaction of the Engineer-in-Charge.

- (b) The Contractor 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.

Clause 30A: Alternate water Arrangements:

The Contractor shall make alternative arrangements for supply of water at his own risk and cost which is fit for Construction purposes.

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 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 if the Contractor (or partner(s) in case of firm/ company) is himself / herself an Engineer, 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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. increases 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 HINDU COLLEGE 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 the Contractor:

Without prejudice to any of the rights or remedies under this Contract, if the Contractor dies, the Engineer-in-Charge on behalf of the Principal HINDU COLLEGE shall have the option of terminating the Contract without levy of compensation to the Contractor.

Clause 36: If relative working in HINDU COLLEGE then the Contractor not allowed to tender

The Contractor shall not be permitted to tender for works in the HINDU COLLEGE, if his near relative is posted as HINDU COLLEGE officer. 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 the HINDU COLLEGE. 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 HINDU COLLEGE 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 Government of India shall work as a Contractor or employee of a Contractor for a period of one year after his retirement from government service without the previous permission of Government of India 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 Government of India 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, 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 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 HINDU COLLEGE to take action against the Contractor under any other Conditions of the Contract for not doing the work according to the prescribed specifications.

Clause 39: Compensation during warlike 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 Engineer-in-charge 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 Engineer-in-charge.

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 there under from time to time. If he fails to do so, his failure will be a breach of the Contract and the Engineer-in-charge 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

Release of Security Deposit of the work shall not be refunded till the Contractor produces a clearance certificate from the Labour Officer. As soon as the work is virtually complete the Contractor shall apply for the clearance certificate to the Labour Officer under intimation to the Engineer-in-Charge. The Engineer-in-Charge, on receipt of the said communication, shall write to the Labour Officer to intimate if any complaint is pending against the Contractor in respect of the work. If no complaint is pending, on record till after 3 months after completion of the work and/or no communication is received from the Labour Officer to this effect till six months after the date of completion, it will be deemed to have received the clearance certificate and the Security Deposit will be released if otherwise due.

6.3 ADDITIONAL CONDITIONS OF THE CONTRACT:

- (i) The Contractors are advised to inspect and examine the site and its surroundings and satisfy themselves with the nature of site, the means of access to the site, constraints put by local regulations, if any, weather conditions at site, general ground / subsoil conditions etc. or any other circumstances which may affect or influence their tenders. The Contractor shall carry out survey of the work area at his own cost, setting out the layout and fixing of alignment of the building as per architectural and Structural drawings in consultation with the Principal, Hindu College . Any discrepancy between the architectural drawings and actual layout at site shall be brought to the notice of the Principal, Hindu College . It shall be responsibility of the Contractor to ensure correct setting out of alignment. Nothing extra shall be payable on this account. No claims, whatsoever, shall be entertained at a later date for any errors found, on plea that the information supplied by the HINDU COLLEGE in the tender is insufficient or is at variance with the actual site conditions.
- (ii) The Contractor shall, if required by him, before submission of the tender, inspect the drawings in the Office of the Principal, Hindu College . The HINDU COLLEGE shall not bear any responsibility for the lack of knowledge and also the consequences, thereof to the Contractor. The information and data shown in the drawings and mentioned in the tender documents have been furnished, in good faith, for general information and guidance only. Principal, Hindu College in no case, shall be held responsible for the accuracy thereof and/or interpretations or conclusions drawn there from by the Contractor and all consequences shall be borne by the Contractor. No claim, whatsoever, shall be entertained from the Contractor, if the data or information furnished in tender document is different or in-correct otherwise or actual working drawings are at variance with the drawings available for inspection or attached to the tender documents. It is presumed that the Contractor shall satisfy himself for all possible contingencies, incidental charges, wastages, bottlenecks etc. likely during execution of work and acts of coordination, which may be required between different agencies. Nothing extra shall be payable on this account.
- (iii) Sub-soil investigation report of work site is available in the office of the Principal, Hindu College). Interested bidders can go through the report if required for their guidance. However, the Bidder is advised to obtain requisite details directly as may be considered necessary by him before quoting rates in the tender. No claim whatsoever on account of any discrepancy between the sub-surface strata conditions that may be actually encountered at the time of execution of the work and those available in the report shall be entertained under any circumstances. The ground water table is a variable condition and the information given in the report is only indicative and it may vary from time to time.
- (iv) The nomenclature of the item given in the schedule of quantities gives in general the work content but is not exhaustive i.e., does not mention all the incidental works required to be carried out for complete execution of the item of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/or described in the specifications, provided that the same can be reasonably inferred. There may be several incidental works, which are not mentioned in the nomenclature of each item but will be necessary to complete the item in all respects. All these incidental works / costs which are not mentioned in item nomenclature but are necessary to complete the item shall be deemed to have been included in the rates quoted by the Contractor for various items in the schedule of quantities. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation / change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of Principal, Hindu College . Nothing extra shall be payable on this account.

- (v) The Contractor(s) shall give to the local body, police and other authorities all necessary notices etc. that may be required by law and obtain all requisite licenses for temporary obstructions, enclosures etc. and pay all fee, taxes and charges which may be leviable on account of these operations in executing the Contract. He shall make good any damage to the adjoining property whether public or private and shall supply and maintain lights either for illumination or for cautioning the public at night.
- (vi) The Contractor(s) shall take all precautions to avoid accidents by exhibiting necessary caution boards day and night. In case of any accident of labours/ contractual staff the entire responsibility will rest on the part of the Contractor and any compensation under such circumstances, if becomes payable, shall be entirely borne by the Contractor. The contractor shall take every precaution for safety of man and material. In case of any mishappening the contractor shall be solely responsible for any civil and/or criminal liability.
- (vii) The work shall generally be carried out in accordance with the latest "CPWD Specifications" with up-to-date correction slips, additional/Particular Specifications, architectural/Structural drawings and as per instructions of Principal, Hindu College , Any additional item of the work, if taken up subsequently, shall also confirm to the CPWD / other relevant specifications as mentioned above.
- (viii) Several documents forming the tender are to be taken as mutually complementary to one another. Detailed drawings shall be followed in preference to small scale drawings and figured dimensions in preference to scale dimensions.
- (ix) There be any difference or discrepancy between the description of items as given in the schedule of quantities, particular specifications for individual items of work (including special conditions) and I.S. Codes etc., the following order of preference shall be observed.
 - a. Working drawings
 - b. Description of items as given in Schedule of quantities
 - c. Particular specifications
 - d. Special conditions
 - e. Additional Conditions
 - f. CPWD Technical Specifications including correction slips issued up to the last updated date of uploading/ till submission of the tender.
 - g. General Conditions of the Contract.
 - h. Indian Standards Specifications of B.I.S.
 - i. Decision of Principal, Hindu College ,
- (x) The works to be governed by this Contract shall cover delivery and transportation up to destination, safe custody at site, insurance, erection, testing and commissioning of the entire works.
- (xi) The works to be undertaken by the Contractor shall inter-alia include the following:
 - a. Preparation of detailed SHOP drawings and AS BUILT drawings wherever applicable.
 - b. Obtaining of Statutory permission is in the scope of Architectural consultant appointed by HINDU COLLEGE. The agency has to assist in providing AS-BUILT drawing etc.
 - c. Pre-commissioning tests as per relevant standard specifications, code of practice, Acts and Rules wherever required.

- d. Warranty obligation for the equipment's and / or fittings/fixtures supplied by the Contractor. Contractor shall provide all the shop drawings or layout drawings for all the coordinated services before starting any work or placing any order of any of the services etc. These shop drawings/layout drawings shall be got approved from Principal, Hindu College ,/ Architect before implementation and this shall be binding on the Contractor. The Contractor shall submit material submittals along with material sample for approval of Principal, Hindu College ,/ Architect prior to delivery of materials at site.
- (xii) The work shall be carried out in accordance with the approved architectural drawings, structural drawings, services drawings to be issued from time to time, by the Engineer-in-Charge. Before commencement of any item of work the Contractor shall correlate all the relevant architectural and structural drawings, nomenclature of items and specifications etc. issued for the work and satisfy himself that the information available from there is complete and unambiguous. The figure and written dimension of the drawings shall be superseding the measurement by scale. The discrepancy, if any, shall be brought to the notice of the Principal, Hindu College ,before execution of the work. The Contractor alone shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information and no claim whatsoever shall be entertained by the HINDU COLLEGE on this account.
- (xiii) Unless otherwise provided in the Schedule of quantities vide Part-D1 and the Quoted Item rates tendered by the Contractor shall be all inclusive and shall apply to all heights, lifts, leads and depths of the building and nothing extra shall be payable to him on this account.
- (xiv) The Contractor(s) shall take instructions from the Principal, Hindu College ,regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed. The stacking shall take place as per stacking plan however, if any change isrequired, the same shall be done with the approval of Principal, Hindu College ,
- (xv) The Contractor shall bear all incidental charges for cartage, storage and safe custody of materials, if any, issued by HINDU COLLEGE as well as to those materials also arranged by the Contractor.
- (xvi) Any cement slurry added over base surface (or) for continuation of concreting for better bond is deemed to have been built in the items and nothing extra shall be payable or extra cement considered in consumption on this account.
- (xvii) The Contractor shall give performance test of the entire installation(s) as per the specifications in the presence of the Principal, Hindu College ,or his authorized representative before the work is finally accepted and nothing extra what-so-ever shall be payable to the Contractor for such test.

(xviii) Prevention of Nuisance and Pollution Control

The Contractor shall take all necessary precautions to prevent any nuisance or inconvenience to the owners, tenants or occupiers of adjacent properties and to the public in general and to prevent any damage to such properties from pollutants like smoke, dust, noise. The Contractor shall use such methodology and equipment so as to cause minimum environmental pollution of any kind and minimum hindrance to road users and to occupants of the adjacent properties or other services running adjacent/near vicinity. The Contractor shall make good at his cost and to the satisfaction of the Principal, Hindu College any damage to roads, paths, cross drainage works or public or private property whatsoever caused due to the execution of the work or by traffic brought thereon by the Contractor. All waste or superfluous materials shall be carried away by the Contractor, without any reservation, entirely to the satisfaction of the Principal, Hindu College. The contractor shall be responsible to follow the Pollution control norms of National Green Tribunal, Delhi Pollution Control Committee or any other statutory authority. If any penalty is imposed by any such authority, the same shall be borne by the contractor.

(xix) Security and Traffic Arrangements

(xx) In the event of any restrictions being imposed by the Security agency, Traffic or any other authority having jurisdiction in the area on the working or movement of labour / material the Contractor shall strictly follow such restrictions and nothing extra shall be payable to the Contractor on such accounts. The loss of time on these accounts, if any, shall have to be made up by augmenting additional resources whatever required.

(xxi) No payment shall be made for any damage caused by rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The Contractor shall be fully responsible for any damage to the govt. property and the work for which payment has been advanced to him under the Contract and he shall make good the same at his risk and cost. The Contractor shall be fully responsible for safety and security of his material, T&P/Machinery brought to the site by him.

(xxii) The Contractor shall construct suitable godowns, yard at the site of work for storing all other materials so as to be safe against damage by sun, rain, damages, fire, theft etc. at his own cost and also employ necessary watch and ward establishment for the purpose at his cost.

(xxiii) All materials obtained from Contractor shall be got checked by the representative of Engineer- in-Charge on receipt of the same at site before use.

(xxiv) The Contractor shall be responsible for the watch and ward/guard of the buildings, safety of all fittings and fixtures including all equipment's, services provided by him against pilferage and breakage during the period of Installations and thereafter till the building is physically handed over to the HINDU COLLEGE, the Client HINDU COLLEGE. No extra payment shall be made on this account and no claim shall be admissible on this account.

- (xxv) The Contractor shall keep himself fully informed of all acts and laws of the Central & State Governments, all orders, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and bye-laws laid down by Collector / MCGM and any other statutory bodies shall be adhered to, by the Contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the local authorities. The water charges (for municipal water connection as well as tanker water) shall be borne by the Contractor. Also, if the Contractor obtains water connection for the drinking purposes from the municipal authorities or any other statutory body, the consequent sewerage charges shall be borne by the Contractor. The clause 30A of the General conditions of Contract for CPWD works is not applicable to the tender. All statutory taxes, levies, charges (including water and sewerage charges, charges for temporary service connections and / or any other charges) payable to such authorities for carrying out the work, shall be borne by the Contractor. The Contractor shall arrange to give all notices as required by any statutory / regulatory authority and shall pay to such authority all the fees that is required to be paid for the execution of work. He shall protect and indemnify the HINDU COLLEGE and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts. The fee payable to statutory authorities for obtaining the various permanent service connections and Occupancy Certificate for the building shall be borne by the HINDU COLLEGE.
- (xxvi) For works below ground level the Contractor shall keep that area free from water. If de-watering or bailing out of water is required, the Contractor shall do the same at his own cost and nothing extra shall be paid.
- (xxvii) The Contractor shall make all necessary arrangements for protecting from rains, fog or likewise extreme weather conditions, the work already executed and for carrying out further work, during monsoon including providing and fixing temporary shelters, protections etc. Nothing extra shall be payable on this account and also no claims for hindrance shall be entertained on this account.
- (xxviii) In case of flooding of site on account of rain or any other cause and any consequent damage, whatsoever, no claim financially or otherwise shall be entertained notwithstanding any other provisions elsewhere in the Contract agreement. Also, the Contractor shall make good, at his own cost, the damages caused, if any. Further, no claims for hindrance shall be entertained on this account.
- (xxix) The Contractor will take reasonable precautions to prevent his workman and employees from removing and damaging any flora (tree/plant/vegetation) from the project area.

6.3.1 Setting out Works:

- (i) The Contractor shall carry out survey of the work area, at his own cost, setting out the layout of buildings/ roads/ services in consultation with the Engineer -in-Charge & proceed further. Any discrepancy between architectural drawings and actual layout at site shall be brought to the notice of the Engineer -in-charge. It shall be responsibility of the Contractor to ensure correct setting out of alignment. Total station survey instruments only shall be used for layout, fixing boundaries, and centre lines, etc., Nothing extra shall be payable on this account.
- (ii) The Contractor shall establish, maintain and assume responsibility for grades, lines, levels and benchmarks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions etc. to the Engineer -in-Charge before commencing work. Commencement of work shall be regarded as the Contractor's acceptance of such grades, lines, levels, and dimensions and no claim shall be entertained at a later date for any errors found.
- (iii) If at any time, any error appears due to grades, lines, levels and benchmarks during the progress of the work, the Contractor shall, at his own expense rectify such error, if so required, to the satisfaction of the Engineer -in-Charge. Nothing extra shall be payable on this account.
- (iv) The Contractor shall protect and maintain temporary/ permanent benchmarks at the site of work throughout the execution of work. These benchmarks shall be got checked by the Principal, Hindu College ,or his authorized representatives. The work at different stages shall be checked with reference to bench marks maintained for the said purpose. Nothing extra shall be payable on this account.
- (v) The approval by the Principal, Hindu College ,of the setting out by the Contractor, shall not relieve the Contractor of any of his responsibilities and obligation to rectify the errors/ defects, if any, which may be found at any stage during the progress of the work or after the completion of the work.
- (vi) The Contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignments, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the Contractor at his own cost to the entire satisfaction of the Engineer- in-Charge.
- (vii) The Tendered Amount by the Contractor is deemed to be inclusive of site clearance, setting out work (including marking of reference points, Centre lines of buildings), construction and maintenance of reference bench mark(s), taking spot levels, construction of all safety and protection devices, barriers, barricading, signage, labour safety, labour welfare and labour training measures, preparatory works, working during monsoon, working at all depths, height and location etc. and any other incidental works required to complete this work. Nothing extra shall be payable on this account.

6.3.2 Site Testing Laboratory

A site laboratory with the minimum equipment's as specified in CPWD specifications/in this agreement shall be established, made functional and maintained within one month from the award of work as per clause 10A of schedule A to F without any extra cost to the

HINDU COLLEGE. In case of non-compliance / delay in compliance in this, a recovery @ Rs. 500/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.

6.3.3 Tools and Plants:

The bidder should have own constructions equipment required for the proper and timely execution of the work. Nothing extra shall be paid on this account. No tools and plants including any special T&P etc. shall be supplied by the HINDU COLLEGE and the Contractor shall have to make his own arrangements at his own cost. No claim of hindrance (or any other claim) shall be entertained on this account.

6.3.4 Scaffolding:

Wherever required for the execution of work, all the scaffolding shall be provided and suitably fixed, by the Contractor. It shall be provided strictly with steel double scaffolding system, suitably braced for stability, with all the accessories, gangways, etc. with adjustable suitable working platforms to access the areas with ease for working and inspection. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. Nothing extra shall be payable on this account. It shall be ensured that no damage is caused to any structure due to the scaffolding.

6.3.5 Schedule and Deployments (Personnel and Equipment)

The Contractor shall do proper sequencing of the various activities by suitably staggering the activities within various pockets in the plot so as to achieve early completion. The agency to deploy adequate equipment, machinery and labour as required for the completion of the entire work within the stipulated period specified. Also, ancillary facilities shall be provided by Contractor commensurate with requirement to complete the entire work within the stipulated period. Nothing extra shall be payable on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire construction period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machineries etc. provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work. Further, all the constructional tools, plants, equipment and machineries provided by the Contractor, on site of work or his workshop for this work, shall be exclusively used in the construction of this work and they shall not be shifted/ removed from site without the permission of the Engineer- in-Charge.

- 6.3.6 The Contractor shall maintain all the work in good condition till the completion of entire work. The Contractor shall be responsible for and shall make good, all damages and repairs, rendered necessary due to fire, rain, traffic, floods or any other causes. The Engineer-in- Charge shall not be responsible for any claims for injuries to person/workmen or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the Contractor or of any other of his representatives, in his employment during the execution of the work. The compensation, if any, shall be paid directly to the HINDU COLLEGE/ authority / persons concerned, by the Contractor at his own cost.

6.3.7 Royalty:

Royalty at the prevalent rates shall be paid by the Contractor or the RMC supplier as per the terms of supply between them, on all materials such as boulders, metals, all sizes stone aggregates, brick aggregates, coarse and fine sand, moorum, earth, river sand, gravels and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government concerned. Further, the Contractor needs to submit proof of submission of full royalty to the state government or local authority. Nothing extra shall be payable on this account.

6.3.8 Preservation and Conservation measures

- (i) Existing drains, pipes, cables, over-head wires, sewer lines, water lines and similar services, if any, encountered in the course of the execution of work shall be protected against the damage by the Contractor at his own expense. In case the same are to be removed and diverted, expenditure incurred in doing so shall be payable to the Contractor. The Contractor shall work out the cost, get the same approved by Principal, Hindu College ,before taking up actual execution. The Contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.
- (ii) All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on project location during excavation/construction shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The Contractor will take reasonable precaution to prevent his work men or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer- in-charge of such discovery and carry out the official instructions of Engineer-in- charge for dealing with the same, till then all work shall be carried out in a way so as not to disturb/damage such article or thing.

6.3.9 Responsibility:

- (i) He shall protect and indemnify HINDU COLLEGE and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts.
- (ii) The Contractor shall assume all liability, financial or otherwise in connection with this Contract and shall protect and indemnify the HINDU COLLEGE from any and all damages and claims that may arise on any account. The Contractor shall indemnify the HINDU COLLEGE against all claims in respect of patent rights, royalties, design, trademarks- of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever and shall himself defend all actions arising from such claims and shall indemnify the HINDU COLLEGE in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account.
- (iii) The entire work up to the plinth level, as required for obtaining approval of the plinth from the local authority, shall be completed by the Contractor at the same time. Work above plinth shall be allowed to be carried out only after obtaining plinth approval from the local body. No delay shall be allowed on this ground and also no claim whatsoever on account of any delay in approval at plinth level by the local body shall be entertained from the Contractor. Nothing extra shall be payable on this account.
- (iv) On completion of work, the Contractor shall submit required sets of “as built” drawings to the Principal, Hindu College ,furnishing requisite information for obtaining various service connections.

6.3.10 Co-operation with other contractors / Specialized agencies / Associated contractors:

- (i) The Contractor shall take all precautions to abide by the environmental related restrictions imposed by any statutory body having jurisdiction in the area as well as prevent any pollution of streams, ravines, river bed and waterways. All waste or superfluous materials shall be transported by the Contractor, entirely to the satisfaction of the Engineer- in-Charge and disposed at designated places only. No claim what so ever on account of site constraints mentioned above or any other site constraints, lack of public transport, inadequate availability of skilled, semi-skilled or unskilled workers in the

near vicinity, non-availability of construction machinery spare parts and any other constraints not specifically stated here, shall be entertained from the Contractor. Therefore, the Tenderers are advised to visit site and get first- hand information of site

constraints. Accordingly, they should quote their tenders. Nothing extra shall be payable on this account.

- (ii) The Contractor shall cooperate with and provide the facilities to the associate contractors and other agencies working at site for smooth execution of the work. The Contractor shall indemnify HINDU COLLEGE against any claim(s) arising out of such disputes. The Contractor shall:
 - a) Allow use of scaffolding, toilets, sheds etc. without any extra rates.
 - b) Properly co-ordinate their work with the work of other contractors.
 - c) Provide control lines and benchmarks to his and other associate contractors and the other contractors.
 - d) Provide electricity and water at mutually agreed rates.
 - e) Provide hoist and crane facilities for lifting material at mutually agreed rates.
 - f) Co-ordinate with other contractors for leaving inserts, making chases, alignment of services etc. at site.
 - g) Adjust work schedule and site activities in consultation with the Engineer- in-Charge and other contractors to suit the overall schedule completion.
 - h) Resolve the disputes with other contractors/ associate contractors amicably and the Principal, Hindu College, shall not be made intermediary or arbitrator.
- (iii) The work should be planned in a systematic manner so as to ensure proper co-ordination of various disciplines viz. sanitary & water supply, drainage, rain water harvesting, electrical, firefighting & fire alarm system, information technology, communication & electronics and any other services.

6.3.11 Supervision of Works:

The Contractor shall depute Site Engineers & skilled workers as required for the work. He shall submit organization chart along with details of Engineers and supervisory staff. It shall be ensured that all decision-making powers shall be available to the representatives of the Contractor at Delhi itself to avoid any likely delays on this account. The Contractor shall also furnish list of persons for specialized works to be executed for various items of work. The Contractor shall identify and deploy key persons having qualifications and experience in the similar and other major works, as per the field of their expertise. If during the course of execution of work, the Principal, Hindu College, is of the opinion that the deployed staff is not sufficient or not well experienced, the Contractor shall deploy more staff or better- experienced staff at site to complete the work with quality and in stipulated time limit. Principle Technical representative of the Contractor having minimum experience in similar nature of work as mentioned in the clause 36 of the General Conditions of the Contract, shall always be available at the site during the actual execution of the work.

6.3.12 Specialized Agencies:

The Contractor has to engage one of the approved agencies as mentioned in the list of specialized work. The Contractor shall not change the specialized agency. However, if the change is warranted, he may do so, with permission of Engineer-in-charge. Nothing extra shall be payable on this account.

It shall be the responsibility of the Contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to HINDU COLLEGE. The Contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Specialized Agencies. The Contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies. No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim whatsoever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies or any dispute amongst them

6.3.13 Quality Assurance and Testing of Materials:

- (i) All material to be used in the work shall bear ISI certification mark unless otherwise the make is specified in the SOQ, list of approved makes and other conditions / specifications, appended with this tender document. In case ISI mark materials or the materials mentioned in the tender documents are not available, the material to be used shall conform to CPWD specifications applicable to this tender and / or national / international codes as approved by Principal, Hindu College. In such cases, the Engineer-in-charge shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified, as first quality by the manufacturers / suppliers shall be used in the work, unless otherwise specified. All materials not having ISI mark, if allowed to be used in the work by Principal, Hindu College shall be tested as per relevant specifications, as approved by the Principal, Hindu College. In all cases of use of ISI marked materials, proper proof of procurement of materials from authentic manufacturers shall be provided by the Contractor to the entire satisfaction of Engineer in charge. The mass procurement of material should be done only after approval of HINDU COLLEGE in writing.
- (ii) The Contractor shall make available, on request from HINDU COLLEGE, the copies of challan, cash memos, receipts and other certificates, if any, vouchers towards the quantity and quality of various materials procured for the work and the same shall be kept in record. The Contractor shall also provide information and necessary documentation on the name of the manufacturer, manufacturer's product identification, manufacturer's instructions, warning, date of manufacturing and test certificates (from manufacturers for the product

- (iii) Inspection of Electrical items at Manufacturers works by consultant and client's representative will have to be arranged by contractors if it is intended by Engineer in charge.
- (iv) The Contractor has to establish field laboratory at site including all necessary equipment for field tests as given in Schedule 'F'. All the relevant and applicable standards and specifications shall be made available by the Contractor at his cost in the field laboratory. The Contractor shall designate one of his technical representatives as Quality Assurance Engineer, who shall be responsible for carrying out all mandatory field/ laboratory tests. The Contractor shall also provide adequate supporting staff at his cost for carrying out field tests, packaging & forwarding of samples for outside laboratory tests and for maintaining test records. All the registers of tests carried out at site or in outside laboratories shall be maintained by the Contractor. The test register shall be issued to the Contractor by the Principal, Hindu College , All the entries in the test register will be made by the designated engineer of the Contractor and same shall be regularly reviewed by the Principal, Hindu College ,or his authorized representatives at site.
- (v) The Contractor shall submit, immediately after the award of work, a detailed and complete 'Method Statement' for the execution, testing and Quality Assurance, of such items of works, as directed by the Principal, Hindu College , All the materials to be used in the work shall comply with the requirements of the specifications and shall pass all the tests required as per specifications as applicable or such specifications / standards as directed by the Principal, Hindu College ,
- (vi) The Contractor shall procure and provide all the materials from the manufacturers / suppliers as per the list attached with the tender documents, as per the item description and particular specifications for the work. The equivalent brand for any item shall be permitted to be used in the work, only when the specified make is not available. This is, however, subject to documentary evidence produced by the contractor regarding non availability of the specified brand and also subject to independent verification by the Principal, Hindu College , In exceptional cases, where such approval is required, the decision of Principal, Hindu College ,as regards equivalent make of the material shall be final and binding on the Contractor. No claim, whatsoever, of any kind shall be entertained from the Contractor on this account. Nothing extra shall be payable on this account. Also, the material shall be procured only after written approval of the Principal, Hindu College ,
- (vii) All materials for construction / incorporation shall be got checked by the Engineer-In-Charge or his authorized personnel on receipt of the same at site before use.
- (viii) The Contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate him, the result of such tests and consequences thereon shall be binding on the Contractor. The Contractor or his authorized representative shall remain in contact with the Engineer-in-Charge or his authorized representative associated for all such operations. No claim of payment or claim of any other kind, whatsoever, shall be entertained from the Contractor.

- (ix) All expenditure to be incurred for testing of samples like packaging, sealing, transportation, loading, unloading, necessary personnel assistance in the process etc. including testing charges shall be borne by the Contractor.
- (x) All the hidden items such as water supply lines, drainage pipes, conduits, sewers etc. are to be properly tested as per the design conditions before covering.
- (xi) Water tanks, taps, sanitary, water supply and drainage pipes, fittings and accessories should conform to byelaws and municipal body / corporation where CPWD Specifications are not available. The Contractor should engage licensed plumbers for the work and get the materials (fixtures/fittings) tested by the Municipal Body/Corporation authorities wherever required at his own cost.

6.3.14 Program Chart:

- (i) The Contractor shall prepare an integrated program chart within fifteen days of issue of award letter including civil as well as E & M activities for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfilment of the program within the stipulated period and submit the same for approval of the Principal, Hindu College. These shall be submitted by the Contractor through electronic media besides forwarding hard copies of the same. The integrated program chart so submitted should not have any discrepancy with the physical milestones attached in the Contract agreement. The program chart should include the following: -
- (ii) Descriptive note explaining sequence of various activities.
- (iii) Construction Program prepared on PRIMAVERA Software, which will indicate resources in financial terms, manpower and specialized equipment for every important stage.
- (iv) Program for procurement of materials by the Contractor.
- (v) Program for arranging and deployment of manpower both skilled and unskilled so as to achieve targeted progress.
- (vi) Program of procurement of machinery/equipment having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the Contractor.
- (vii) In case of noncompliance/delay in compliance in this, a penalty @ Rs. 500/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.
- (viii) If at any time, it appears to the Principal, Hindu College, that the actual progress of work does not conform to the approved program referred above, the Contractor shall produce a revised program showing the modifications to the approved program by additional inputs to ensure completion of the work within the stipulated time.
- (ix) The submission for approval by the Principal, Hindu College, of such program or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract. This is without prejudice to the right of Engineer- In-Charge to take action against the Contractor as per terms and conditions of the agreement.
- (x) Apart from the above integrated program chart, the Contractor shall be required to submit fortnightly progress report of the work in a computerized form on 1st and 16th of every month. The progress report shall contain the following, apart from whatever else may be required as specified above:

- a. Construction schedule of the various components of the work through a bar chart for the next two fortnights (or as may be specified), showing the micro- milestone/milestones, targeted tasks (including material and labour requirement) and up to date progress. At least 10 digital photographs showing all the parts of construction site along with at least 5 minutes video of executions of different items in soft copy has to be submitted in every fortnightly progress report.
 - b. Progress chart of the various components of the work that are planned and achieved, for the fortnight as well as cumulative up to the fortnight under reckoning, with reason for deviations, if any in a tabular format.
 - c. Plant and machinery statement, indicating those deployed in the work.
- (xi) In case of non-compliance / delay in compliance in submission of fortnightly, a penalty @ Rs. 1000/- per fortnightly report will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.
- (xii) HINDU COLLEGE shall in no way be responsible for either any delay in getting electric and/or water and/or telephone connections for carrying out the work or not getting connections at all. No claim of delay or any other kind, whatsoever, on this account shall be entertained from the Contractor. Also, contingency arrangement of stand-by water & electric supply shall be made by the Contractor for commencement and smooth progress of the work so that work does not suffer on account of power failure or disconnection or not getting connection at all. No claim of any kind whatsoever shall be entertained on this account from the Contractor. Nothing extra shall be payable on this account.

6.3.15 Cleanliness of the Site:

- (i) The Contractor shall not stack building material / malba/muck on the land or road of the College or on the land owned by the others, as the case may be. So the muck, rubbish etc. shall be removed periodically as directed by the Principal, Hindu College from the site of work to the approved dumping grounds as per the local bye laws and regulations of the concerned authorities and all necessary permissions in this regard from the local bodies shall be obtained by the Contractor. Nothing extra shall be payable on this account. In case, the Contractor is found stacking the building material / malba as stated above, the Contractor shall be liable to pay the stacking charges/penalty as may be levied by the local body or any other authority and also to face penal action as per the rules, regulations and bye-laws of such body or authority. The Engineer –in-Charge shall be at liberty to recover, such sums due but not paid to the concerned authorities on the above accounts, from any sums due to the Contractor including amount of the Security Deposit and performance guarantee in respect of this Contract agreement.
- (ii) The Contractor shall take instructions from the Principal, Hindu College, regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed.

- (iii) The Contractor shall take all care to prevent any water- logging at site. The waste water, slush etc. shall not be allowed to be collected at site. For discharge into public drainage system, necessary permission shall be obtained from relevant authorities after paying the necessary charges, if any, directly to the authorities. The work shall be carried out in such a way that the area is kept clean and tidy. All the fees/charges in this regard shall be borne by the Contractor. Nothing extra shall be payable on this account.

6.3.16 Inspection of Work:

Officers of Hindu College , University of Delhi, Delhi or authorized personnel of HINDU COLLEGE shall be inspecting the on-going work at site at any time with or without prior intimation. The Contractor shall, therefore, keep updated the following requirements and detailing.

- (i) Display Board showing detail of work, weekly progress achieved with respect to targets, reason of shortfall, status of manpower, wages being paid for different categories of workers.
- (ii) Entrance and area surrounding to be kept cleaned.
- (iii) Display layout plan key plan, building drawings including plans, elevations and sections.
- (iv) Up to date displays of Bar chart, CPM and PERT etc.
- (v) Keep details of quantities executed, balance quantities, deviations, possible Extra item, substituted Item etc.
- (vi) Keep plastic / cloth mounted one sets of building drawings.
- (vii) Set of Helmets and safety shoes for exclusive use for officers/dignitaries visiting at site.

6.3.17 Final Testing of the Installation:

The Contractor shall demonstrate trouble free functioning of all the Civil, Mechanical, Electrical, Plumbing (MEP) installations and services. The Principal, Hindu College ,or his authorized representatives shall carry out final inspection of the various Civil and MEP services and installations. Any defect(s) noticed during demonstration shall be rectified by the Contractor at his own cost to the entire satisfaction of the Principal, Hindu College , Nothing extra shall be payable on this account.

6.3.18 Defect Liability Period (Refund of Security Deposit):

The clause 17 of the General Conditions of the Contract shall be applied. The defect liability / maintenance period shall start after the date of issue of completion certificate. Besides observing other formalities prescribed in the General Conditions of the Contract, for release of security deposit, the Contractor shall have to produce a certificate stating that no defects are pending for rectification from the Principal, Hindu College Hindu College , University of Delhi, Delhi or any other authorized representative of the Hindu College , University of Delhi, Delhi.

6.3.19 Unit Rates:

- (i) Wherever any reference to any Indian Standards occurs in the documents relating to this Contract, the same shall be inclusive of all amendments issued thereto or revisions thereof, if any, up to the date of receipt of tenders.
- (ii) Unless otherwise specified in the schedule of quantities, the rates for all items of work shall be considered, as inclusive of pumping out or bailing out water, if required throughout the construction period for which no extra payment shall be made. This shall also include water encountered from any sources such as rains, floods, sub soil water

table being high and/or due to any other cause whatsoever.

- (iii) The rates for all items of work, shall unless clearly specified otherwise, include cost of all operations and all inputs of labour, material, T & P, wastages, transportation, scaffolding at all locations, levels and heights, wastages, watch and ward, other inputs, all incidental charges, all taxes, cess, GST, VAT, duties, levies etc. required for execution of the work.
- (iv) Unless otherwise provided in the Schedule of Quantities, the unit rates for the various items are inclusive of carrying out the works at and / or up to all heights, lifts, leads and depths.
- (v) Unless otherwise specified in the Schedule of Quantities, the unit rates for the various items shall be inclusive of carrying out the work in curvilinear portions of the building in plan and elevation as per the architectural drawings. Nothing extra shall be payable on this account.
- (vi) Waterproofing and Anti-termite Treatment items of work shall be carried out by specialized Agencies and shall carry 10 years warranty which shall commence from Project completion date.
- (vii) All warranty obligations as per the Contract are deemed included in the unit rates. Warranty shall be provided in the standard formats incorporated in the Tender and mutually agreed format for other items of works.

6.3.20 Insurance Policies:

- (i) Before commencing the execution of work, the Contractor shall, without in any way limiting his obligations and liabilities, insure at his own cost and expense against any damage or loss or injury, which may be caused to any person or property, at site of work. The Contractor shall obtain and submit to the Principal, Hindu College, proper Contractor All Risk Insurance Policy for an amount 1.25 times the Contract amount for this work, with Principal, Hindu College ,as the first beneficiary. The insurance shall be obtained in joint names of Principal, Hindu College ,and the Contractor (who shall be second beneficiary). Also, he shall indemnify the HINDU COLLEGE from any liability during the execution of the work. Further, he shall obtain and submit to the Principal, Hindu College a third-party insurance policy for maximum Rs.10 lakh for each accident, with the Principal, Hindu College ,as the first beneficiary. The insurance shall be obtained in joint names of Principal, Hindu College ,and the Contractor (who shall be second beneficiary).
- (ii) The Contractor shall, from time to time, provide documentary evidence as regards payment of premium for all the Insurance Policies for keeping them valid till the completion of the work. The Contractor shall ensure that Insurance Policies are also taken for the workers of his Sub-Contractors / specialized agencies also. Without prejudice to any of its obligations and responsibilities specified above, the Contractor shall within 10 days from the date of letter of acceptance of the tender and thereafter at the end of each quarter submit a report to the HINDU COLLEGE giving details of the Insurance Policies along with Certificate of these insurance policies being valid, along with documentary evidences as required by the Principal, Hindu College , No work shall be commenced by the Contractor unless he obtains the Insurance Policies as mentioned above. Also, no payment shall be made to the Contractor on expiry of insurance policies unless renewed by the Contractor. Nothing extra shall be payable on this account. No claim of hindrance (or any other claim) shall be entertained from the Contractor on these accounts.

6.3.21 Facilities for HINDU COLLEGE:

- (i) The Contractor shall provide, construct and maintain at all times during execution and till completion of the work, a temporary site office with adequate electrical light fittings, A.C., fans, electric/ power points, switches etc. at his cost for exclusive use of the Principal, Hindu College ,and his authorized representatives, Program Management Consultants

and Architects. Area of such office shall be approximately 160 sqm and shall have required partitions, doors, windows, locking arrangement etc. with a conference hall for 20 persons with conference table, chairs etc. all as per direction of Principal, Hindu College, Adequate toilet facilities connected to a temporary septic tank /soak pit, drinking water with water purifier & cooler etc. shall also be provided in the site office. All the water and electricity charges for the site office shall be borne by the Contractor. The Contractor shall also provide one latest configuration desk top computer along with licence for required software such as PRIMAVERA, AUTO CAD, etc..

- (ii) The Contractor shall at all reasonable times provide access to the Principal, Hindu College, or his authorized representative to the workshops, factories or other places where materials are stored, for inspection and/or collection of samples. Nothing extra shall be payable on this account.

6.3.22 Preparation of Mockups and Sample Units:

The Contractor shall prepare & display mock-ups in actual position of each and every item and obtain approval of Principal, Hindu College ,before execution in case of required en masse items. The mock up shall be preserved for the purpose of reference till completion of the item represented by the mock up. Similarly, the Contractor shall prepare two sample toilet blocks comprising of all finishes and fittings included in the scope of this Contract. Approval of Principal, Hindu College ,shall be obtained before taking up finishing works en masse. The work executed in approved mock ups / sample units in actual position forming part of the main work shall be measured and paid to the Contractor under the respective items of the Contract. However, any mock-up/sample not approved shall not be measured and paid. Also, the Contractor shall have to dismantle and remove the same from the site of work at his cost. However, those mock-up/ samples not prepared in actual position and not forming the part of main work shall not be paid.

6.3.23 Standard operating procedure for GRIHA during construction:

It is envisaged to obtain minimum 3-star GRIHA rating from TERI for building to be constructed under this Contract. The Contractor shall strictly adhere to the following conditions as part of his contractual obligation. Tendered Amount deemed to be inclusive of expenditure on this account and nothing extra shall be paid for these compliances.

- (i) The Contractor shall give priority to sourcing materials which are manufactured within a 400 km radius of the Project site.
- (ii) Barricading of existing retained trees shall be provided with brick foundation single layer, bamboo/bar supports & covered with transparent green cloth.
- (iii) Sedimentation & erosion control system shall be provided by Construction of temporary sedimentation tank at the lowest level of site. (Dimensions- 2m X 2m X 0.6m) along with wire mesh filter at the outlet. Once the sediments in Water settle down, the water can be pumped into the city storm-water drains. Nothing extra shall be paid on this account.
- (iv) TOP SOIL PROTECTION: Top soil to be tested by accredited laboratory of ICAR – Indian Council of Agricultural Research. Parameters to be checked in test are for primary plant nutrients {Organic Carbon (%), Alkaline KMnO₄ Nitrogen (%), Olsen Phosphorus (Kg/ha), Ammonia Acetate Potassium (mg/g)} and pH. Top soil up to 20cm in depth to be removed from the areas proposed for the buildings, roads, paved areas and external services. The top soil should be stockpiled to a height of 40cm and reapplied during plantation of the proposed vegetation. Nothing extra shall be paid on this account
- (v) Provide minimum level of sanitation/safety facilities for construction workers: The agency shall ensure compliance with the NBC (latest revision) safety norms for providing the necessary safety equipment and measures for construction workers. Provisions for drinking water, healthy and clean-living conditions and sanitation facilities shall be provided for the workers. Nothing extra shall be paid on this account.

- (vi) Barricading of complete site along with suitable gates for vehicular and personnel movement shall be carried out and removed after completion of the Project including intermittent removal and re construction as and when needed to facilitate the construction or ease of movement of the vehicles / machinery / personnel. Payment towards this activity is made as per the item provision in the Bill of Quantities (BOQ) under Part D2 of the Tender.
- (vii) Spraying of water on loose soil at site shall be done by the agency at regular interval. Nothing extra shall be paid on this account.
- (viii) Wheel washing facility for outgoing vehicles- Gravel bed where truck types will be washed before exit from site. Nothing extra shall be paid on this account.
- (ix) Efficient water use during construction: Use waste jute bags to cover columns and beams during curing. Nothing extra shall be paid on this account.
- (x) Percolation test: A percolation test needs to be carried out to ascertain the recharging rate of water and to know the ground water table at site. Nothing extra shall be paid on this account.
- (xi) Storage & segregation of recyclable waste generated at site: A separate storage area (weather proof shed) to be maintained at site for the following materials: Steel/Aluminium/Metals- Should be sent to recyclers.
 - a. RMC- should be used for back filing
 - b. Concrete debris-should be used for back filing
 - c. Blocks-should be used for back filing
 - d. Glass-Should be sent to recyclers
 - e. Wood-Should be sent to recyclers
 - f. Cement bags/Plastics-Should be sent to recyclers
- (xii) Water Meters shall be provided for the following:
 - a. Municipal Inlet
 - b. Bore Well inlet
 - c. STP Outlets
 - d. Treated water Flushing
 - e. Treated water Landscaping
- (xiii) Firefighting system: It shall be CFC free and Halon free.
- (xiv) Energy meter for the following: -
 - a. Main Source (from electricity supply company)
 - b. Alternate source DG
 - c. Internal lighting,
 - d. External lighting,
 - e. Air Conditioning,
 - f. Solar PV system
 - g. Major loads, if any.

- (xv) Automatic controls for 100% of outdoor lightings: Automatic switches (Timer) for 100% of outdoor lights.
- (xvi) Luminous efficacy of 100% of lamps used in outdoor lighting to meet the lamp luminous efficacy table shown.
- (xvii) Lighting levels in tabular format for all indoor spaces along vis-à-vis the lighting levels required by NBC 2005 (BIS 2005).
- (xviii) HVAC System
 - a. The efficiencies of the air conditioning system should be as (mandatory):- o Split ACs- IS 1391 – part 2(table 5.3)
 - b. Refrigeration system should be CFC free. (mandatory).
 - c. Insulation proposed in the building is CFC & HCFC free. (mandatory)
 - d. Fresh air calculations for all spaces (conditioned & non-conditioned areas) as per NBC Part 8, section-3 or as per ASHARE 62-4 ventilation std. (mandatory).
- (xix) No Smoking

No smoking signages to be installed in the project building at various places/common areas. Penalty clause to be included in the signages.

6.4 SPECIAL CONDITIONS OF THE CONTRACT:

(PERTAINING TO SITE FACILITIES /RESTRICTIONS)

- a. Hindu College , University of Delhi, Delhi is fully residential and fully operational campus. The bidders are advised to take utmost care while executing the works that minimum/ no disturbances happen to the users. The bidder shall also protect site of work from the unauthorized entry of any persons by erecting necessary barricading as specified for which payments shall be done under relevant item.
- b. Hindu College , University of Delhi, Delhi campus is situated in densely populated locality of Delhi with huge flow of traffic in the roads leading to Hindu College , University of Delhi, Delhi. The bidders shall fully understand restrictions before participating in the tender. Nothing extra shall be paid on this account. No delay or claims of any kind shall be entertained from the Contractor on this account.
- c. Since the campus is fully residential, no concrete plant/ batch mix plant/ ready mix plant shall be allowed inside the COLLEGE campus. Nothing extra shall be paid on this account.
- d. Water only for drinking purposes on chargeable basis shall be made available by Hindu College , University of Delhi, Delhi at one point near the site. The agency shall be required to lay the grid as per their requirement for which nothing extra shall be paid on this account. Charges as per prevailing rate from time to time and 70% of sewerage charges shall be payable to HINDU COLLEGE. The Contractor shall be required to pay water charges at regular interval as desired by HINDU COLLEGE. RA bill/Final bill shall be paid only after proof of up-to-date payment of water charges and sewerage charges submitted to the Principal, Hindu College ,
- e. Water for construction purposes shall be responsibility of Contractor. Bore well will be allowed only after permission from HINDU COLLEGE (subjected the quality of water confirms to CPWD specification /applicable BIS Code and after obtaining all approval from local body/administration/ competent authority. The contractors shall hand over the bore well in working condition to COLLEGE after completion of work for which nothing extra shall be paid. In case approval for drilling bore well not granted by HINDU COLLEGE/ local body/competent authority, the Contractor shall make own arrangement for tanker water for which nothing extra shall be paid.
- f. Electricity connection shall be provided by COLLEGE at one point near the site. The Contractor shall make is own arrangement for tapping at multiple locations and distribution network for which nothing extra shall be paid. Consumption charges as per NDPL Commercial tariffs. The current rates and fixed monthly charges may be ascertained from Hindu College or as per prevailing rate from time to time shall be payable to HINDU COLLEGE by the Contractor. Before tendering, he shall visit the site and assess the manner in which he is able to arrange the above facilities. The Principal, Hindu College ,shall in no way be responsible for any delay on this account and no claim, whatsoever, on this account shall be entertained. The Contractor shall be required to pay electricity charges at regular interval as desired by HINDU COLLEGE. RA bill/ Final bill shall be paid only after proof of up-to-date payment of electricity charges submitted to the Engineer-in- Charge.
- g. The Contractor shall abide by the rules /bye laws applicable in respect of water /electricity connection and he shall be solely responsible for any penalty on account of violation of any of the rules / bye laws in this regard. The Contractor shall indemnify the HINDU COLLEGE against any claim arising out of pilferage, theft, damage, penalty, non-settlement of bills etc. whatsoever on this account.
- h. Space for site office, site storage yard and worker restrooms (including toilets) shall be provided in the vicinity of site free of ground rent. The agency shall be required to establish all such facilities and for which nothing extra shall be paid. It shall be responsibility of agency to transport the material from material stacking yard to site and for which nothing extra shall be paid. In case any building or infrastructure work is required to be executed on the land occupied by the site office/site store/workers rest room/ labour camp, agency shall relocate these shelters for which nothing extra shall be paid.

- i. Site office facilities for HINDU COLLEGE and / or the representatives appointed by HINDU COLLEGE (PMC and Architect Consultants) shall be provided by the Contractor at free of cost on the free issued land / plot by HINDU COLLEGE in the vicinity of the Site / Work as elaborated in the Special Conditions of the Contract.
- j. Contractor shall make temporary access / approach roads to the work site / storage areas etc. to suite with the movement and loads of the transport vehicles including smooth movements during monsoon period at free of cost and deemed included in the Tendered price.
- k. The Contractor has to provide creche facility for the children of labour deployed in the work.
- l. Estate Officer of HINDU COLLEGE shall be authorized to check the cleanliness and hygienic of the site & labour accommodation units and suggestion given by him will be binding on the Contractor for which nothing extra shall be paid.
- m. The Contractor shall be required to strictly follow security norms and procedure in terms of entry/exit passes to all the vehicles/ persons/ materials, issue/ reissue/ surrender of labour passes and other rules and regulations that will be brought in force from time to time by HINDU COLLEGE. Any penalty imposed by Hindu College , University of Delhi, Delhi for violating security norms will be immediately paid by the Contractor for which nothing extra shall be paid.
- n. All pre-fabrication works wherever possible shall be carried outside the HINDU COLLEGE premises and only assembling and finishing portion of the work shall be at the site of work.
- o. Some trees are required to be replanted & some are to be cut and both shall be paid under relevant items. Approval for the same shall be responsibility of HINDU COLLEGE. Agency shall be required to follow the guidelines prescribed by local body for transplanting & cutting and nothing extra shall be paid on this account. Apart from that some trees exist in the vicinity of construction area need to be preserved throughout the time till final handing over. The agency shall take every measure for protection of such trees and nothing extra shall be paid on this account.
- p. Space of about 500 Sq.M designated place for labour accommodation shall be provided within the SITE . Whole area of labour accommodation shall be cordoned off by erecting GI Sheet of height 3.5 metre for which nothing extra shall be paid. The Bidder Shall be required to construct labour accommodation neatly with proper sanitation including soak pit etc. The bidder shall follow security regulations issued by HINDU COLLEGE from Time to time. Nothing extra shall be paid on this account. Bidder shall be required to pay at Rs.40 / month (Including applicable GST) per Sq.M or part thereof to HINDU COLLEGE toward licence fee for the area being used for labour hutment. After completion of work area shall be handed over in original condition.
- q. Contractor shall be responsible to establish the Closed-Circuit Television (CCTV) Surveillance system for the entire construction Site throughout the Construction activity right from the taking over the Site and till handed over the Building and Facility to HINDU COLLEGE.
- r. CCTV Surveillance system of HD quality shall be included with the necessary hardware, software, networking cables, switches, signal boosters etc. for construction site shall cater minimum requirements but not limited to the following:
 - Real time viewing, watching progress as it unfolds
 - Record of constant traffic all day long and during the night
 - keeping track of all the construction and other activities that occur at the site on day-to-day basis
 - Archiving, all major project milestones saved and logged
 - Embeddable video (java script), to view any of the site related feeds on the website
 - CCTV camera shall act as deterrent against crime and vandalism at site

- CCTV cameras shall be able to provide a virtual experience of going around the entire site to determine the progress of work and current worker's activities at site.
- Time lapse video of the construction progress from commencement to till date of the request

The cost towards CCTV Surveillance system establishment and removal after completing the project is deemed included in the tendered amount and shall not be paid separately.

The footage of surveillance system shall be shared I real time with the Representatives of Principal Hindu College. Any major works like Casting of RCC items and other items as specified by Engineer-in -charge shall not be done in case of non -working CCTV surveillance system.

7. 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 $\frac{1}{4}$ to 1 ($\frac{1}{4}$ horizontal and 1 vertical).
2. Scaffolding of staging more than 3.6 m (12 ft.) 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.(3 ft.) 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 3.6m(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 90cm.(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 ladders shall be over 9 m.(30 ft.) 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 $\frac{1}{4}$ " 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. (i) Excavation and Trenching - All trenches 1.2 m. (4 ft.) 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. (3 ft.) above the surface of the ground. The side of the trenches which are 1.5 m. (5 ft.) 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. (5 ft.) 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.
(ii) Safety Measures for digging bore holes:-
 - a. If the bore well is successful, it should be safely capped to avoid caving and collapse of the borewell. The failed and the abandoned ones should be completely refilled to avoid caving and collapse;
 - b. 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;
 - c. 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 50 m around the point

of drilling to avoid entry of people;

- d. After drilling the borewell, 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;
 - e. After the completion of the borewell, 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;
 - f. After the borewell 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 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 roof, floor or other part of the building shall be so overloaded with debris or materials as to render it unsafe.
- The contractor shall take every precaution for safety of man & material. In case of any mishap, the contractor shall be responsible for any civil and/or criminal liability.
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 contractors should take adequate steps to ensure proper use of equipment by those concerned. The following safety equipment shall invariably be provided.
- a. Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles
 - b. 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.
 - c. Those engaged in welding works shall be provided with welder's protective eye shields.
 - d. Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
 - e. 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 :-
 - i. Entry for workers into the line shall not be allowed except under supervision of the responsible engineer of the contractor.
 - ii. 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.
 - iii. 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.
 - iv. 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.
 - v. 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.

- vi. The area should be barricaded or cordoned off 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.
- vii. No smoking or open flames shall be allowed near the blocked manhole being cleaned.
- viii. 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.
- ix. Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge shall decide the time up to which a worker may be allowed to work continuously inside the manhole.
- x. Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
- xi. 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.
- xii. The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the manhole.
- xiii. 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.
- xiv. Workmen descending a manhole shall try each ladder step 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.
- xv. 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.
- xvi. 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.

9. 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 readymade 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.
10. Workmen executing work on scaffolds or other structures above specified height shall be provided with full body harness and fall arresters.
11. An additional clause (viii)(i) of Central Public Works Department 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:
- (a) White lead, sulphate of lead or product containing this pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.
 - (b) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.
 - (c) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.
 - (d) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
 - (e) Overall, shall be worn by working painters during the whole of working period.
 - (f) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.
 - (g) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of HINDU COLLEGE
 - (h) HINDU COLLEGE may require, when necessary medical examination of workers.
 - (i) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

12. 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.
13. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions: -
 - (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.
 - (c) 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.
 - (d) 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.
 - (e) 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.
14. 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.
15. 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.
16. 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.

17. 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.
18. Notwithstanding the above clauses from (1) to (17), there is nothing in these to exempt the Contractor from the operations of any other Act or Rule in force in the Republic of India.
19. The contractor shall take every precaution for safety of man & material. In case of any mishappening the contractor shall be responsible for any civil and/or criminal liability.

8. MODEL RULES FOR THE PROTECTION OF HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS EMPLOYED BY CONTRACTORS.

A. APPLICATION

These rules shall apply to all buildings and construction works in charge of Central Public Works Department/PWD (DA) 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.

B. DEFINITION

Workplace 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.

C. FIRST-AID FACILITIES

- (a) At every workplace, 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.
- (b) The first-aid box shall be distinctly marked with a red cross on white background and shall contain the following equipment: -
- (c) For work places in which the number of contract labour employed does not exceed 50- Each first-aid box shall contain the following equipment: -
 - (i) 6 small sterilised dressings.
 - (ii) Medium size sterilised dressings.
 - (iii) Large size sterilised dressings.
 - (iv) Large sterilised burn dressings.
 - (v) 1(30ml.) bottle containing two percent alcoholic solution of iodine.
- (d) 1 (30 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
 - (i) 1 snakebite lancet.
 - (ii) 1 (30 gms.) bottle of potassium permanganate crystals.
 - (iii) 1 pair scissors.
- (e) 1 copy of the first-aid leaflet issued by the Principal General, Factory Advice Service and Labour Colleges, Government of India.
 - (i) 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.
 - (ii) Ointment for burns.
 - (iii) A bottle of suitable surgical antiseptic solution.
- (f) For workplaces in which the number of contract labour exceed 50. Each first-aid box shall contain the following equipment's.
 - (i) 12 small, sterilised dressings.
 - (ii) 6 medium size sterilised dressings.
 - (iii) 6 large size sterilised dressings.

- (iv) 6 large size sterilised burn dressings.
- (v) 6 (15 gms.) packets sterilised cotton wool.
- (vi) 1 (60 ml.) bottle containing a two per cent alcoholic solution iodine.
- (vii) 1 (60 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
- (viii) 1 roll of adhesive plaster.
- (ix) 1 snake bite lancet.
- (x) 1 (30 gms.) bottle of potassium permanganate crystals.
- (xi) 1 pair scissors.
- (xii) 1 copy of the first-aid leaflet issued by the Principal General Factory Advice Service and Labour College s /Government of India.
- (xiii) A bottle containing 100 tablets (each of 5 gms.) of aspirin.
- (xiv) Ointment for burns.
- (xv) A bottle of suitable surgical antiseptic solution.
- (g) Adequate arrangements shall be made for immediate recouplement of the equipment when necessary.
- (h) 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.
- (i) 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.
- (j) 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.
- (k) 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.

D. DRINKING WATER

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

E. WASHING FACILITIES

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

F. LATRINES AND URINALS

- (a) Latrines shall be provided in every work place on the following scale namely: -
- (b) Where female are employed, there shall be at least one latrine for every 25 females.
- (c) Where males are employed, there shall be at least one latrine for every 25 males.
- (d) 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.
- (e) Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings
- (f) Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat- resisting non-absorbent materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system.
- (g) 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.
- (h) The notice shall also bear the figure of a man or of a woman, as the case may be.
- (i) 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 exceeding 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.
 - (i) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.
 - (ii) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.
- (j) Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.
- (k) 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).
- (l) 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.

G. 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. 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.

H. CRECHES

- (a) 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.
- (b) 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.
- (c) 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.
- (d) 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.
- (e) The use of the rooms earmarked as creches shall be restricted to children, their attendants and mothers of the children.

I. CANTEENS

- (a) 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.
- (b) The canteen shall be maintained by the Contractor in an efficient manner.
- (c) The canteen shall consist of at least a dining hall, kitchen, storeroom, pantry and washing places separately for workers and utensils.
- (d) The canteen shall be sufficiently lighted at all times when any person has access to it.
- (e) 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.
- (f) Provided that the inside walls of the kitchen shall be lime-washed every four months.
- (g) The premises of the canteen shall be maintained in a clean and sanitary condition.
- (h) Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.
- (i) Suitable arrangements shall be made for the collection and disposal of garbage.
- (j) The dining hall shall accommodate at a time 30 per cent of the contract labour working at a time.
- (k) 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 per diner to be accommodated as prescribed in sub-Rule 9.
 - (i) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number.
 - (ii) Washing places for women shall be separate and screened to secure privacy.
- (a) Sufficient tables stools, chair or benches shall be available for the number of diners to be accommodated as prescribed in sub-Rule 9.
- (b) There shall be provided and maintained sufficient utensils crockery, furniture and any other equipment necessary for the efficient running of the canteen.
- (c) The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.
- (d) Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.
- (e) A service counter, if provided, shall have top of smooth and impervious material.

- (f) Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipment's.
- (g) The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.
- (h) 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.
- (i) 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:-
 - (i) The rent of land and building.
 - (ii) The depreciation and maintenance charges for the building and equipment provided for the canteen.
 - (iii) The cost of purchase, repairs and replacement of equipment including furniture, crockery, cutlery and utensils.
 - (iv) The water charges and other charges incurred for lighting and ventilation.
 - (v) The interest and amounts spent on the provision and maintenance of equipment provided for the canteen.
- (j) The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

J. ANTI-MALARIAL PRECAUTIONS:

- (a) 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.
- (b) The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral part of the contracts.

K. AMENDMENTS

Government may, from time to time, add to or amend these rules and issue direction— - it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

9. CONTRACTOR'S LABOUR REGULATIONS

A. SHORT TITLE

These regulations may be called the CPWD ./PWD (DA) Contractors Labour Regulations.

B. DEFINITIONS

- (a) Workman means any person employed by HINDU COLLEGE or its Contractor directly or indirectly through a subcontractor with or without the knowledge of the HINDU COLLEGE 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: -
 - (i) Who is employed mainly in a managerial or administrative capacity: or
 - (ii) Who, being employed in a supervisory capacity draws wages exceeding five hundred rupees 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
 - (iii) 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.
- (b) No person below the age of 18 years shall be employed to act as a workman.
- (c) 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.
- (d) 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.
- (e) Wages shall have the same meaning as defined in the Payment of Wages Act.
- (f) 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.
- (g) 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.
- (h) 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.
- (i) Where the minimum wages prescribed by the Government under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same Contractor for a continuous period of not less than 6 days.
- (j) 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.

C. 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'.

D. PAYMENT OF WAGES

- (a) The Contractor shall fix wage periods in respect of which wages shall be payable.
- (b) No wage period shall exceed one month.
- (c) 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.
- (d) 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.
- (e) 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.
- (f) Wages due to every worker shall be paid to him direct by Contractor through Bank or ECS or online transfer to his bank account.
- (g) All wages shall be paid through Bank or ECS or online transfer.
- (h) Wages shall be paid without any deductions of any kind except those specified by the Central Government by general or special order in this behalf or permissible under the Payment of Wages Act 1956.
- (i) 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.
- (j) It shall be the duty of the Contractor to ensure the disbursement of wages through bank account of labour.
- (k) The Contractor shall obtain from the Junior Engineer or any other authorised 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: -
- (l) "Certified that the amount shown in column No has been paid to the workman concerned through bank account of labour on at....."

E. FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES

- (a) The wages of a worker shall be paid to him without any deduction of any kind except the following: -
- (b) Fines
- (c) 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.
- (d) 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
- (e) Deduction for recovery of advances or for adjustment of overpayment of wages, advances granted shall be entered in a register.

- (f) Any other deduction which the Central Government may from time to time allow.
- (g) 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 enclosed at Appendix-X

- (h) 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.
- (i) 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.
- (j) No fine imposed on any worker shall be recovered from him by instalment, or after the expiry of sixty days from the date on which it was imposed.
- (k) Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

F. LABOUR RECORDS

- (a) 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)
- (b) 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).
- (c) 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).
- (d) Register of accidents - 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:
 - (e) Full particulars of the labourers who met with accident.
 - (f) Rate of Wages.
 - (g) Sex
 - (h) Age
 - (i) Nature of accident and cause of accident.
 - (j) Time and date of accident.
 - (k) Date and time when admitted in Hospital,
 - (l) Date of discharge from the Hospital.
 - (m) Period of treatment and result of treatment.
 - (n) Percentage of loss of earning capacity and disability as assessed by Medical Officer.
 - (o) Claim required to be paid under Workmen's Compensation Act.
 - (p) Date of payment of compensation.
 - (q) Amount paid with details of the person to whom the same was paid.
 - (r) Authority by whom the compensation was assessed.
 - (s) Remarks
- (t) The Contractor shall maintain a Register of Fines in the Form XII of the CL (R&A) Rules 1971 (Appendix-XI)

- (u) 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)
- (i) The Contractor shall maintain a Register of deductions for damage or loss in Form XX of the CL (R&A) Rules 1971 (Appendix-XII)
- (ii) The Contractor shall maintain a Register of Advances in Form XXIII of the CL (R&A) Rules 1971(Appendix-XIII)
- (iii) The Contractor shall maintain a Register of Overtime in Form XXIII of the CL (R&A) Rules 1971(Appendix-XIV).

G. ATTENDANCE CARD-CUM-WAGE SLIP

- (a) The Contractor shall issue an Attendance card-cum-wage slip to each workman employed by him in the specimen form at (Appendix-VII).
- (b) The card shall be valid for each wage period.
- (c) 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.
- (d) The card shall remain in possession of the worker during the wage period under reference.
- (e) 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.
- (f) 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.

H. 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).

I. 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).

J. 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 authorised by the Ministry of Urban Development in this behalf.

K. POWER OF LABOUR OFFICER TO MAKE INVESTIGATIONS OR ENQUIRY

The Labour Officer or any person authorised by Central Government 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.

L. REPORT OF LABOUR OFFICER

The Labour Officer or other persons authorised as aforesaid shall submit a report of result of his investigation or enquiry to the Executive Engineer 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.

- (a) 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.

M. APPEAL AGAINST THE DECISION OF LABOUR OFFICER

Any person aggrieved by the decision and recommendations of the Labour Officer or other person so authorised 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.

N. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER

- (a) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by:-
- (i) An officer of a registered trade union of which he is a member.
 - (ii) An officer of a federation of trade unions to which the trade union referred to in clause (a) is affiliated.
 - (iii) 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.
- (b) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by: -
- (i) An officer of an association of employers of which he is a member.
 - (ii) An officer of a federation of associations of employers to which association referred to in clause (a) is affiliated.
 - (iii) Where the employer 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.
 - (iv) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these regulations.

O. 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, authorised by the Central Government on his behalf.

P. SUBMISSIONS OF RETURNS

The Contractor shall submit periodical returns as may be specified from time to time.

Q. AMENDMENTS

The Central Government 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 Engineer-In-Charge shall be final.

प्रसूति प्रसुविधाओं का रजिस्टर (ठेके की शर्तों का खण्ड 19-च)

REGISTER OF MATERNITY BENEFITS (Clause 19 F)

ठेकेदार का नाम और पता

Name and address of the contractor.....

कार्य का नाम और स्थिति

Name and location of the work.....

कर्मचारी का नाम	पिता/पति का नाम	नियोजन का स्वरूप	वास्तविक नियुक्ति की अवधि	तारीख जिसको प्रसवावस्था की सूचना दी गई
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

तारीख जिसको प्रसूति छुट्टी प्रारम्भ हुई और समाप्त हुई

Date on which maternity leave commenced and ended

प्रसव/गर्भपात की तारीख	प्रसव की दशा में		गर्भपात की दशा में	
Date of delivery/	In case of delivery		In case of miscarriage	
miscarriage	प्रारम्भ हुई	समाप्त हुई	प्रारम्भ हुई	समाप्त हुई
	commenced	Ended	Commenced	Ended
6	7	8	9	10

कर्मचारी को संदत्त छुट्टी वेतन

Leave pay paid to the employee

प्रसव की दशा में		गर्भपात की दशा में		टिप्पणियां
In case of delivery		In case of miscarriage		Remarks
छुट्टी वेतन की दर	संदत्त रकम	छुट्टी वेतन की दर	संदत्त रकम	
Rate of leave pay	Amount paid	Rate of leave pay	Amount paid	
11	12	13	14	15

**केन्द्रीय लोक निर्माण विभाग संकर्मों में ठेकेदारों के श्रमिकों को अनुज्ञेय प्रसूति
प्रसुविधा के बारे में रजिस्टर का नमूना प्रारूप**

**SPECIMEN FORM OF THE REGISTER, REGARDING
MATERNITY BENEFIT ADMISSIBLE TO THE CONTRACTOR'S LABOUR
IN CENTRAL PUBLIC WORKS DEPARTMENT WORKS.**

ठेकेदार का नाम और पता

Name and address of the contractor.....

कार्य का नाम और स्थिति

Name and location of the work.....

1. स्त्री का नाम और उसके पति का नाम
Name of the woman and her husband's name.
2. पद नाम
Designation.
3. नियुक्ति की तारीख
Date of appointment.
4. मास और वर्षों सहित वह तारीख जिसको उसे नियुक्त किया गया
Date with months and years in which she is employed.
5. सेवान्मुक्त/पदच्युत किये जाने की तारीख, यदि कोई हो
Date of discharge/dismissal, if any.
6. गर्भ धारण के बाबत प्रमाण पत्र पेश किए जाने की तारीख
Date of production of certificates in respect of pregnancy.
7. वह तारीख जिसको स्त्री प्रत्याशित प्रसव के बारे में इत्तिला देती है
Date on which the woman informs about the expected delivery.
8. प्रसव/गर्भपात/ मृत्यु होने की तारीख
Date of delivery/miscarriage/death
9. प्रसव/गर्भपात/ संबंधी प्रमाण पत्र किये जाने की तारीख
Date of production of certificate in respect of delivery/miscarriage.
10. प्रत्याशित प्रसव से पूर्व संदत्त प्रसूति/मृत्यु प्रसुविधा की रकम और उसकी तारीख
Date with the amount of maternity/death benefit paid in advance of expected delivery.
11. प्रसूति प्रसुविधा के पश्चातवर्ती संदाय की रकम और उसकी तारीख
Date with amount of subsequent payment of maternity benefit.
12. स्त्री के मृत्यु के बाद उसकी प्रसूति प्रसुविधा का संदाय प्राप्त करने के लिए उस स्त्री द्वारा नाम निर्देशित व्यक्ति का नाम
Name of the person nominated by the woman to receive the payment of the maternity benefit after her death.
13. यदि महिला की मृत्यु हो जाती है तो उसकी मृत्यु की तारीख, उस व्यक्ति का नाम, जिसको प्रसूति प्रसुविधा की रकम संदत्त की गई, संदाय की तारीख और मास
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. रजिस्टर की प्रविष्टियों को अधिप्रमाणित करते हुए ठेकेदार के हस्ताक्षर
Signature of the contractor authenticating entries in the register.
15. निरीक्षक आफिसर के उपयोग के लिए टिप्पणी स्तम्भ
Remarks column for the use of Inspecting Officer.

श्रम बोर्ड Labour Board

कार्य का नाम.....

Name of work

ठेकेदार का नाम.....

Name of Contractor

ठेकेदार का पता.....

Address of Contractor

के० लो० नि० विभाग के मंडल का नाम व पता.....

Name and address of C.P.W.D. Division

के. लो. नि. विभाग के श्रम अधिकारी का नाम

Name of C.P.W.D. Labour Officer

के. लो. नि. विभाग के श्रम अधिकारी का पता.....

Address of C.P.W.D. Labour Officer

श्रम कार्यान्वयन अधिकारी का नाम

Name of Labour Enforcement Officer

श्रम कार्यान्वयन अधिकारी का पता

Address of Labour Enforcement Officer

क्रम संख्या Sl. No.	श्रेणी Category	न्यूनतम निर्धारित मजदूरी Minimum wage fixed	भुगतान की गई वास्तविक मजदूरी Actual wage paid	वर्तमान संख्या Number present	टिप्पणी Remarks

साप्ताहिक छुट्टी

Weekly holiday

मजदूरी की अवधि.....

Wage period

मजदूरी के भुगतान की तारीख

Date of payment of wages

काम के घंटे.....

Working hours

आराम का मध्यान्तर.....

Rest interval

ठेकेदार द्वारा लगाये गए मजदूरों का रजिस्टर Register of Workmen Employed by Contractor

ठेकेदार का नाम व पता.....

Name and address of contractor

कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है

Name and address of establishment under which contract is carried on

कार्य का स्वरूप व स्थान

Nature and location of work

मुख्य नियोक्ता का नाम व पता

Name and address of Principal Employer

क्र. संख्या	मजदूर का नाम	आयु तथा लिंग	पिता/पति का नाम	कार्य का स्वरूप/ पद का नाम	मजदूर का स्थायी गृह पता (गांव व तहसील ताल्लुक और जिला)	स्थानीय पता	नौकरी आरम्भ होने की तारीख	मजदूर के हस्ताक्षर/अंगूठे का निशान	नौकरी से बरखास्त करने की तारीख	बरखास्त करने के कारण	टिप्पणी
Sl. No.	Name and Surname of workman	Age and Sex	Father's/Husband's name	Nature of employment/ designation	Permanent home address of the workman (Village and Tehsil, Taluk and District)	Local address	Date of commencement of employment	Signature or thumb impression of the workman	Date of termination of employment	Reasons for terminations	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Appendix IV

टेकेदार का नाम व पता.....

Name and address of contractor

कार्यालय का नाम और पता जिसके अधीन ठेका चल रहा है

Name and address of establishment under which contract is carried on

कार्य का स्वरूप व स्थान.....

Nature and location of work

मुख्य नियोक्ता का नाम व पता..... महीने पक्ष के लिए.....

Name and address of Principal Employer.

For the Month of fortnight

क्र. संख्या Sl. No	मजदूर का नाम Name of Workman	लिंग Sex	पिता / पति का नाम Father's/Husband's name	दिनांक Dates	टिप्पणी Remarks
1	2	3	4	5	6
				1 2 3 4 5	

फार्म 17 Form-XVII (कृपया नियम 78 (2)(क) देखें) (See Rule 78(2)(a))

मजदूरी रजिस्टर Register of wages

ठेकेदार का नाम व पता.....

Name and address of contractor

कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है

Name and address of establishment under which contract is carried on

कार्य का स्वरूप व स्थान.....

Nature and location of work

मुख्य नियोजता का नाम व पता..... मजदूरी की अवधि: मासिक या पक्षिक

Name and address of Principal Employer..... wages Period: Monthly/Fortnight

क्र. संख्या Sl. No.	मजदूर का नाम Name of workman	मजदूरों के रजिस्टर में क्रम संख्या Serial No. in the register of workman	लिए गए कार्य का स्वरूप/ पदनाम Designation/ nature of work done	जितने दिन कार्य किया No. of days worked	किए गए कार्य के एक Unit of work done	मजदूरी की दर/पीस रेट Daily rate of wages/ piece rate	की गई मजदूरी की रकम Amount of wages earned					वसूली, यदि कोई हो (वसूली का स्वरूप लिखें) Deductions if any (indicate nature)	मुगतान की गई शुद्ध राशि Net amount paid	मजदूर के हस्ताक्षर / अंगुठी का निशान Signature or thumb impression of the workman	ठेकेदार अथवा उसके प्रतिनिधि के हस्ताक्षर Initial of contractor or his representative
							मूल मजदूरी Basic wages	महंगाई भत्ता Dearness allowances	समयोपरी भत्ता Overtime	अन्य नकद भुगतान के स्वरूप लिखें Other cash payments (indicate nature)	जोड़ Total				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

मजदूरी कार्ड संख्या / Wage Card No.....

मजदूरी कार्ड Wage Card

ठेकेदार का नाम व पता..... जारी करने की तारीख

Name and address of contractor

Date of Issue

कार्य का नाम व स्थान पद

Name and location of work

Designation

मजदूर का नाम..... मास / पक्ष

Name of workman

Month/Fortnight

मजदूरी की दर

Rate of Wages

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

प्रातः

Morning

दर

Rate

सायं

Evening

रकम

Amount

हस्ताक्षर

Initial

परिशिष्ट / Appendix 'VII'
(सीधी तरफ / Obverse)



..... से अपनी मजदूरी के रूपये प्राप्त किए
Received from the sum of Rs. on account of my wages

हस्ताक्षर Signature.

यह मजदूरी कार्ड जारी होने की तारीख से एक मास तक के लिए वैध है।
The Wage Card is valid for one month from the date of issue

फार्म 19/Form-XIX

(कृपया नियम 78(2)(ख) देखें)
[See rule 78 (2)(b)]मजदूरी कार्ड
Wages Slip

ठेकेदार का नाम व पता

Name and address of contractor.....

मजदूर का नाम तथा उसके पिता/पति का नाम

Name and Father's/Husband's name of workman.....

कार्य का स्वरूप तथा स्थान का नाम

Nature and location of work.....

सप्ताह/पक्ष/मास के लिए

For the Week/Fortnight/Month ending.....

1. जितने दिन कार्य किया

No. of days worked.....

2. किए गए कार्य के एककों की संख्या (पीस रेट मजदूरों के बारे में)

No. of units worked in case of piece rate workers.....

3. दैनिक मजदूरी की दर/पीस रेट

Rate of dailly wages/piece rate

4. समयोपरि मजदूरी की रकम

Amount of overtime wages.....

5. दी जाने वाली कुल रकम

Gross wages payable.....

6. वसूलियां, यदि कोई हो

Deduction, if any.....

7. दी गई मजदूरी की शुद्ध रकम

Net amount of wages paid.....

ठेकेदार अथवा उसके प्रतिनिधि के हस्ताक्षर
Initials of the contractor or his representative

Appendix VIII

फार्म 14 / Form-XIV

(कृपया नियम 76 देखें)

[See rule 76]

रोजगार कार्ड Employment Card

ठेकेदार का नाम व पता

Name and address of contractor-----

कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है

Name and address of establishment under which contract is carried on-----

कार्य का नाम व स्थान

Name of work and location of work-----

मुख्य नियोक्ता का नाम व पता

Name and address of Principal Employer-----

1. मजदूर का नाम

Name of the workman-----

2. लगाये गए मजदूरों के रजिस्टर में क्रम संख्या

Sl. No. in the register of workman employed-----

3. रोजगार/पद का नाम

Nature of employment/designation-----

4. मजदूरी की दर

(पीस वर्क के बारे में एकक के ब्यौरा सहित)

Wage rate (with particulars of unit in case of piece work)-----

5. मजदूरी की अवधि

Wage period-----

6. रोजगार की अवधि

Tenure of employment-----

7. टिप्पणी

Remarks-----

ठेकेदार के हस्ताक्षर
Signature of contractor

फार्म 15 Form-XV (कृपया नियम 77 देखें) (See Rule 77)
सेवा प्रमाणपत्र Service Certificate

ठेकेदार का नाम व पता.....
Name and address of contractor.....
कार्य का स्वरूप तथा स्थान.....
Nature and location of work.....
मजदूर का नाम व पता.....
Name and address of workman.....
आयु अथवा जन्म तिथि.....
Age or date of birth.....
पहचान चिन्ह.....
Identification marks.....
पिता/पति का नाम.....
Father's/Husband's name.....
कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है.....
Name and address of establishment in under which contract is carried on.....
मुख्य नियोक्ता का नाम और पता.....
Name and address of Principal Employer.....

क्र. संख्या Sl. No	रोजगार की कुल अवधि Total Period for which employed से From	तक To	किए गए कार्य का स्वरूप Nature of Work Done	मजदूरी दर (पीस वर्क के मामलों में एकक के ब्योरो सहित) Rate of wages (with particulars of unit in case of piece work)	टिप्पणी Remarks
1	2	3	4	5	6

हस्ताक्षर / Signature

Appendix X

LIST OF ACTS AND OMISSIONS FOR WHICH FINES CAN BE IMPOSED

ऐसे कार्यों तथा भूलों की सूची जिसके लिए जुर्माने किये जा सकते हैं

केन्द्रीय लोक निर्माण विभाग ठेकेदार श्रमिक विनियमों के नियम 7 (v) के अनुसार कार्य स्थल पर अंग्रेजी तथा स्थानीय भाषा दोनों में अच्छी तथा स्थानीय भाषा दोनों में अच्छी प्रकार से प्रदर्शित किया जाना।	In accordance with rule 7(v) of the CPWD Contractor's Labour Regulations to be displayed prominently at the site of work both in English and local Language.
1. जान बूझ कर अकेले या अन्य के साथ मिल कर अवज्ञा या उल्लंघन।	1. Wilful insubordination or disobedience, whether alone or in combination with other.
2. केन्द्रीय लोक निर्माण विभाग के कार्य या सम्पत्ति के अतिरिक्त, ठेकों के संबंध में चोरी धोखाबाजी, बेईमानी करना।	2. Theft fraud or dishonesty in connection with the contractors beside a business or property of CPWD.
3. घूस या अन्य गैरकानूनी परितोषण लेना या देना।	3. Taking or giving bribes or any illegal gratifications
4. नित्य देर से काम पर आना।	4. Habitual late attendance.
5. शराब पीकर लड़ना, उपद्रवी या बेदंगा या अन्यमनस्क व्यवहार।	5. Drunkenness lighting, riotous or disorderly or indifferent behaviour
6. नित्य लापरवाही।	6. Habitual negligence.
7. उस क्षेत्रों के आस-पास बीड़ी-सिग्रेट पीना जहां आग पकड़ने वाली या अन्य सामग्री रखी हो।	7. Smoking near or around the area where combustible or other materials are locked
8. नित्य अनुशासनहीनता।	8. Habitual indiscipline.
9. चालू कार्य में अथवा के. लो. नि. वि. या ठेकेदार की संपत्ति को क्षति पहुंचाना।	9. Causing damage to work in the progress or to property of the CPWD or of the contractor.
10. ड्युटी पर सोना।	10. Sleeping on duty.
11. कामचोरी या कार्य को धीरे करना।	11. Malingering or slowing down work.
12. नाम, आयु, पिता के नाम आदि के बारे में गलत सूचना देना।	12. Giving of false information regarding name, age father's name, etc.
13. नियोक्ता द्वारा दिये गये मजदूरी कार्ड को नित्य खो देना।	13. Habitual loss of wage cards supplied by the employers.
14. मालिक की उत्पादन की सम्पत्ति का अनधिकृत उपयोग या कार्यस्थल पर अनाधिकृत वस्तुएं बनाना।	14. Unauthorised use of employer's property of manufacturing or making of unauthorised particles at the work place.
15. कुशल कामगारों द्वारा निर्माण तथा अनुरक्षण में अकुशल कारीगरी दिखाना जिसे विभाग स्वीकार नहीं करता जिसके संशोधन के लिये ठेकेदार को बाध्य किया जाता है।	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. गलत शिकायतें लगाना और/या भ्रामक विवरण देना।	16. Making false complaints and/or misleading statements.
17. स्थापनाओं के परिसर के भीतर कोई व्यापार चलाना।	17. Engaging on trade within the premises of the establishments.
18. कर्मचारियों का अनधिकृत व्यापार कार्य करना।	18. Any unauthorised divulgence of business affairs of the employees.
19. स्थापना के परिसर के भीतर किसी प्रकार का धन एकत्र करना या उसके लिए प्रचार करना जब तक कि मालिक द्वारा अधिकार न दिया गया हो।	19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorised by the employer.
20. मालिकों की पूर्व अनुमति के बिना परिसर के भीतर बैठकें बुलाना।	20. Holding meeting inside the premises without previous sanction of the employers.
21. परिसर के भीतर कार्य समय के दौरान किसी कामगार या कर्मचारी को डराना या धमकाना।	21. Threatening or intimidating any workman or employer during the working hours within the premises.

फार्म 12 Form-XII (कृपया नियम 78(2)घ देखें) (See Rule 78(2) (d))

जुर्मानों का रजिस्टर Register of Fines

ठेकेदार का नाम व पता
 Name and address of contractor
 कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है
 Name and address of establishment in under which contract is carried on
 कार्य का स्वरूप व स्थान
 Nature and location of work
 मुख्य नियोजता का नाम व पता
 Name and address of Principal Employer

क्र. संख्या Sl. No.	मजदूर का नाम Name of workman	पिता/पति का नाम Father's/ Husband's name	नौकरी का स्वरूप/ पदनाम Designation/ nature of employment	वह कार्य/मूल जिसके लिए जुर्माना लगाया गया Act/Omission for which fine imposed	जिसके लिए जुर्माना अपराध की तारीख Date of Offence	क्या कर्मकार ने इस जुर्माने के विरुद्ध कोई कारण बताया है Whether workman showed cause against fine	उस व्यक्ति का नाम जिसकी उपस्थिति में कर्मचारी की व्याख्या सुनी गई Name of person in whose presence employee's explanation was heard	मजदूरी की अवधि तथा देय मजदूरी Wage period and wages payable	जुर्माना की गई राशि Amount of fine imposed	जुर्माना जिस तिथि को समाप्त हुआ Date on which fine realised	टिप्पणी Remarks
1	2	3	4	5	6	7	8	9	10	11	12

परिशिष्ट / Appendix 'XI'



फॉर्म 20 Form-XX (कृपया नियम 78(2)घ) देखें) (See Rule 78(2) (d))

क्षति/हानि के लिए कटौती का रजिस्टर Register of Deduction for Damage or Loss

ठेकेदार का नाम व पता
Name and address of contractor

कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है
Name and address of establishment in under which contract is carreid on

कार्य का स्वरूप व स्थान
Nature and location of work

मुख्य नियोक्ता का नाम व पता
Name and address of Principal Employer

क्र. सख्या S.N.	मजदूर का नाम Name of Workman	पिता /पति का नाम Father's/Husband name	नौकरी का स्वरूप / पदनाम Designation/ nature of employment	क्षति अथवा हानि का ब्यौरा Particulars of damage or loss	क्षति अथवा हानि की तारीख Date of damage or loss	क्या कर्मकार ने इस कटौती के विरुद्ध कोई कारण बताया है Whether workman showed cause against deduction	उस व्यक्ति का नाम जिसकी उपस्थिति में कर्मचारी की व्याख्या सुनी गई name of person in whose presence employee's explanation was heard	लगाई गई कटौती की राशि Amount of deduction imposed	किश्तों की संख्या No. of installments	वसूली की तिथि Date of recovery			टिप्पणी Remarking
										प्रथम किश्त First install- ment	अंतिम किश्त Last install- ment		
1	2	3	4	5	6	7	8	9	10	11	12	13	

परिशिष्ट / Appendix 'XII'

फॉर्म 22 Form-XXII (कृपया नियम 78(2)(घ) देखें) (See Rule 78(2) (d))

अग्रिम का रजिस्टर Register of Advances

देकेदार का नाम व पता

Name and address of contractor

कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है

Name and address of establishment in under which contract is carred on

कार्य का स्वरूप व स्थान

Nature and location of work

मुख्य नियोक्ता का नाम व पता

Name and address of Principal Employer

क्र. संख्या Sl. No.	मजदूर का नाम Name of workman	पिता/पति का नाम Father's/ Husband name	नौकरी का स्वरूप/ पदनाम Designation/ nature of employment	मजदूरी की अवधि तथा देय मजदूरी Wage Period and wages payable	दिए गए अग्रिम की तिथि तथा राशि Date and amount of advance given	वह प्रयोजन जिसके लिए अग्रिम दिया गया Purpose(s) for which advance made	किस्तों की संख्या जिनके द्वारा अग्रिम लौटाया जाना है Number of installments by which advance to be repaid	लौटाई गई प्रत्येक किस्त की तिथि तथा राशि Date and amount of each installm- ent repaid	वह तिथि जबकि अन्तिम किस्त लौटाई गई Date and which last installment was repaid	टिप्पणी Remarks
1	2	3	4	5	6	7	8	9	10	11

फार्म 23 Form-XXIII (कृपया नियम 78(2)(ब) देखें) (See Rule 78(2) (e))

समयोपरि रजिस्टर Register of Overtime

ठेकेदार का नाम व पता

Name and address of contractor

कार्यालय का नाम व पता जिसके अधीन ठेका चल रहा है

Name and address of establishment in under which contract is carried on

कार्य का स्वरूप व स्थान

Nature and location of work

मुख्य नियोक्ता का नाम व पता

Name and address of Principal Employer

क्र. संख्या Sl. No.	मजदूर का नाम Name of Workman	पिता/पति का नाम Father's/ Husband's name	लिंग Sex	नौकरी का स्वरूप/ Designation/ nature of employment	जिन तारीखों को समयोपरि कार्य किया Date on which Overtime worked	कुल समयोपरि कार्य अथवा पीस सेट के मामले में उत्पादन Total overtime worked or production in case of piece rated	मजदूरी की सामान्य दर Normal rate of wages	समयोपरि मजदूरी की दर Overtime rate of wages	समयोपरि कमाई Overtime earning	जिस दर पर समयोपरि मजदूरी दी Rate on which overtime paid	टिप्पणी Remarks
1	2	3	4	5	6	7	8	9	10	11	12

**10. INTEGRITY PACT
(DECLARATION BY
HINDU COLLEGE)**

To,

.....
.....
.....

Sub: NIT No. _____

Name of the work:

Dear Sir,

It is here by declared that HINDU COLLEGE is committed to follow the principle of transparency, equity and competitiveness in public procurement.

The subject Notice Inviting Tender (NIT) is an invitation to offer made on the condition that the Bidder will sign the integrity Agreement, which is an integral part of tender / bid documents, failing which the tenderer / bidder will stand disqualified from the tendering process and the bid of the bidder would be summarily rejected.

This declaration shall form part and parcel of the Integrity Agreement and signing of the same shall be deemed as acceptance and signing of the Integrity Agreement on behalf of the HINDU COLLEGE.

Yours faithfully

Principal, Hindu College

INTEGRITY PACT
(UNDERTAKING BY THE BIDDER)

To,

Principal, Hindu College ,

.....

.....

Sub: Submission of the Tender for the work of _____

Respected Madam,

I/We acknowledge that HINDU COLLEGE is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the tender/bid document.

I/We agree that the Notice Inviting Tender (NIT) is an invitation to offer made on the condition that I/We will sign the enclosed integrity Agreement, which is an integral part of tender documents, failing which I/We will stand disqualified from the tendering process. I/We acknowledge that THE MAKING OF THE BID SHALL BE REGARDED AS AN UNCONDITIONAL AND ABSOLUTE AND ACCEPTANCE of this condition of the NIT.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the Contract, which will come into existence when tender/bid is finally accepted by HINDU COLLEGE. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in line with Para 6 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my/our failure to sign and accept the Integrity Agreement, while submitting the tender/bid, HINDU COLLEGE shall have unqualified, absolute and unfettered right to disqualify the tenderer/bidder and reject the tender/bid in accordance with the terms and conditions of the tender/ bid.

Yours faithfully

(Duly authorized signatory of the Bidder)

To be signed by the bidder and same signatory competent / authorized to sign the relevant Contract on behalf of HINDU COLLEGE.

INTEGRITY AGREEMENT

This Integrity Agreement is made at on this day of 20

BETWEEN

Principal HINDU COLLEGE represented through Principal, Hindu College

Delhi(Herein referred as the

(Address of Division)

'Principal/Owner', which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

AND

.....

(Name and Address of the Individual/firm/Company)

through (Hereinafter referred as the (Details of
duly authorized signatory)

"Bidder/Contractor" and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

Preamble

WHEREAS the Principal / Owner has floated the Tender (NIT No _____) (hereinafter Referred to as "Tender/Bid") and intends to award, under laid down organizational procedure, Contract for Construction of _____(Name of work).

hereinafter referred to as the "Contract".

AND WHEREAS the Principal/Owner values full compliance with all relevant laws of the land, rules, regulations, economic use of resources 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" or "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.

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

Article 1: Commitment of the Principal/Owner

- (1) The Principal/Owner commits itself to take all measures necessary to prevent corruption and to observe the following principles:
 - a. No employee of the Principal/Owner, 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/Owner will, during the Tender process, treat all Bidder(s) with equity and reason. The Principal/Owner 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/Owner shall endeavour to exclude from the Tender process any person, whose conduct in the past has been of biased nature.
- (2) If the Principal/Owner 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/Owner 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 HINDU COLLEGE / 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/Owner's 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)/Contractor(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/ representatives in India, 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.

- (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 means a wilful 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 (means 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/Owner under law or the Contract or its established policies and laid down procedures, the Principal/Owner 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/Owner's 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/Owner 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/Owner. Such exclusion may be forever or for a limited period as decided by the Principal/Owner.
- (2). Forfeiture of EMD/Performance Guarantee/Security Deposit: If the Principal/Owner 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/Owner apart from exercising any legal rights that may have accrued to the Principal/Owner, 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/Owner 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 IPC Act, or if the Principal/Owner has substantive suspicion in this regard, the Principal/Owner 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 5 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/ Owner.
- (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/Owner 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/Pact by any of its Subcontractors/sub-

vendors.

- (2). The Principal/Owner will enter into Pacts on identical terms as this one with all Bidders and Contractors.
- (3). The Principal/Owner will disqualify Bidders, who do not submit, the duly signed Pact between the Principal/ Owner and the bidder, along with the Tender or violate its provisions at any stage of the Tender process, from the Tender process.

Article 6- Duration of the Pact

This Pact begins when both the parties have legally signed it. It expires for the Contractor, 12 months after the completion of work under the Contract or till the continuation of defect liability period, whichever is more and for all other bidders, till the Contract has been awarded.

If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged/determined by the Competent Authority, HINDU COLLEGE.

Article 7- Other Provisions

- (1). This Pact is subject to Indian Law, place of performance and jurisdiction is the Headquarters of the Division of the Principal/Owner, who has floated the Tender.
- (2). Changes and supplements need to be made in writing. Side agreements have not been made.
- (3). If the Contractor is a partnership or a consortium, this 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 Pact must be signed by a representative duly authorized by board resolution.
- (4). Should one or several provisions of this 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 intentions.
- (5). It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement / Pact, any action taken by the Owner/Principal in accordance with this Integrity Agreement/ Pact or interpretation thereof shall not be subject to arbitration.

Article 8- 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 any of the provisions covered under this Integrity Pact.

IN WITNESS WHEREOF 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/Owner)

.....

(For and on behalf of Bidder/Contractor)

WITNESSES:

1

(Signature, name and address)

2

(Signature, name and address)

Place:

Dated :

11. PROFORMA OF SCHEDULES (COMBINED FOR MAJOR AND MINOR COMPONENTS) SCHEDULE “A” to “F”

SCHEDULE “A”

Item rate Bid bid is as per **Part D1**

SCHEDULE “B”

Schedule of materials to be issued to the Contractor: NIL

SCHEDULE “C”

Tools and Plants to be hired to the Contractor: NIL

SCHEDULE “D”

Extra Schedule for specific requirements/ documents for the work, if any: NIL

SCHEDULE “E”

Reference to General Conditions of Contract:

Name of Work:

Construction of Hostel No 4 (Ground plus 9 upper Floors) Including Finishing Works, Water Supply & Sanitary Works, Electrical Works, Fire Fighting, Fire Alarm & PA Systems, Lifts, Mechanical Ventilation, Internal Furniture and External Development Works at Hindu College , University of Delhi, Delhi, --

Estimated Amount:

Refer to Article 1.1 of Part A

Earnest Money:

Refer to Article 1.1 of Part A

Performance Guarantee:

5% of tendered value

Security Deposit:

2.5% of tendered value

SCHEDULE “F”

Reference to General Conditions of Contract:

Officer inviting Tender:

Principal, Hindu College

Definitions:

2(v) Engineer-in-charge :

Principal, Hindu College

2(viii) Accepting Authority:

Principal, Hindu College , for & on behalf of Chairman, Governing Body, Hindu College.

2(x) Percentage on cost of materials and labour to cover all overheads and profits:

15%

2(xi) Standard Schedule of Rates:

sDelhi Schedule Rates (DSR) 2023,

Delhi Schedule Rates, Analysis of Rates and specification (Horticulture & Landscape) 2020.

	Delhi Schedule Rates (DSR) 2022 for E&M Works
2(xii) College :	HINDU COLLEGE
9(ii) Standard Contract Form:	Generally, as per CPWD -GCC 2023, CPWD Form 8

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 or proof of applying thereof from the date of issue of letter of acceptance by HINDU COLLEGE:	15 days
ii. Maximum allowable extension beyond the period provided in(i) above:	7 days with late fee @0.1% per day of the Performance Guarantee amount.

CLAUSE 2:

Authority for fixing compensation under Clause 2:	Chairman, Building Committee , HINDU COLLEGE

CLAUSE 2A:

Incentive for early completion:	Not Applicable

CLAUSE 5:

Schedule of handing over of site reckoned from date of issue of work order	15 Days

Schedule of issue of designs:	7 days after W.O

Submission of Programme Chart (Time and Progress using PRIMAVERA within a period from the date of start	07 days

Number of days from the date of issue of letter of acceptance / Work Order for reckoning date of start of the work	15 days

Milestones as per the Table below:

Sl. No.	Description of Milestone (Physical progress)	Time allowed in months (from date of start)	Amount to be with- held in case of non- achievement of milestone (% of tendered amount)
1.	Completion of excavation work	1 months	0.50%
2.	Completion of work up to plinth level (including RCC slab at plinth level)	3 months	0.50%
3.	Completion of RCC work up to First floor slab	6 months	1.00%
4.	• Completion of RCC work up to 4th floor slab • Completion of masonry work up to First floor • Completion of sample toilet at Ground floor • Completion of sample room at Ground floor	10 Months	1.00%
5.	• Completion of all RCC work up to Mumty slab and Terrace Pergola • Completion of internal plumbing work up to 4th floor • Completion of masonry, plaster & flooring work up to 4th floor • Completion of Internal Electrical work up to 4th floor • Completion of firefighting work up to 4th floor	14 months	1.00%
6.	• Completion of all development work including Roads • Completion of entire masonry, plaster & flooring work • Completion of electrical work up to 9th floor • Completion of entire internal & external plumbing work • Lift installation & testing • Completion of entire Fire Fighting work	16 months	1.00%

7.	• Completion of entire internal painting work of building • Completion of entire electrical work • Completion of HVAC work • Supply & installation of furniture items including built-in furniture • External development works including electricals • Exterior finishing & painting works of building • Ancillary balance works under Civil, E&M & Furniture works	18 Months	-

AUTHORITY TO DECIDE:

Extension of time:

Chairman
Building
Committee,
Hindu College

Rescheduling of Milestones:

Chairman
Building
Committee,
Hindu College

Shifting of date of start in case of delay in
handing over of site:

Principal, Hindu
College

CLAUSE 6, 6A:

Clause applicable (6 or 6A)

6A (only computerized MB)

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 (As per discretion of Engineer-In-Charge)

Rs. 50 lakhs

CLAUSE 7A

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 shall be submitted **within a period of 15 days** from issue of work order.

CLAUSE 8A

Authority to decide compensation on account if Contractor fails to: Principal,
submit completion plans
Hindu
College

Compensation for failure in submission of completion plans for Internal and External Civil, Electrical and Mechanical Services within thirty days of the completion of the work is limited to 0.1% of the Tendered Price.

CLAUSE 10A

a. List of minimum testing equipment to be provided by the Contractor at site lab for Civil Works

1. Cube testing machine (with Calibration)
2. Silt testing Jar
3. Sieve analysis – full set
4. Proctor density apparatus
5. Levelling instrument.
6. Oven 01 Number.
7. Cube mould-30Nos.
8. Balance – 7 to 10 kg-1No. and 500gm capacity-1No.
9. Vernier Calliper,
10. Measuring cylinder-2Nos,
11. Measuring tape 3-meter, 5-meter, 10-meter, 30 meter – 2each.
12. Earth Merger,
13. Hipot-Testing Kit.
14. Phase sequence Metre
15. R-L-C Metre
16. Clip-on-metre for different rangers.

b. List of testing equipment to be provided by the Contractor at site lab for E&M Works:

1. Megger
2. Earth Tester
3. Lux meter
4. Wire Gauge
5. Micro meter
6. Vernier Calipers

This list is only indicative and not exhaustive. The bidders shall be required to provide any such testing equipment as required as per CPWD specifications/ item nomenclature as and when required on the site.

CLAUSE 10B (ii): (Mobilization advance)

Whether clause 10B (ii) shall be applicable:

Yes

CLAUSE 10C:

Component of labour expressed as percent of value of work:

25%

Whether clause 10CA shall be applicable:

NOT
APPLICABLE

CLAUSE 10CC: NOT APPLICABLE

CLAUSE 11:

Specifications to be followed for execution of work:

As per CPWD Specifications for Civil and MEP works with up-to-date correction slips (Hereinafter termed as CPWD specifications).

(Enclosed as an Attachment separately for Civil and E&M Works)

i. For Civil, Plumbing Works Horticulture & Landscaping:

CPWD Specifications- 2019_VOL 01 (July 2019) and updates if any till submission of the Bid and

CPWD Specifications- 2019_VOL 02 (July 2019) and updates if any till submission of the Bid.

Manufacturer specifications and IS Standards for non-scheduled items of CPWD.

ii. Electrical works Part – 1; internal – 2023 & External -2023,

iii. Lift & Escalators part – III, 2003),

iv. Wet Riser & Sprinkler System - (Part V 2020).

v. Substation Part IV 2013.

vi. DG Sets Part VII – 2013,

vii. Fire Detection & Alarm System Part VI – 2018.

viii. HVAC -2017 with Amendments

ix. And relevant IS codes

CLAUSE 12:

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:

Refer below

12.2 & 12.3	Deviation Limit beyond which clauses 12.2, 12.3 & 12.4 of GCC shall apply for E&M Works	100% (One Hundred percent)

12.5	i) Deviation Limit beyond which clauses 12.2, 12.3 & 12.4 of GCC shall apply for substructure up to plinth level	100 % (One Hundred percent)
	ii) Deviation Limit beyond which clauses 12.2, 12.3 & 12.4 of GCC shall apply for super structure.	100 % (One Hundred percent)

CLAUSE 16:

Competent Authority for deciding reduced rates.

Principal,
Hindu
College

CLAUSE 17:

Defect liability period: 12 months (From the date of certificate or otherwise of completion of work)

CLAUSE 18:

As minimum, list of mandatory machinery, tools & plants to be deployed by the Contractor at site:-

1. Tower Crane 1 no.
2. Truck 2 nos,
3. Shuttering and props – Quantity as required as per the approved programme.
4. Building hoist 3 nos.
5. Excavator 2 nos.
6. Vibrator 5 nos.
7. Vibration compactor 2 nos.
8. Dewatering pump 4 nos.
9. Cutting & Bending machine 2 Set
10. Total Station – 1 No.
11. Auto Level – 1 nos.
12. DG set – 1 No

This list is indicative only and not exhaustive. The bidders shall be required to deploy any such T & P as required as per as per work requirement and contract conditions.

CLAUSE 19:

Authority for applying Penalty for default under this Clause: Principal,
Hindu College ,Clause 19C -Rs 1000 per each default
Clause 19D -Rs 1000 per each default
Clause 19G -Rs 1000 per day for each default (max 5% of estimated cost put to tender)
Clause 19K -Rs 1000 per tradesman per day

CLAUSE 25:

Constitution of Dispute
Redressal Committee (DRC)

Building Committee (BWC) of HINDU COLLEGE shall act as Dispute Resolution Committee (DRC) with co-opted additional members with legal and contract expertise in the committee by Principal HINDU COLLEGE.

Place of Arbitration

Delhi

CLAUSE 36 (i):

Requirement of Technical Representative(s) and recovery Rate: -

Sl.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical	Minimum	Number	Rate at which recovery shall be made from the Contractor in the event of not fulfilling provision of clause 36 (i)

			/ Technical Representative)			Figures (in Rs.)	Words
1	Project Manager with degree in Civil Engineering	Civil	Principle Technical Representative	15 Yrs	1 no.	1,00,000/-	(Rupees One Lakh only) per Month
2	Graduate Engineer	Civil	Technical Representative	5 Yrs	2 Nos	30,000/-	(Rupees Thirty Thousand Per Month only)
3	Graduate Engineer Or Diploma Engineer	Electric al	MEP	5 Yrs	1 no.	30,000/-	(Rupees Thirty Thousand per month only)
4	Graduate Engineer	Civil	Project Planning/ Billing Engineer	6 yrs	1 No.	25,000/-	(Rupees Twenty-five Thousand only) Per Month
5	Diploma Engineer	QA/ QC	Quality Engineer/ Inspector	2 yrs	1 No.	30,000/-	(Rupees Thirty Thousand per month only)
6	Degree in any discipline with Certificate in Safety	Safety	Safety Cum Labour Officer	NA	1 no.	25,000/-	(Rupees Twenty five Thousand only) per month

Note:

Assistant Engineers retired from Government services who are holding Diploma will be treated at par with Graduate Engineers. Diploma holder with minimum 10-year relevant experience with a reputed 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.

12. STANDARD PROFORMAS

12.1 APPENDIX - XVI (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 CON 297 Page 27
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).

Submitted to the Authority indicated in Schedule F With copy to the Engineer-in-charge.

Signature of the Contractor

Dated

.....

12.2 APPENDIX - XVII
Notice for appointment of Arbitrator.

[Refer Clause 25]

To

Principal HINDU COLLEGE

.....

.....

Respected Madam,

In terms of clause 25 of the agreement, particulars of which are given below, I/we hereby give notice to you to appoint an arbitrator for settlement of disputes mentioned below:

1. Name of applicant
2. Whether applicant is Individual/Prop. Firm/Partnership Firm/Ltd. Co.
3. Full address of the applicant
4. Name of the work and contract number in which arbitration sought
5. Name of the Division which entered into contract
6. Contract amount in the work
7. Date of contract
8. Date of initiation 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 completed)
16. Date of appeal to you
17. Date of receipt of your decision.

Specimen signature s of the
Applicant (only the
person/authority who signed
the contract should sign)

I/We certify that the information given above is true to the best of my/ our knowledge. I/We enclose following documents.

1. We have exhausted provision of DRC as per clause 25 of this agreement.
2. Statement of claims with amount of claims.

Yours faithfully,

(Signatures)

Copy in duplicate to:

1. Principal, Hindu College HINDU COLLEGE/ DD FE

12.3. FORMATS OF GUARANTEE BONDS:

FORM OF PERFORMANCE SECURITY (GUARANTEE)

BANK GUARANTEE BOND - FORMAT - I

In consideration of the Principal, Hindu College(hereinafter called "the HINDU COLLEGE") having offered to accept the terms and conditions of the proposed agreement between.....and (herein after called "the said Contractor(s)") for the work.....(herein after called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs.....(Rupees only) as a security /guarantee from the Contractor(s) for compliance of this obligations in accordance with the terms and conditions in the said agreement.

1. We, ...(herein after referred to as "the Bank") hereby undertake to pay to the HINDU COLLEGE an amount not exceeding Rs.....(Rupees Only)on demand by the HINDU COLLEGE.
2. We, ... (indicate the name of the Bank) do hereby undertake to pay the amounts due and payable at Delhi under this guarantee without any demure, merely on a demand from the HINDU COLLEGE stating that the amount claimed as required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable at Delhi by the bank under this Guarantee. However, our liability under this guarantees hall be restricted to an amount not exceeding Rs.....(Rupees only)
3. We, the said bank further undertakes to pay the HINDU COLLEGE any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suitor proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payments o made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor(s)shall have no claim against us for making such payment.
4. We, (indicate the name of the Bank)further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to been forceable till all the dues of the HINDU COLLEGE under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in Charge on behalf of the HINDU COLLEGE certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We, ...(indicate the name of the Bank)further agree with the HINDU COLLEGE that the HINDU COLLEGE shall have the fullest liberty without our consent and without affecting in any manner our obligation here under to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the HINDU COLLEGE against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall notbe relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the HINDU COLLEGE or any indulgence by the HINDU COLLEGE to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sure ties would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).
7. We, ... (indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the HINDU COLLEGE in writing.
8. This guarantee all be valid up to unless extended on demand by the HINDU COLLEGE.

Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs.....(Rupees) and unless acclain in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee all our liabilities

under this guarantee shall stand discharged. Dated the... day
of.....for... (Indicate the name of the Bank).

FORM OF PERFORMANCE SECURITY (GUARANTEE)

BANK GUARANTEE BOND- FORMAT -II

In consideration of the Principal, Hindu College(herein after called "the HINDU COLLEGE") having offered to accept the terms and conditions of the proposed agreement between.....and (here in after called "the said Contractor(s)") for the work..... (here in after called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs.....(Rupees only) as a security / guarantee from the Contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement.

1. We, ... (hereinafter referred to as "the Bank") hereby undertake to pay to the HINDU COLLEGE an amount not exceeding Rs. (Rupees Only) on demand by the HINDU COLLEGE.
2. We, ... (indicate the name of the Bank) do hereby undertake to pay the amounts due and payable at Delhi under this guarantee without any demure, merely on a demand from the HINDU COLLEGE stating that the amount claimed as required to meet the recoveries due or likely to be due from the said Contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable at Delhi by the bank under this Guarantee. However, our liability under this guarantees hall be restricted to an amount not exceedingRs.....(Rupees only)
3. We, the said bank further undertakes to pay the HINDU COLLEGE any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suitor proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payments o made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor(s)shall have no claim against us for making such payment.
4. We, ...(indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to been force able till all the dues of the HINDU COLLEGE under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineering Charge on behalf of the HINDU COLLEGE certified that the terms and conditions ofthese aid agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We, ...(indicate the name of the Bank)further agree with the HINDU COLLEGE that the HINDU COLLEGE shall have the fullest liberty without our consent and without t affecting in any manner our obligation here under ovary any of the terms and conditions of the said agreement or to extendtime of performance by the said Contractor(s) from time to time or to postpone for any time or fromtime to time any of the powers exercisable by the HINDU COLLEGE against the said Contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the HINDU COLLEGE or any indulgence by the HINDU COLLEGE to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sure ties would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).
7. We, (indicate the name of the Bank) lastly undertaken ot to revoke this guarantee except with the previous consent of the HINDU COLLEGE in writing.
8. This guarantee shall be valid up to unless extended on demand by the HINDU COLLEGE. Not with standing anything mentioned above, our liability against this guarantee is restricted to Rs.....(Rupees.....).

12.4 INDENTURE FOR SECURED ADVANCES

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 Principal, Hindu College / Principal HINDU COLLEGE (hereinafter called the President 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, HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE (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 HINDU COLLEGE and declare as follows: -

- (1) That the said sum of Rupees so advanced by the Principal HINDU COLLEGE 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 HINDU COLLEGE 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 Engineer in charge 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 Engineer in charge 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 Engineer-in-Charge.

- (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 Engineer in charge or an officer authorised by him on that behalf.
- (6) That the advances shall be repayable in full when or before the Contractor receives payment from the Principal HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE shall immediately on the happening of such default be repayable by the Contractor to the Principal HINDU COLLEGE together with interest thereon at 12% (twelve percent) 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE 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 HINDU COLLEGE in the presence of

Signature

Witness Name

Address

12.5 FORMS FOR GUARANTEE BONDS

i. GUARANTEE BOND FOR REMOVAL OF DEFECTS OF WATER PROOFING WORKS.

This Agreement made this day of two thousand and.....

Between (Name of the Contractor, hereinafter called the Guarantor on the one part) and Principal, Indian College of Delhi (hereinafter called the HINDU COLLEGE on the other part).

WHEREAS this agreement is supplementary to a contract (hereinafter called the contract) dated and made between the GUARANTOR on the one part and the HINDU COLLEGE on the other part for construction (Name of the work) where by the GUARANTOR, 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 from the date of completion of the work.

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 of completion of the work as a whole.

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

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

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

(c) The decision of the Engineer – in - Charge with regard to cause of leakage shall be final

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

That if the GUARANTOR fails to execute the necessary rectification of water proofing or commits breach there under, then the Guarantor will indemnify HINDU COLLEGE and his successors against all loss, damage, cost expense or otherwise which may be incurred by him by reasons of any default on the part of GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and / or damage and / or cost incurred by the HINDU COLLEGE, the decision of the Engineer – in – Charge / HINDU COLLEGE will be final and binding on the parties.

IN WITNESS WHEREOF these presents has been executed by the Obligator 1. Principal. HINDU COLLEGE and by and for and on behalf of the Principal, HINDU COLLEGE 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 PRINCIPAL HINDU COLLEGE byin the presence of:

1. _____ 2. _____

ii . GUARANTEE BOND FOR REMOVAL OF DEFECTS IN CURTAIN GLAZING & OTHER RELATED WORKS.

This Agreement made this _____ day of two thousand and _____

between _____ (Name of the Contractor, hereinafter called the Guarantor on the one part) and the Principal, Hindu College (hereinafter called the HINDU COLLEGE on the other part).

WHEREAS this agreement is supplementary to a contract (hereinafter called the contract) dated _____ and made between the GUARANTOR on the one part and the HINDU COLLEGE on the other part for construction_ (Name of the work) where by the GUARANTOR, inter alia, undertook to carry out structural analysis and design, preparation of shop drawings, setting out, design, supply, fabrication, installation, aligning, fixing, protection and testing of the curtain glazing and other related works, all as specified and set out in the contract and as per the correct international / national standards.

AND WHEREAS THE GUARANTOR agreed to give a guarantee (for all works as stated above) for the following:

1. System

- a. Structural design has been carried out for design loads, as specified, thermal stresses, building movements and the consequent deflections without compromising the performance characteristics.
- b. That deflections in the framing members shall be within permissible limits as specified.
- c. Structural stability, safety, integrity and required performances of the work for all design works and building movements as specified.

2. Material

- a. Glass (single, laminated or DGUs) – Substrate, coatings, lamination of laminated glass, insulation of DGUs
- b. Sealant – Material used, performance of sealant used, usage as per the requirement of structural design and functional requirement, compatibility with different substance and sealants, bite size, quality assurance during sealing of DGUs and fixing glass to glass and glass to the aluminium frame, etc.
- c. EPDM / Silicone gaskets – for ozone resistance and other properties as specified etc.
- d. Aluminium – material quality, tempering requirement, suitability of aluminium grade and anodizing etc.
- e. Anchor fasteners – suitability and strength requirements as per manufacturers' specifications etc.

3. Performance

- a. Water tightness, wherever specified in the Contract.
- b. Workmanship
- c. Integrity of system during movements within and relative to the building structure.
- d. Indemnify the HINDU COLLEGE against all claims of whatsoever nature due to defective designing by the Contractor, material & workmanship etc. and /or non-performance of the work during the guarantee period.

NOW THE GUARANTOR hereby guarantees that the work executed by him shall perform to the specified standards of quality and workmanship during the guarantee period of ten years to be reckoned from the date of completion of work.

During this period of guarantee, the guarantor shall make good all defects and if any defect is noticed during the guarantee period, it shall be rectified by the Contractor within seven days of issue of notice to the Contractor, at least temporarily, to the satisfaction of the Principal, Hindu College ,, till the permanent rectification of the defects / replacement of defective materials is carried out by the Contractor, in maximum four months period, retaining same aesthetic and other functional parameters of the original work. If not attended to, the same shall be got done by the HINDU COLLEGE / HINDU COLLEGE through other agency at the risk and cost of the Contractor which shall be final and binding on the Contractor.

That if the Guarantor fails to execute the necessary rectification or commits breach there under, then the Guarantor will indemnify HINDU COLLEGE and his successors against all loss, damage, cost expense or otherwise which may be incurred by him by reasons of any default on the part of GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and / or damage and / or cost incurred by HINDU COLLEGE, the decision of the Principal, Hindu College ,will be final and binding on the parties.

IN WITNESS WHERE OF these presents has been executed by the OBLIGATOR

and

by

and for and on behalf of Principal. HINDU COLLEGE. 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 PRINCIPAL. HINDU COLLEGE. BY
in the presence of:

- 1.
- 2.

12.6 FORM OF AGREEMENT

ARTICLES OF AGREEMENT made this Day of

BETWEEN

Dean, IPS, for and on behalf of Principal, Hindu College , Powai, Delhi-400 076 (hereinafter referred to as "the Employer" which expression shall include its successors and designs where the context so admits) of the one part.

AND

M/s.....(herein after referred to as "the Contractor" which expression shall include their heirs, executors, administrators and designs where the context so admits) of the other part.

WHEREAS

The employer is desirous that certain works should be executed, viz "Construction of..... At Hindu College , University of Delhi, Delhi, Powai, Delhi-400 076" and has accepted Tender by the Contractor for the execution completion and maintenance of such works Now THIS AGREEMENT WITNESSTH as follows:-

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and constructed as part of this Agreement, viz:-
 - a) Work order No. HINDU COLLEGE / Dean.(IPS)/CACI/..... dated Along with the correspondence.
 - b) Conditions of the Contract.
 - c) Technical Specifications of Civil works.
 - d) Technical Specifications of Services.
 - e) Financial Bid-Bill of Quantities
 - f) Drawings
 - g) Prebid queries and responses
3. In consideration of the payments to be made by the Employer to the Contractor as herein after mentioned the Contractor hereby covenants with the Employer to execute, complete and maintain the works in conformity in all respects with the provisions of Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and maintenance of the works at the Contract price at the time and in the manner prescribed by the Contract.
5. The particulars referred to in the various clauses of the Conditions of the Contract are as given in Schedules A to F.

IN WITNESS whereof the parties hereto have caused of their respective Common Seals to be here into affixed (or have hereinto set their respective hands and seals) the day and year first above written.

Dean (I.P.S.):

For and on behalf Principal, Hindu College ,
University of Delhi, Delhi

In the Presence of:-

1. _____

2. _____

For and on behalf Contractor, ...

In the Presence of:-

1. _____

2. _____

PARTB:
MAJOR COMPONENTS (CIVIL & PLUMBING WORKS)

1 SPECIFICATIONS

Referred to Clause 11 of the 'Clauses of the Contract' under GCC and to the Proforma of Schedules A to F.

2 SPECIAL CONDITIONS FOR CEMENT AND STEEL REINFORCEMENT BARS

2.1 SPECIAL CONDITIONS FOR STEEL REINFORCEMENT BARS

- a) The Contractor shall procure TMT bars of Fe 500D or higher Grade, at the discretion of Engineer-In-Charge, from SAIL, Tata Steel Ltd., RINL, Jindal Steel & Power Ltd. and JSW Steel Ltd. The Contractor may also procure IS marked TMT bars of various grades from the steel manufactures or their authorized dealers (as per following selection criteria) have valid BIS license for IS: 1786-2008 (Amendment -1 November 2012) from the producers fulfilling the following criteria.
- b) The procured steel should have following qualities: -
- Excellent ductility, bend ability and elongation of finished product due to possible refining technology.
 - Consumption of steel should be accurate as per design.
 - Steel should have no brittleness problem in finished product.
 - Steel should carry the quality of corrosion and earthquake resistance.
 - Quality steel with achievement of proper level of sulphur and phosphorus as per IS: 1786-2008.
- c) Selection criteria of steel manufacturers: shall have the following selection criteria of steel manufactures: -
- Steel producers of any capacity using iron ore/ processed iron ore as the basis raw material adopting advance refining technologies as given hereunder:
 - DRI-EAF = Direct Reduced Iron – Electric arc furnace.
 - BF-BOF = Blast furnace – Basic oxygen furnace
 - CORES-BOF = COREX - Basic oxygen furnace

For production of liquid steel to finish product at single/multiple locations with NABL or any other similarly placed accrediting Government body which operates in accordance with ISO/IEC 17011 and accredits labs as per ISO/IEC 17025 conforming to IS: 1786-2008 (Amendment -1 November 2012). Following is the check lists for incorporation any quality steel producer for technical assessment.

Sl.	item	Checkpoint	Remarks
		a. Factory address and Registration no.	
		b. Certificate of manufacturing process	
		c. Refining process of steel producer	
		c.1 BF-BOF route	
		c.2 Corex-BOF route	
		c.3 DRI-EAF route	
		d. With documentary evidence either for BOF or EAF	
		e. Steel plant having infrastructure for producing Sponge iron, billet and TMT Rebars	
		f. Production and Quality Flow Chart	

Sl.	item	Checkpoint	Remarks
		g. Plant Evaluation and Process Verification	
		h. List of Plant & Machinery	
		Document verification for :	
		a. Govt./PSU Approvals	
		b. Supply orders of TMT Re– bars in Govt. Projects (Minimum–5 years)	
		c. Verification of direct supply orders to any State/Central Govt. Department	
		d. User Certificate issued by any Govt. Department	
		e. directly	
		Documents evidence like:	
		a. Certificate of Incorporation	
		b. Memorandum of Articles of Association	
		c. Credit rating of the company from CARE/CRISIL/ICRA should not be C/D grade (minimum last 3 years)	
		a. Test Results from Govt./NABL accredited laboratories	
		b. In –house testing facility for physical/chemical tests (NABL accredited)	
		c. Calibration certificates	
		d. List of lab Equipment:	
		e.1 Spectrometer	
		e.2 Computerized UTM	
5.	Use of Iron – Ore/ Processes Iron are as basic raw materials	Verification of Iron–Ore / Process iron ore invoices	
6.	In house rolling facility	Plant verification to identify in house rolling facilities, production of liquid steel and crude	

Sl.	item	Checkpoint	Remarks
		steel	
		a.ISO9001:2008 Certification	
		b.ISO14001:2004 Certification	
		c.OHSAS18001:2007 Certification	
		d.IS1786:2008 (TMT Re-bars	
		e.IS2830:1992(Billets)	
		TMT Re-bars FE415/415D/500/500D/550/550D	
		CRS (Corrosion Resistant) & EQR (Earthquake Resistant) TMT Re-Bar Size 8to36 mm dia.	

Note:

DRI-EAF-> Direct Reduce Iron-Electric ARC Furnace

BF-BOF-> Blast Furnace-Basic Oxygen Furnace

COREX BOF-> COREX Furnace-Basic Oxygen Furnace.

- b) Dean HINDU COLLEGE shall approve the steel manufacturers prior to procurement and it shall be the responsibility of the Contractor to obtain the proposed manufacturer, much in advance so as not to hamper progress of the site Work.
- c) The Contractor shall have to obtain and furnish test certificates to the Engineer-in-charge in respect of all supplies of steel brought by him to the site of work.
- d) 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 the steel arranged by the Contractor does not conform to the specifications, the same shall stand rejected, and it shall be removed from the site of work by the Contractor at his cost within a week time on written orders from the Engineer-in-charge to do so.
- e) The steel reinforcement bars shall be brought to the site in bulk supply of 10 tonnes or more, as decided by the Engineer-in-charge.
- f) The steel reinforcement bars shall be stored by the Contractor at site of work in such a way as to prevent their distortion and 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.
- g) For checking nominal mass, tensile strength, bend test, re-bend test etc. specimens of sufficient length shall be cut from each size of the bar at random, and at frequency not less than that specified below:

Size of bar	For consignment below 100 ton	For consignment above 100 ton
Under 10mm dia bars	One sample for each 25 ton or part thereof	One sample for each 40 Ton or part thereof
10 mm to 16mm dia bars	One sample for each 35	One sample for each 45

Size of bar	For consignment below 100 ton	For consignment above 100 ton
	Ton or part thereof	Ton or part thereof
Over 16 mm dia bars	One sample for each 45 Ton or part thereof	One sample for each 60 Ton or part thereof

- h) 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.
- i) The actual issue and consumption of steel on work shall be regulated and proper accounts maintained as provided in Clause 10 A of the General Conditions of the Contract. The theoretical consumption of steel shall be worked out as per procedure prescribed in clause 38 of the General Conditions 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 needs to be made.
- j) 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.
- k) For the purpose of payment, the actual weight of reinforcement steel shall be worked out as below:

To arrive at unit weight for the purpose of payment three random samples each of 1 meter length shall be collected for each diameter of re-bar from every consignment received at site. Actual weight of three specimens for each diameter shall be taken and average weight calculated and recorded. The average weight so arrived at shall be compared with the theoretical weight of that particular diameter of rebar. Actual or theoretical weight whichever is less shall be considered for making payment for that consignment. However final payment shall be made on the basis of weighted average of all the consignment. The decision of the Engineer-in-charge as regards the random samples and average weight shall be final and binding on the Contractor and no claim of any kind shall be entertained in this regard.

2.2 CONDITIONS WHERE CEMENT IS TO BE PROCURED BY THE CONTRACTOR:

- a) The Contractor shall procure 43/ 53 grade ordinary Portland cement conforming to IS 8112/ as required in the work, from reputed manufacturers of cement such as ACC, Ultratech, Vikram, Shree Cement, Ambuja, Jaypee Cement, Century Cement & J.K. Cement or from any other reputed cement Manufacturer having a production capacity not less than one million tonnes per annum as approved by ADG for that sub region.
- b) The tenderers may also submit a list of names of cement manufacturers which they propose to use in the work. The tender accepting authority reserves right to accept or reject name(s) of cement manufacturer(s) which the tenderer proposes to use in the work. No change in the tendered rates will be accepted if the tender accepting authority does not accept the list of cement manufacturers, given by the tenderer, fully or partially. The supply of cement shall be taken in 50 kg. bags bearing manufacturer's name and ISI marking.
- c) 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.
- d) The cement shall be brought at site in bulk supply of approximately 50 tonnes or as decided by the Engineer- in- charge.
- e) The cement godown of the capacity to store a minimum of 2000 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.

- f) 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.
- g) The cement shall be got tested by the Engineer-in-charge and shall be used on the work only after satisfactory test results have been received. The Contractor shall supply free of charge the cement required for testing including its transportation cost to testing laboratories. The cost of tests shall be borne by the Contractor / HINDU COLLEGE in the manner indicated below:
 - i) By the Contractor, if the results show that the cement does not conform to relevant BIS codes.
 - ii) By the HINDU COLLEGE, if the results show that the cement conforms to relevant BIS codes.
- h) 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 42 of the Contract and shall be governed by conditions laid therein. In case the cement consumption is less than the theoretical requirement including permissible variation, recovery at the rate prescribed in Schedule F shall be made. In case of excess consumption, no adjustment shall be made.
- i) Cement brought to site and cement remaining unused after completion of work shall not be removed from site without written permission of the Engineer-in-Charge.
- j) Damaged cement, noticed if any shall be removed from the site immediately by the Contractor on receipt of a notice from the Engineer-in Charge. In the absence of compliance within 3 days of receipt of such notice, the Engineer-in-charge shall be at liberty to get the same removed from the site at the cost of the Contractor.

3 ADDITIONAL / PARTICULAR SPECIFICATIONS:

3.1 Particular Specifications for Earthwork

- a. Earthwork in excavation, in general, shall be carried out as per the CPWD Specifications.
- b. The earthwork in excavation, wherever required, shall be carried out in dry/ slushy position. Rates for earthwork shall include cost of the element for working in or under water / liquid mud including pumping of water / liquid mud. Nothing extra shall be payable on this account. Therefore, the Contractor shall quote his rates after studying the site conditions.

3.2 Particular Specifications for De-watering

- a. De-watering shall be carried out by suitable means with adequate stand-by arrangements of pumps etc. and it shall be ensured that its disposal is carried out as per the regulations of the local bodies. The agencies are, therefore, advised to inspect and acquaint themselves of the site and location of disposal point(s) of water / slush and satisfy themselves as regards method of pumping and disposal required to be adopted. Any default or failure on the part of the Contractor to acquaint himself with the aforesaid aspect of work shall not absolve him from his responsibility for the execution / performance of this Contract. Also, all permissions in this regard, to be taken from local authorities, shall be obtained by the Contractor. Nothing extra shall be payable on these accounts.
- b. In trenches where surface water is likely to get into cut / trench during monsoons, a ring bund of puddle clay or by any other means shall be formed outside, to the required height, and maintained by the Contractor. Also, suitable steps shall be taken by the Contractor to prevent back flow of pumped water into the trench. Nothing extra shall be payable on this account.
- c. The cost of de watering or working under water and / or liquid mud for execution of all the items for the work is deemed to be included in quoted rates of the respective items and shall not be measured separately for payment. Nothing extra shall be payable for de watering in this work, irrespective of whether specified or not, in the item descriptions or in the specifications / conditions in this Contract Agreement.
- d. This shall also include water encountered from any sources such as rains, floods, sub soil water table being high and/or due to any other cause whatsoever.

3.3 Particular Specifications for Exposed Brick Work

:- Exposed brick work shall be done as per specified brick quality in the item. The aesthetics , workmanship and quality of exposed brick work shall be of very high quality.

3.4 Particular Specifications for Concrete and RCC Works

- a. The work in general shall be carried out as per the CPWD specifications.
- b. Before taking up the RCC (wall / box) work for external façade as mentioned in the structural drawings of the respective buildings, the Contractor shall submit a method statement for carrying out shuttering and RCC work, for approval of Principal, Hindu College , The work for this portion shall be executed only after approval of method statement, after taking into consideration the observations of Principal, Hindu College if any.
- c. In case, expansion strip is required to be provided as per the structural requirement in any of the buildings, the Contractor shall follow the scheme provided by Principal, Hindu College ,including keeping the shuttering in position for extended period. Nothing extra shall be paid on this account.
- d. Construction joints in RCC shall be provided only at places as per approved structural drawings. It shall not in any manner structurally or functionally affect the structure. If, any additional construction joint is required to be provided, it shall be done with approval of the Principal, Hindu College ,
- e. **Core cutting tests** shall be carried out as per following schedule
 - a. Columns – after 7 days of Casting, 12 Columns randomly selected on each floor by Engineer-in- charge
 - b. Slab and beams – after 28 days of Casting – at 12 places randomly selected on each floor by Engineer-in- chargeIf the core tests show less than 85% of required strength, the RCC of complete area shall be removed and Cast again.
- f. The College shall be free to get the Core cutting testing done on its own. The Contractor shall supply necessary platform/ scaffolding/shuttering/ labour and materials to enable Core cutting sampling.

- g. The centring, shuttering, strutting etc., required for the construction joint in RCC shall be provided as per the CPWD Specifications.
- h. Testing of concrete shall be done as per CPWD procedure.
- i.

3.5 Particular specifications for wood work, factory made doors and wooden fire-resistant door (FRD) frames and shutters

- a. General
- b. The work in general shall be carried out as per the CPWD specifications.
- c. The glue / wooden adhesive to be used for this sub-head shall be PVAc based adhesive, of approved make (Fevicol of Pidilite Industries Ltd. or Korlok of National).

A. Wood work

- a. The work in general shall be carried out as per the CPWD specifications.
- b. The wood shall be selected best quality second-class teak wood.
- c. The work shall be carried out in accordance with the architectural drawings issued by the HINDU COLLEGE. The architectural drawings shall at all times be properly correlated and architectural requirements have to be fully satisfied.
- d. All the wood used for the manufacturing of the door shutters including the door frames, internal & external lipping, beading for fixing glazing etc. shall be seasoned as per the requirements of the CPWD Specifications.
- e. All the screws used for woodwork shall be fully threaded, counter sunk stainless steel screws, grade 304 and they shall be suitably concealed or plugged.

B. Factory made doors

The work shall be carried out as per the CPWD specifications.

- a. Decorative high pressure laminate
- b. The work in general shall be carried out as per CPWD specifications.
- c. The Contractor shall procure and submit to the Principal, Hindu College ,, samples of laminate for approval. After approval of the samples, the Contractor shall prepare a mock up for approval. The material shall be procured and the mass work taken up only after the approval of the mock up by the Principal, Hindu College ,.
- d. Each type of laminate shall be obtained from only one of the approved manufacturers as specified and in one lot. Adequate spare quantity shall be ordered to cover for any damaged sheet and for replacement by the Contractor till the completion of the work.
- e. The Contractor shall ensure that the edges of the laminates do not come out or chip / peel off during cutting and fixing of the laminates. Defective work on this account shall not be accepted and shall be redone by the Contractor at his own cost.

C. Wooden Fire-Resistant Door (FRD) frames and shutters

- a. The fire-resistant flush doors along with the frames shall be procured as a set from one of the approved manufacturers and shall be as per the specifications, as per description of the item and the approval of the Principal, Hindu College , The door shutters shall be entirely symmetrical on both faces. The complete door assembly shall have the required stability and shall satisfy performance required for integrity & insulation as per BS 476: Part 20 & 22 applicable for 2 hours fire rating. Besides, it shall conform to all the requirements for Flush door shutters as per the relevant IS codes and CPWD Specifications.
- b. The gap between the shutter and frame, between shutters in case of double leaf shutter should not be more than 2mm. Similar care shall be taken for making rebates for fixing hinges and other hard wares. The workmanship required is of superior class for achieving the desired results.

- c. Graphite based Intumescent strip seal of required size as per manufacturer's specifications shall be provided and fixed in the grooves on the door shutters all around the periphery exception the bottom to prevent penetration of smoke and fire. The shutters shall not be worked upon at site to prevent damage to the intumescent strip. In case of double leaf shutters, Intumescent strips, of required size as per manufacturer's specifications shall be fixed in the rebate portion of meeting styles of each leaf of the shutter.
- d. All the FRD shutters shall be provided with 2nd class teak wood external lipping all around the shutter as per manufacturer's specifications. The grooves of required size and shape shall be made in the external wooden lipping for fixing intumescent seal. All the external visible surfaces of lipping will be finished with 3 coats of melamine polish.
- e. The hinges to be used for fixing the door shutters shall be fire rated stainless steel ball bearing hinges of grade 304 fixed with stain steel screws of grade 304. While testing for fire resistance, the whole assembly shall be tested along with the door shutter, door frame, beadings, hinges, etc.
- f. All the shutters shall be treated for anti-termite treatment, against woodborer, fungus, pests etc. Therefore, it shall be provided with the preservative treatment based on Boron & Fluoride and as per CPWD Specifications. Nothing extra shall be payable on this account.
- g. The calcium silicate boards to be used for manufacturing fire rated door shutters shall be from one of the approved brands. It shall be non-combustible and shall conform to BS 476 part 4 and to class 1 of BS476 part 7 for surface spread of flame.
- h. The Contractor shall submit manufacturer's test certificate for specified fire rating for integrity and insulation criteria, required as per the item nomenclature and the specifications. The Contractor shall also co-ordinate and facilitate with the office of the Fire Officer for obtaining clearance for the FRD shutters along with frames including getting the required site visits conducted by such authorities with a view to obtain Fire NOC. The Contractor shall also be responsible for liaising work required, if any, in this regard. Statutory charges / fees etc. required to be paid to the concerned authorities in this connection shall only be paid by the HINDU COLLEGE or shall be reimbursable to the Contractor on production of proof of actual payment by him.
- i. Destructive Testing for fire resistance of the door shutter along with door frame shall be done in a laboratory approved by Principal, Hindu College , The complete door assembly should be able to resist thermal stresses and should not fail on account of shrinkage, cracking or distortion or any other reason, during testing for the duration for which it is fire rated. The cost of sample of door shutter along with the frame (including cost of laminates, beadings, intumescent strips, hinges, screws etc. but excluding painting, polishing etc.), packaging, sealing and transportation of sample to the approved laboratory etc., shall be borne by the Contractor. At least one finished sample (door shutter fixed to the door frame with hinges etc.) for two- hour fire rating shall be tested.
- j. The sample shall be randomly chosen by the Principal, Hindu College from the lot (of shutter along with frame) procured and brought to the site of work for fixing. If the shutter fails to satisfy the test requirements, the entire lot shall be rejected and replaced by the Contractor at his own cost. Nothing extra shall be payable on this account and no delay shall be accepted on this account.
- k. Necessary Testing charges including packaging, sealing, transportation, loading, unloading, necessary personnel for logistic arrangements etc. shall be borne by the Contractor.

- I. Measurement - For the purpose of payment, the area shall be measured from outer frame to outer frame above the finished floor level excluding the portion embedded inside floors, wall cladding. The door frame shall not be measured separately for payment. No deduction shall be made for making vision panel, if any.

D. Metal Fire Resistant Door (FRD) frames and shutters

- a. The fire-resistant metal flush doors along with the frames shall be procured as a set from one of the approved manufacturers and shall be as per the specifications, as per description of the item and the approval of the Principal, Hindu College
- b. The metal door shutters shall be entirely symmetrical on both faces. The complete door assembly shall have the required stability and shall satisfy performance required for both stability & integrity as per BS 476: Part 20 & 22 and IS 3614Part -2 applicable for 2 hours fire rating. Besides, it shall conform to all the requirements of fire rated flush door shutters as per the relevant IS codes and CPWD Specifications.
- c. The gap between the shutter and frame, between shutters in case of double leaf shutter should not be more than 3mm. Similar care shall be taken for making rebates for fixing hinges and other hard wares. The workmanship required is of superior class for achieving the desired results.
- d. The hinges to be used for fixing the door shutters shall be fire rated stainless steel ball bearing hinges of grade 304 fixed with stain steel screws. While testing for fire resistance, the whole assembly shall be tested along with the door shutter, door frame, beadings, hinges, vision panels etc.
- e. Honey comb paper or fire metal ceramic wood of 96 kg/M3 should be used for manufacturing the metal fire doors. The wool or honey comb paper shall be snugly fit in the internal frame work of the door shutter.
- f. The Contractor shall submit through the proposed manufacturer prior test certificates for the specified 2 hours fire rating for stability and integrity criteria for both single leaf and double leaf doors required as per the item nomenclature and the specifications. The test certificates shall clearly show that doors have been tested with vision panels and approved hardware to establish the technical credentials of the proposed manufacturer. The Contractor shall also co- ordinate and facilitate with the office of the Fire Officer for obtaining clearance for the FRD shutters along with frames including getting the required site visits conducted by such authorities with a view to obtain Fire NOC. The Contractor shall also be responsible for liaising work required, if any, in this regard. Statutory charges / fees etc. required to be paid to the concerned authorities in this connection shall only be paid by the HINDU COLLEGE or shall be reimbursable to the Contractor on production of proof of actual payment by him.
- g. Destructive Testing for fire resistance of the door shutter along with door frame shall be done in a laboratory approved by Principal, Hindu College ,. The complete door assembly should be able to resist thermal stresses and should not fail on account of shrinkage, cracking or distortion or any other reason, during testing for the duration for which it is fire rated. The cost of sample of door shutter along with the frame (including cost of intumescent strips, hinges, screws etc. but excluding painting, polishing etc.), packaging, sealing and transportation of sample to the approved laboratory etc., shall be borne by the Contractor. At least one finished sample (door shutter fixed to the door frame with hinges etc.) for two-hour fire rating shall be tested.
- h. The sample shall be randomly chosen by the Principal, Hindu College ,, from the lot (of shutter along with frame ,vision panels and the proposed hardware) procured and brought to the site of work for fixing. If the shutter fails to satisfy the test requirements, the entire lot shall be rejected and replaced by the Contractor at his own cost. Nothing extra shall be payable on this account and no delay shall be accepted on this account.

- i. Necessary Testing charges including packaging, sealing, transportation, loading, unloading, necessary personnel for logistic arrangements etc. shall be borne by the Contractor.
- j. Measurement - For the purpose of payment, the area shall be measured from outer frame to outer frame above the finished floor level excluding the portion embedded inside floors, wall cladding. The door frame shall not be measured separately for payment. No deduction shall be made for making vision panel, if any.
- k. All door frames and shutters shall be finished with polyurethane aliphatic grade paint of approval colour. The door leaf and frame shall have passed minimum 250 hours of Salt Spray Test.

3.6 Particular specifications for door hardware and fittings

i. General

- a. The work in general shall be carried out as per CPWD specifications.
- b. The Contractor shall procure and submit samples of various hardware's and fittings for approval, of the Principal, Hindu College , The material shall be procured and the mass work shall be taken up only after the approval of the samples by the Principal, Hindu College ,
- c. All the hardware and fittings shall be supplied with the required spindles, pivots, stud, connecting bolts, screws, grub screws, nuts, bolts, connecting pin / bolt (including stainless steel washers / shims, PVC washers, PVC buffers etc.) and of the material as per the manufacturer's specifications. Their cost is deemed to be included in the cost of the hardware and fittings to be supplied and these accessories shall not be measured separately for payment. If any of the accessories get damaged during fixing of the hardware and fittings, additional numbers as required shall be supplied by the Contractor at his own cost.
- d. The size for the hardware and fittings shall be as specified in the item description in the schedule of quantities and the particular specifications. Wherever the size is not mentioned in the item nomenclature and particular specifications, it shall be as per the manufacturer's specifications or as directed by the Principal, Hindu College , The shape has been specified as per the model number mentioned in the manufacturer's product catalogue / information.
- e. If the model number for an item is changed or modified or the item itself is changed /modified, during execution and / or during the defect liability period / guarantee period, the decision of the Principal, Hindu College ,as to the equivalence of the item provided inthe schedule of quantities shall be final and binding on the Contractor and no claim of any kind shall be entertained from the Contractor on this account. Nothing extra shall be payable on this account.
- f. The Contractor shall be permitted to supply items superior than the item in the schedule of quantities, but only with specific written approval of the Principal, Hindu College provided they are aesthetically similar and nothing extra shall be payable on this account. That the product proposed to be supplied by the Contractor is superior than that provided in the schedule of quantities / product supplied, shall be the solediscretion of the Principal, Hindu College ,and his decision shall be final and binding on the Contractor and no claim of any kind shall be entertained from the Contractor on this account.
- g. The entire supply for each type of hardware and fittings shall be made, preferably, in one lotto keep variations in finishes to the minimum.
- h. Three samples from each lot of each hardware shall be tested for conformity to the required grade. Samples shall be supplied by the agency free of cost. Necessary arrangements for testing and testing charges shall be borne by the Contractor.

ii. Handles

- a. All the Door handles shall be of the same type (model and finish) and make unless specifically permitted in writing by the Principal, Hindu College ,
 - b. The handles shall be of stainless-steel grade as specified under item description.
 - c. The handles shall be supplied in required finish as directed by Principal, Hindu College ,for which nothing extra shall be paid.
- iii. **Mortise latch, mortise dead bolt, mortise latch cum lock, lock with keys, escutcheon.**
- a. The mortise latch, mortise dead bolt, mortise latch cum lock, lock with keys and escutcheon shall be of approved same make.
 - b. The locks and accessories shall be supplied as per item description.
 - c. The strike plate and for end plate shall be brush finish stainless steel of grade SS 304. Nothing extra shall be payable for supplying stainless steel grade SS 316 instead of SS 304 specified.
 - d. The cylinder escutcheons (key hole covers) shall be of stainless-steel grade SS
 - e. These shall be supplied along with the key cylinder lock and shall not be measured separately for payment. Nothing extra shall be payable for supplying stainless steel grade SS 316 instead of SS 304 specified.
 - f. The lock shall be supplied with a set of three keys.
- iv. **Concealed / flush tower bolts**
- The concealed / flush tower bolts shall be made out of SS grade, size and shape as specified, as per the item description and as per the approved samples.
- v. **Door stopper**
- a. The fittings shall be made out of stainless steel of Grade as specified.
 - b. The required screws, bolts, spindles etc. of stainless-steel grade SS 304 as per the manufacturer's specifications, shall be supplied along with the fittings and their cost is deemed to be included in the cost of the fitting itself.
 - c. The fittings shall be of size, shape and finish as specified in the item description in the schedule of quantities and as per the approved samples.
- vi. **Floor spring: The floor spring of approved make shall conform to the following parameters:**

S.No.	Attributes	Range
6.1	Mechanism	As per manufacturer's specifications
6.2	Maximum door width	≤1100 mm
6.3	Maximum door weight	Minimum 120 kg
6.4	Spring strength (EN)	1 - 4
6.5	back check	Mechanical
6.6	Closing speed	Two Independent Speed Adjustment Valves - (175□ – 15□) and (15 □0)□
6.7	Hold open Function feature	At 90□

6.8	Internal components of floor Spring	Stainless steel precision manufactured
6.9	Cover plate	Stainless steel SS grade 304, secured to the floor spring body using stainless steel screws of SS 304 grade.
6.10	Non handed	Should be suitable for single and double action doors

vii. Surface door closer: The surface door closer of approved make shall conform to the following parameters:

a. Surface door closer –

S. No.	Attributes	Range
7.1.1	Mechanism	As per manufacturer's specifications
7.1.2	Maximum door width	1100mm
7.1.3	Closing force as per EN	2–4
7.1.4	Non-handed	Feature needed
7.1.5	Two Independent Speed Adjustment for variable closing and latching speed	Two Independent Speed Adjustments, (180 $\pm$ 15 °) and speed (15 $\pm$ 0 °).

b. Surface door closer -

S. No.	Attributes	Range
7.2.1	Mechanism	As per manufacturer's specifications
7.2.2	Maximum door width	1100mm
7.2.3	Closing force as per EN	3–4
7.2.4	Non-handed	Feature needed
7.2.5	Two Independent Speed Adjustment for variable closing and latching speed	Two Independent Speed Adjustments, (180 $\pm$ 15 °) and speed (15 $\pm$ 0 °).
7.2.6	Suitability for fire door	Feature needed

3.7 Particular Specifications for pressed galvanized steel door frame

- a. The work in general shall be carried out as per the Specifications (as per Schedule F) for pressed steel doorframe and relevant IS code.

3.8 Particular Specifications for hot dipping galvanizing work

- a. work shall be carried out as per item nomenclature and relevant IS code.

- b. Rates quoted by the bidder also includes cutting of required sections, transporting to factory, complete procedure for galvanization, transporting to site and installation.
- c. Three random sample of each section shall be tested for required coating and samples shall be supplied free of cost by the agency. Testing shall be done as per relevant IS code in the lab approved by Principal, Hindu College ,

3.9 Particular Specifications for Stainless Steel Works

- a. Stainless steel work: The work under this sub-head in general shall be carried out as per the CPWD Specifications.
- b. Stainless steel cladding:

The scope of the work includes preparation of the shop drawings (based on the architectural drawings), fabrication, supply, installation and protection of the stainless-steel work till completion and handing over of the work.

Based on the samples approved by the Principal, Hindu College the Contractor shall prepare mock up (one no.) at site of work, for approval of quality of workmanship. If the quality of the workmanship and the material is as per the required standards and approved by the Principal, Hindu College the mock up shall be allowed as part of the work and measured for payment. Otherwise, it shall be dismantled by the Contractor and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.

One test (three specimens) for each lot shall be conducted for the stainless-steel sheet in the approved laboratory. Therefore, the material shall preferably be procured in one lot from one manufacturer. If the test fails, the entire lot of material shall be rejected and shall be replaced by the Contractor at his own cost. The cost of the sample shall be borne by the Contractor.

The finished surface shall be free of any defects like dents, waviness, scratches, stains etc. and shall have uniform finish as directed by Principal, Hindu College

. Any defective work shall be rejected and redone by the Contractor at his own cost. The finished surface shall therefore be protected using protective tape which shall be removed at the time of completion of the work. The surface shall then be suitably cleaned using nonabrasive approved cleaner for the material. Nothing extra shall be payable on this account.

3.10 Particular Specifications for Flooring & Dado / Cladding

- a. General (applicable for all kinds of flooring and dado / cladding works under this sub-head):
- b. The work under this sub-head in general shall be carried out as per the CPWD Specifications, as per the architectural drawings and as per the direction of Principal, Hindu College ,
- c. The Principal, Hindu College ,or his representative may, if required, visit the source of supply of the various stones to assess the quality as well as availability of the material in the required quantities. The HINDU COLLEGE shall bear the cost of such visits of the officers of the HINDU COLLEGE.
- d. Based on the samples approved by the Principal, Hindu College ,for various flooring and dado / cladding materials as specified hereinafter, the Contractor shall prepare mock up(s) at site of work as specified under relevant flooring and dado / cladding items, for approval of quality of workmanship and material specified. If the quality of the workmanship and the material is as per the required standards and approved by the Engineer-in- Charge, the mock up shall be allowed as part of the work and measured for payment. Otherwise, it shall be dismantled by the Contractor as directed by the

Principal, Hindu College , and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.

- e. The stones / tiles shall be transported to site well packed in boxes or otherwise. These shall be handled carefully to prevent any damage. The various types of stones and tiles, procured shall be free of any surface defect or any edge damage. The damaged stones and tiles shall not be allowed to be used in the work. So, the contractor shall procure additional quantity of the stone and tiles to cover such contingencies. However, nothing extra shall be payable on this account.
- f. For the enclosures with circular or curved profile, only the actual area of the flooring shall be measured for payment and nothing extra shall be payable for labour, material, wastages and any other incidental charges.
- g. For the skirting in the enclosures with curvilinear profiles, the tiles / stones shall be cut to the required size and the shape to match the profile and/ or the joints as per the architectural drawings. Similarly, the skirting shall be fixed in a manner as to flush or project from the finished face of the wall as per the architectural drawings and as directed by the Engineer – in- Charge. Any chasing of the C.C masonry blocks required for such fixing is deemed to be included in the cost of masonry. Nothing extra shall be payable on this account.
- h. For flooring work, the joints between the different types of flooring shall be located as per the architectural drawings and the measurement shall be done as per item description. Also, the Contractor shall maintain the uniform level of the finished flooring of the different types unless specifically mentioned on the architectural drawings. Nothing extra shall be payable on these accounts.
- i. All the flooring works specified under this sub-head shall be adequately protected by a layer of plaster of Paris which shall be laid over a 400-micron PVC film. The protective layer shall be maintained throughout the execution of works and removed just before handing over of the site for which nothing extra shall be payable.
- j. At the time of handing over, flooring & dado / cladding shall be free of any scratches, stains etc. The flooring & dado / cladding shall be properly cleaned before handing over. However, abrasive cleaners shall not be used to clean the marks and other scratches.

3.11 Kota stone work

- a. The Contractor shall procure and submit the samples of the kota stone for flooring as well as risers and treads in the staircase, for the approval of the Principal, Hindu College ,prior to the execution of the item.
- b. Mock up (one no.) shall be prepared for staircase (tread as well as riser).
- c. All the Kota stones shall have uniform colour and shade. So, the entire quantity shall be obtained, preferably, in one lot from one location (in one quarry) to keep variation to the minimum. The Contractor shall also sort, segregate and use the stone slabs, according to colour, shade, etc. at any one location to keep variation in the colour, shade etc. in stones used to the minimum. Any stone slab with a variation, not acceptable to the Engineer-in- Charge, shall not be used in the work and shall be removed and replaced by the Contractor at his own cost. Nothing extra shall be payable on these accounts. Also, no claim of any kind shall be entertained from the Contractor on this account.
- d. The exposed cut edges of the Kota Stone slab in risers and treads along its width (sides of the risers and treads of the steps i.e. along the shorter dimensions of the kota stone slab for the risers and treads) shall be polished in a workmanlike manner. The top exposed edge of the kota stone skirting shall also be polished in a workmanlike manner. Nothing extra shall be payable on this account.

- e. Nosing / edge moulding shall be provided to the front edge of the Kota stone slab treads along its length i.e. along the longer dimensions of the kota stone
- f. slab, as per the architectural drawings. The payment of the same shall be made separately under relevant item.

3.12 Granite stone work

- a. The Contractor shall procure and submit the samples of different types of granite stones, for the approval of the Principal, Hindu College ,prior to the execution of the item.
- b. The mock up (one each) shall be prepared in staircase, amphitheatre, stilt of academic block, dining area, etc.
- c. The entire supply for each type of granite stone slab shall be procured from one location (in one quarry), and supplied preferably, in one lot to keep variations to the minimum. The Contractor shall also segregate and sort the slabs according to colour, shade, texture and size of grains etc. to keep variation(s) in stones used at any one location to the minimum. Any slab with variation in the colour, shade, texture and size of grains etc., not acceptable to the Principal, Hindu College shall not be used in the work and shall be removed and replaced by the Contractor. Nothing extra shall be payable on these accounts. Also, no claim of any kind shall be entertained from the Contractor on this account.
- d. Granite stone slabs shall be pre polished (mirror polished) or given any other surface treatment as specified in the item nomenclature, as per the Architectural drawings and as directed by the Principal, Hindu College , .
- e. Machine polishing and cutting to required size shall be done with water (as lubricant) only. Sawing shall also be done preferably with water as lubricant but as a special case, the Principal, Hindu College ,may permit, at his discretion, oil or kerosene as lubricant subject to all kerosene or oil in the body and surface of tiles / slabs being thoroughly dried in ovens. Tiles / slabs with stains or patches due to the use of oil or otherwise, either before or after installation, shall be rejected and shall be replaced by the Contractor at his own cost. Nothing extra shall be payable on this account.
- f. The stone work may be required to be carried out in patterns, design and / or in combination with granite stones of different colour and shade with or without borders and in combination of different stone slabs / tiles for which nothing extra shall be payable. The stones shall be provided in sizes and shapes as per the architectural drawings and wastages and incidental costs, if any, shall be deemed to be covered in the cost of the relevant items. Nothing extra shall be payable on this account.
- g. For the flooring portions curved in plan, the stone slabs (at the edge) shall be cut to the required profile and shape as per the architectural drawings. Nothing extra shall be payable on this account and any consequent wastages and incidental charges on such accounts shall be deemed to be included in the cost of such items. For the purpose of payment, the actual area of granite stone shall be measured separately as specified under the relevant items.
- h. The granite slabs used for providing and fixing in the sills, soffits and jambs of doors, windows, ventilators and similar locations shall be in single piece unless otherwise directed by the Principal, Hindu College ,. Wherever stone slab other than in single piece is allowed to be fixed, the joints shall be provided as per the architectural drawings and as per the directions of the Principal, Hindu College ,. In the cabin areas, the joints in sills shall preferably be provided in line with the partition wall. Depending on the number of joints, as far as possible, the stone slabs shall be procured and fixed in slabs of equal lengths as per the architectural drawings and as directed by Principal, Hindu College ,.
- i. The specifications for dressing, laying, curing, finishing, measurements, rate etc. for the granite stone flooring shall be same as that of works for the Marble flooring, skirting and risers of steps under Flooring Sub Head of the CPWD Specifications. The

wall lining / veneer work with granite stone shall be as per the CPWD Specifications for Marble work Sub Head.

3.13 Vitrified and ceramic tiles work

- a. The Contractor shall procure and submit the samples of approved make, shade and thickness of different types of vitrified and ceramic tiles, for the approval of the Principal, Hindu College ,prior to the execution of the item.
- b. The mock up (one each) shall be prepared for flooring and dado, for vitrified tiles etc.
- c. The entire supply for each type of tiles shall be procured from one manufacturer/ authorized dealer, preferably, in one lot to keep variations to the minimum.
- d. The tiling work may be required to be carried out in patterns, design and / or in combination with tiles of different colour and shade and in combination of different stone slabs / tiles for which nothing extra shall be payable. The tiles shall be provided as per the architectural drawings and wastages and incidental costs, if any, shall be deemed to be covered in the cost of the relevant items. Nothing extra shall be payable on this account.
- e. For the flooring portions curved in plan, the tiles (at the edge) shall be cut to the required profile and shape as per the architectural drawings. Nothing extra shall be payable on this account and any consequent wastages and incidental charges on such accounts shall be deemed to be included in the cost of such items.
- f. The Contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate for compliance of various parameters for the material as per the manufacturer's specifications, with each lot of material received at site.
- g. The flooring and dado / cladding should be set out such that the perimeter/ corner tiles are in excess of half a tile so that the edge panels on both the sides are of equal sizes, as far as possible. The tiles shall be cut to required size and shape in a workman like manner but with all precautions, as per the manufacturer's specifications.
- h. For dado / cladding / skirting work, the tiles shall be chamfered at the meeting edges on the corners in a manner that butt edges are not visible. It shall be ensured that the edges shall be ground / filed to chamfer the edges so that the glazing layer at the edges of the tiles is not chipped off otherwise the work shall be rejected and redone by the Contractor at his own cost.

3.14 PVC sports flooring

- a. The Contractor shall procure and submit the samples of approved make, shade and thickness of PVC sports flooring material along with accessories and adhesives proposed to be used as per the manufacturer's recommendations, for the approval of the Principal, Hindu College , prior to execution of the item.
- b. Once the material is approved, the entire material for PVC sports flooring shall be procured from one of the approved manufacturers / authorized dealers preferably, in one lot to keep variations to the minimum. The Contractor shall also procure various accessories and adhesive required for satisfactory installation of PVC sports flooring.
- c. The work shall be carried out as per the architectural drawings, as per site conditions and as per the directions of the Engineer-in- Charge. The work shall be carried out in design and pattern including in combination with PVC sheets/ tiles of different colours and shade in linear as well as curvilinear portions of the building, as per the architectural drawings. The joints shall be kept as minimum as possible.
- d. The work shall be carried out as per the manufacturer's specifications. The work shall be got executed through an experienced agency executing similar works.

- e. Before fixing the PVC sports flooring, it shall be ensured that the sub floor on which the PVC sports flooring is being laid is smooth, flat, hard & free from moisture, grease, etc. In case of uneven sub floor, the same shall be levelled by self-levelling compound at no extra cost to the HINDU COLLEGE. The PVC sports flooring shall have perfect level after laying and no undulations from the sub- base shall be visible (reflected) on the surface. Also, there shall not be any air bubbles or delamination of the flooring, otherwise the work shall be rejected and redone by the Contractor at his own cost.
- f. Care shall also be taken to ensure that sub floor is dry at the time of installation.
- g. The composite thickness of the PVC flooring sheet shall be as per item description.
- h. All the joints shall be sealed by hot welding as recommended by the manufacturer to make the floor seamless and safe.
- i. The Contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate for compliance of various parameters for the material as per relevant EN standards, with each lot of material received at site.
- j. For the purpose of measurement, the actual area of PVC sports flooring including skirting provided and fixed in position shall be considered.

3.15 Crazy ceramic (china mosaic) tile flooring

- a. The materials to be used shall be broken glazed ceramic tile pieces. These shall be obtained from broken glazed tiles of uniform thickness and of approved shade and manufacture and conforming to I.S. 13753. The tile pieces shall be hard, sound, dense and glossy in texture. These shall be of required colour and shade and free from stains, cracks, decay and weathering.
- b. The work shall be carried out as per the architectural drawings in design (geometric, abstract etc.) and in linear and / or curvilinear pattern and in combination with tile pieces of different colour and shade.
- c. Before laying tile flooring on RCC slabs / PCC base, the laitance shall be removed and the surface shall be roughened. A coat of cement slurry @ 2.2 kg of cement per sqm shall be applied over the base surface for bonding between RCC slab / PCC and mortar bedding of tile flooring. Nothing extra shall be payable on this account.
- d. Pieces of ceramic glazed shall be brought to required size & shape to achieve the required design/ pattern. The shade of the tiles shall also be selected depending upon the pattern/ design. Tiles shall be thoroughly cleaned and soaked in water before fixing. Cement grout of desired consistency admixed with approved waterproofing compound and synthetic polyester fibre shall be spread over the mortar bedding when the mortar is still plastic. Pieces of glazed tile shall be pressed piece by piece in the required pattern in the cement float. The fixing shall be done by keeping the joints between the pieces as thin as possible but not exceeding 5mm. The work shall be carried out to correct level and slopes and compacted by striking the surface with hand thappies and straight screed tamper. The grout shall cream up to the surface. The junctions of the flooring and the parapet wall shall be rounded and the flooring shall be extended up to the wall for 15cm or as specified. After the flooring has been laid or the day's fixing work is completed, surplus cement grout that may have come out of the joints on compacting shall be cleaned off. The flooring laid shall be kept moist and allowed to mature undisturbed for 10 days to allow the bedding and flooring to set properly.
- e. Once the floor has set, it shall be carefully washed clean and dried. When dry, the floor shall be covered with oil free dry saw dust which shall be removed only after the construction work is completed.
- f. The Contractor shall ensure that the China Mosaic work provides waterproofing treatment and shall not allow penetration of water. The guarantee for the water

proofing work at the terrace shall also include restoration of the China Mosaic work after rectification, if any to the integral cement based waterproofing treatment to the terrace. Nothing extra shall be payable on this account.

- g. For the purpose of payment, actual area of the China Mosaic tile work shall be measured in sqm correct to two decimal places. No deduction shall be made for joint width between the adjacent tile pieces.

3.16 Particular Specifications – Roofing (False ceiling)

- a. General (applicable for all kinds of roofing works under this sub-head):
- b. The work in general shall be carried out as per the CPWD specifications, as per the manufacturer's specifications, as per architectural drawings and as per directions of Engineer- in-Charge.
- c. Various false ceiling shall be done in different levels in linear and curvilinear pattern in plan and elevation and in combination with other types of false ceiling as specified in schedule of quantities, as per the architectural drawings. However, payment shall be made under respective items.
- d. The tiles and the suspension system shall be as specified in the item nomenclature. The Contractor shall procure and submit the samples of tiles and grid system of approved make, for the approval of the Principal, Hindu College ,prior to execution of the item.
- e. The Contractor shall prepare the mock-up at site for approval of material and quality of workmanship by the Principal, Hindu College , Only after the approval of Mock-up, the Contractor shall start the mass work. If the quality of the workmanship and the material is as per the required standards and approved by the Engineer- in- Charge, the mock up shall be allowed as part of the work and measured for payment. Otherwise, it shall be dismantled by the Contractor as directed by the Principal, Hindu College ,and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.
- f. Once the material and mock up are approved, the entire material (tiles as well as grid system) shall be procured from the approved manufacturer or its authorized dealer.
- g. The installation shall be got done through an experienced installer, executing similar works.
- h. The material shall be transported to site well packed. The ceiling material procured shall be free of any surface defect, edge damage and any other such defects. The Contractor shall ensure careful handling and storage and prevent any rough handling, rolling of cartons or dropping cartons to prevent any edge damage or breakage. The defective / damaged material shall not be allowed to be used in the work. So, the contractor shall procure additional quantity of material to cover such contingencies. However, nothing extra shall be payable on this account.
- i. Adequate care shall be taken before installation as well as afterwards till completion of the work. It shall be protected from rains, excessive humidity, chemical fumes, vibrations, dust etc. Any tile with edge damaged or crack etc. shall not be allowed to be used in the work and shall be replaced by the Contractor at his own cost. Similarly, adequate care shall be taken by the Contractor while placing or removing and handling the tiles so as not to cause any damage. The ceiling shall be cleaned as per manufacturer's specifications. Abrasive cleaners shall not be used to clean the marks.
- j. The Contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate
/report for compliance of the material to the relevant standards along with each lot of material supplied for the work.

- k. The suspension system for various types of false ceiling shall be as per manufacturer's specifications. The false ceiling tiles shall be fixed on to coordinated suspension ceiling system with supporting grids system that fully integrates with the ceiling tiles as per manufacturer's specifications. It shall be ensured that the suspension system shall be suitable to take all designed dead, imposed and all incidental loads efficiently and shall not sag. The true line and levels for false ceiling work shall be maintained.
- l. The luminaries, air grills / diffusers, signages etc. shall be as far as possible independently supported to avoid any over loading of the ceiling system which may result in excessive deflection or twisting of grids. Any strengthening of grid system by providing additional hangers, fasteners, runners, cross tees etc. or providing additional bracing may be carried out as required for any specific locations or for specific purpose for which nothing extra shall be payable.
- m. The rate for the item of various false ceiling system shall include cost of all inputs of labour, materials, wastage if any, T&P, scaffolding, staging or any other temporary enabling structure / services etc. and all other incidental charges including making necessary cut outs for A.C diffusers, Light fittings, grills, Fire detection, alarm, sprinklers devices and fittings etc. No deduction in the area shall be made for openings nor anything

3.17 Gypsum board false ceiling

- a. The work in general shall be carried out as per CPWD specifications extra shall be payable for making the openings. Also, nothing extra shall be payable on account of any wastage in materials. Also, nothing extra shall be payable on account of any strengthening of the supporting suspension system for the false ceiling, around the openings in the false ceiling by using additional hangers, fasteners, runners, cross tees, cross channels, etc. However, for the purpose of payment only the actual area of the false ceiling shall be measured in sqm., as per the manufacturer's specifications, as per architectural drawings and as per directions of Principal, Hindu College , .

3.18 Particular Specifications – Finishing

A. General (applicable for all items under this sub-head)

- a. The work shall in general be carried out as per the CPWD specifications and the manufacturer's specifications (where CPWD specifications are not available).
- b. The theoretical consumptions of the various materials like plaster, primer, paint, etc. shall be as per the CPWD specifications and the various coefficients specified herein. Wherever coefficients are not mentioned in CPWD specifications, the same shall be as specified under relevant items. Nothing extra shall be payable on account of actual consumption exceeding the theoretical consumption. However, in exceptional cases, if the actual consumption is lesser than the theoretical consumption, cost adjustment shall be made for lesser consumption of material at the prevailing market rate.

B. Ready Mixed Cement Plaster

- c. The quantity of plaster required as per the theoretical consumption including wastages, if any, shall be procured from one of the approved manufacturers or his authorized dealers.
- d. The plaster shall be obtained in packing (40 Kg or 50 Kg, as per manufacturer) as far as possible.
- e. The name of the manufacturer, manufacturer's product identification, and manufacturer's mixing instructions, warnings and instructions for handling and application, date of manufacturing and shelf life shall be clearly and legibly mentioned on the labels of each bag. These details shall be kept in record. The material shall be consumed in the order of material brought to site, first come first consume basis. The

Contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate for compliance of various parameters for the material as per the manufacturer's specifications, with each lot of material received at site.

- f. The method of storage of material shall be same as applicable for cement specifications. The material older than 6 months from the date of manufacturing shall not be allowed to be used in the work.
- g. Surface preparation - The base surface shall be cured properly prior to the application of plaster. It shall be cleaned thoroughly, with no loose particles or dust. The surface shall be structurally sound, clean and free from dirt, oil, grease, efflorescence or any other contaminant that could impair the natural bond. Surface defects such as cracks, holes or voids shall be repaired prior to application. The base surface shall also be in-line & levelled before the application of plaster
- h. Pre-wetting of the substrate - The surface shall be wet properly before application of plaster.

C. Mixing:

- a. Plaster shall be thoroughly mixed with water before use in a mechanical stirrer for uniform and thorough mixing to ensure proper workability.
- b. Mixing ratio of clean potable water to the weight of the powder shall be as per manufacturers' specifications, depending upon the thickness of the plaster to be applied.
- c. The entire plaster proposed to be used in specific work shall be mixed thoroughly and uniformly with water. No plaster shall be left unmixed in the container.
- d. In exceptional cases, manual mixing shall be allowed with prior approval of Engineer-in-Charge. However, it shall be ensured that the plaster is mixed uniformly during manual mixing.
- e. All arrangements for measuring, dosing etc. at site shall be made by the Contractor.

D. Application:

- a. Plaster shall be applied on the surface manually with a trowel.
- b. The first coat of mixed plaster will be applied on the moistened wall surface uniformly, going upward from the bottom.
- c. The thickness of the coating to be applied shall be as per the manufacturer's specifications.
- d. The first coat of the plastered surface shall be allowed to dry as per manufacturer's specifications before applying second coat. The surface after second coat shall be allowed to dry completely and same process shall be followed for subsequent coats.
- e. The curing shall be done as per manufacturer's specifications.
- f. The entire quantity of plaster shall be used within 2 to 3 hours or as per manufacturer's specifications, after mixing with water. No extra water shall be added in the mixture made.
- g. For application in exterior surfaces, necessary measures like covering the surface with net and water curing as per manufacturer's specification shall be undertaken.
- h. Coverage:
 - i. The coverage for 12 mm thick plaster shall be 23 Kg per sqm. (approx.).
 - ii. The coverage for 18 mm thick plaster shall be 35 Kg per sqm. (approx.).
- i. The Contractor shall maintain proper records for receipt and consumption of the plaster for verification of Engineer-in-Charge.

- j. Measurement - The mode of measurement shall be as per cement plaster items of respective thicknesses as per CPWD Specifications (referred to Schedule F).

E. Acrylic texture plaster

- a. The Contractor shall procure and submit the samples of approved make and shade along with catalogue, for the approval of the Principal, Hindu College, prior to execution of the item.
- b. Based on the samples approved by the Principal, Hindu College the Contractor shall prepare the mock-up at site for approval of material and quality of workmanship by the Engineer-in-Charge. Only after the approval of mock-up, the Contractor shall start the mass work. The mock-up shall not form part of the work. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.
- c. Once the material and mock up are approved, the entire quantity of various materials shall be procured from the approved manufacturer or its authorized dealer, preferably, in one lot to keep variations to the minimum.
- d. The work shall be carried out as per the manufacturer's specifications.
- e. The Contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate / report for compliance of the material to the relevant standards along with each lot of material supplied for the work.
- f. The material shall consist of two parts: Scratch-plaster and Terra-coat.
- g. Scratch-plaster - It shall have two components which comes in liquid & powder form. These shall be mixed at site before application in the ratio 25kg. Powder in 1.0 litre of liquid. Powder shall be made-up of Acrylic powder polymer, inert filler material in powder form, finally graded silica (450 micron to 1.00mm graded) particles, Anti-fungal agents, Emulsifying agent (Extender) to prevent lumping of powder during mixing, Titanium di-oxide pigments for making it water-proof from exterior while allowing trapped water vapour breathability & Thixotropic agent for maintaining consistency of mix. & to prevent flowing of mix during application. The surface to be covered shall be pre-cured & shall be applied with surface stabilization primer before application of Scratch-plaster.
- h. Terra-coat - It shall be made-up of Acrylic Co-polymer emulsion, crushed & precisely graded silica particles (500 micron & down size), high quality rutile (Purest form) grade Titanium di-oxide, fungicide, plasticizers & anti-corrosive agent. This shall be applied over scratch-plaster in two or more coats to get approved shade & pattern.

3.19 Melamine polish

- a. The wood/veneer surface before polishing shall be well sanded to obtain smooth and even surface. A coat of appropriate wood sealer of the same manufacturer approved for melamine polish shall be applied over the surface before polishing. The surface shall be sand papered again to remove the excess filler material to obtain smooth even surface. Melamine polish of approved brand and manufacture in matt or glossy finish stained to required shade shall be machine sprayed in required coats over the prepared surface. Final polished surface shall be even, smooth and free from waviness. The natural grains of the wood /veneers shall be clearly visible from the final polished surface. Consumption of the melamine polish shall not be less than 0.25 lits/sqm.
- b. The material for melamine polish shall be of the approved make as specified.

3.20 Particular Specifications – Road work

A. General (applicable for all items under this sub-head)

- a. The work under this sub-head in general shall be carried out as per the CPWD specifications, as per architectural drawings and as per directions of Principal, Hindu College ,

B. Tiles and paver block

- a. The work under this sub-head in general shall be carried out as per the CPWD specifications, as per the manufacturer's specifications, as per architectural drawings and as per directions of Principal, Hindu College ,
- b. The Contractor shall procure and submit the samples of approved make, shade and thickness of various materials (tiles and paver blocks etc.) along with catalogue, for the approval of the Principal, Hindu College ,prior to execution of the item.
- c. Based on the samples approved by the Principal, Hindu College ,for various tiles and paver blocks etc, the Contractor shall prepare the mock-up at site for approval of material and quality of workmanship by the Principal, Hindu College , Only after the approval of mock-up, the Contractor shall start the mass work. If the quality of the workmanship and the material is as per the required standards and approved by the Engineer-in- Charge, the mock up shall be allowed as part of the work and measured for payment. Otherwise, it shall be dismantled by the Contractor as directed by the Principal, Hindu College ,and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.
- d. Once the material and mock-up are approved, the entire quantity of various materials shall be procured from the approved manufacturer or its authorized dealer, preferably, in one lot to keep variations to the minimum.
- e. The material (tile and paver blocks etc.) shall be supplied at site only after attainment of required strength at the factory itself.
- f. The Principal, Hindu College ,or his representative may, if required, shall inspect the factory during production of various tiles to assess the quality of the material and also collect samples from the factory itself. The HINDU COLLEGE shall bear the cost of such visits of the officers of the HINDU COLLEGE.
- g. The material shall be transported to site well packed. These shall be handled carefully to prevent any damages. The material procured shall be free of any surface defect, edge damage and any other such defects. The defective / damaged material shall not be allowed to be used in the work. So, the contractor shall procure additional quantity of material to cover such contingencies. However, nothing extra shall be payable on this account.
- h. Adequate care for various materials shall be taken before fixing as well as afterwards till completion of the work. It shall be protected from rains, excessive humidity, chemical fumes, vibrations, dust etc. The Contractor shall ensure careful handling and storage and prevent any rough handling, to prevent any edge damage or breakage. Any material (tiles and paver blocks etc.) with edge damaged or crack etc. shall not be allowed to be used in the work and shall be replaced by the Contractor at his own cost. Similarly, adequate care shall be taken by the Contractor while placing or removing and handling the material so as not to cause any damage. The finished work shall be cleaned as per manufacturer's specifications. Abrasive cleaners shall not be used to clean the marks
- i. The work shall be carried out as per the manufacturer's specifications.
- j. The tiles and paver blocks shall be fixed in required pattern and design in combination with tiles / paver blocks of different colours and shades in linear or curvilinear pattern as per the architectural drawings and the site conditions.

- k. The Contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate / report for compliance of the material to the relevant standards along with each lot of material supplied for the work.
- l. For the enclosures with circular or curved profile, only the actual area of the respective works shall be measured under relevant sub-heads for payment and nothing extra shall be payable for labour, material, wastages and any other incidental charges.
- m. For tiling and paver work, the joints between the different types of tiles and pavers shall be located as per the architectural drawings and the measurement shall be done as per item description.
- n. The Contractor shall maintain the uniform level of the finished flooring of the different types unless specifically mentioned on the architectural drawings.
- o. At the time of handing over, the finished areas (tiles and paver blocks etc) shall be free of any scratches, stains etc. These areas shall be properly cleaned before handing over. However, abrasive cleaners shall not be used to clean the marks and other scratches.

3.21 Particular specifications for sanitary installations, water supply & drainage

A. General (applicable for items under this sub-head):

- a. The work under this sub-head in general shall be carried out as per the CPWD specifications, as per architectural drawings and as per directions of Principal, Hindu College ,
- b. Before taking up the work, the Contractor shall prepare integrated shop drawings showing details of various pipe lines running horizontally and vertically and obtain approval of Principal, Hindu College . Integrated services drawings shall conform to local byelaws. The work shall be carried out as per approved integrated shop drawings for sanitary installations, water supply, rain water and drainage pipes.
- c. Samples of all the pipes, fittings, fixtures etc., of make as per the list of approved materials shall be brought to site, well in advance, prior to start of any of the works and got approved by the Principal, Hindu College ,
- d. Two sample toilets with all the pipelines, fittings and fixtures shall be prepared and tested for proper functioning of the system and got approved from the Principal, Hindu College ,before taking up mass work. The sample toilet(s) shall form part of the main work if the performance is found satisfactory; otherwise, the same shall be dismantled and redone by the Contractor at this cost.
- e. The chasing, cutting and making holes in the masonry and / or cement concrete and / or RCC works shall be done carefully without causing any damage to the structure. As far as possible, mechanical cutters & core cutting machines shall be used in a workman like manner, for concealing the pipelines and fittings. The chases / holes, so made, shall be made good with the cement mortar of mix 1: 4 (1cement: 4 coarse sand) mixed with approved water proofing chemical after testing of the pipe lines for leakage. The cost of cutting cores in RCC, cutting holes in masonry & making good the same shall be inclusive in the respective item of drainage/water supply lines.
- f. All vertical sanitary & GI pipes shall be fixed to hot dipped galvanized M.S supporting frame with "U" shaped G.I bolts, threaded at both ends, as specified, with GI nuts, GI washers, GI cleats etc. as approved by the Principal, Hindu College , Supporting frame shall be fixed with approved anchor fasteners as directed by the Principal, Hindu College , In all cases, pipelines shall be fixed, minimum 50 mm away from the finished wall face and shall not be fixed directly to the walls. The cost of providing and fixing GI supporting frame shall be paid for separately under relevant items.
- g. All horizontal pipes shall be fixed to the soffit of beams / slabs etc. with G.I. hanger rods & G.I. frame work as per the approved shop drawings and as directed by the

Principal, Hindu College, The pipelines shall be clamped to the structural steel frame work with "U" bolts and nuts, washers, cleats etc., of length and diameter as required and as specified. The G.I. frame work shall be paid for separately under relevant items.

- h. The Contractor shall sequence the activities for external drainage and other pipe lines work in such a way that no hindrance is caused to other activities like laying of external electrical cable, development, landscape and road work etc.

3.22 Particular specifications – Aluminium work

- a. The material for the work shall be procured from the approved manufacturer as per the list attached with the tender documents. The Contractor shall procure and submit samples of various materials to be used in the work for the approval of Principal, Hindu College, and no work shall commence before such samples are approved. Samples of un-anodized as well as anodized aluminium sections, neoprene gaskets, glass, stainless steel screws, anchor fasteners, hardware and any other material or components requiring approval of samples, in opinion of Principal, Hindu College shall be submitted for the approval as mentioned above. The above samples shall be retained as standards of materials and workmanship.
- b. The Contractor shall prepare the shop drawings for the aluminium windows giving details of the various aluminium sections, neoprene gaskets, cleats, anchor fasteners, hardware, sealants, glass etc. and submit the same for the approval of Principal, Hindu College,
- c. Only after the approval of the samples and the shop drawings by the Principal, Hindu College the Contractor shall procure the material for the work. All materials brought to the site by the Contractor, for use in the work, as well as fabricated components shall be subject to inspection and approval by Principal, Hindu College, The Contractor shall produce manufacturer's test certificates for any material or particular batch of materials supplied by him.
- d. The Contractor shall prepare a finished sample of the aluminium window along with glazing panel and fittings etc. for approval of workmanship and material. Nothing extra shall be payable on this account.
- e. Aluminium sections to be used for various works shall be appropriate to meet technical, structural, functional and aesthetic considerations. The anodizing shall be carried out in an approved factory / workshop as specified in the tender documents.

A. Fabrication

- a. All joints shall be accurately fabricated and be hairline in appearance. The finished surface shall be free from visible defects.
- b. All hardware used shall conform to the relevant specifications and as per samples approved by the Principal, Hindu College, Design, quality, type, number and fixing of hardware shall be generally in accordance with architectural drawings and as approved by the Engineer-in- Charge before use.
- c. All doors, windows, ventilators and glazing etc. shall be made water tight with neoprene gaskets and weather silicone sealants to the satisfaction of the Principal, Hindu College for which nothing extra shall be payable.
- d. The frames shall be strictly as per Architectural drawings, the corners of the frame being fabricated to the true right angles. Both the fixed frames and openable shutter frames shall be fabricated out of sections cut to required length, metered and mechanically jointed for satisfactory performance. All members shall be accurately machine milled and fitted to form hairline joints. The jointing accessories such as aluminium cleats, stainless steel screws etc. shall not to cause any bi-metallic reaction by providing separators, wherever required.
- e. Vertical members of the aluminium frame work shall be embedded in the floors, wherever required, by cutting and making good of the floor.

B. Fixing of Aluminium Frame Work

- a. The screws used for fixing fixed aluminium frames of the aluminium windows to masonry walls/ RCC members and aluminium members to other aluminium members shall be of stainless steel of approved make and quality and of stainless-steel grade 304. Threads of machines crews used shall conform to requirement of I.S. 4218.
- b. For the aluminium windows, the gap between the aluminium frames and the R.C.C / Masonry and also any gaps in the various sections shall be filled with weather silicone sealant DC 795 of Dow Corning or equivalent in the required bite size, to ensure water tightness including providing and fixing backer rod , wherever required. The weather silicone sealant shall be of such approved colour and composition that it would not stain or streak the masonry / R.C.C. work. It should not sag or flow and shall not set hard or dry out under any conditions of weather and shall be tooled properly. The weather silicone sealant shall be used as per the manufacturer's specifications and shall be of approved colour and shade. Any excess sealant shall be removed / cleared. Nothing extra shall be payable for the above.
- c. Fixing of glass panes shall be designed in such a way that replacing damaged / broken glass panes is easily possible without having to remove or damage any members or interior finishing materials.

C. ANODIZING

- a. Aluminium sections shall be anodized as per I.S. 7088 – 1973. Anodizing to be as per grade AC 20 and not less than 20 microns thick when measured as per I.S. 6012, in colour and shade as approved by the Principal, Hindu College ,The anodic coating shall be properly sealed by steam or dipping in de-ionized water as per I.S. 1868-1982 and / or I.S. 6057. Sealing quality shall be tested in accordance with the relevant standards. Nothing extra shall be payable on this account.
- b. The Contractor shall satisfy himself by checking in the factory that the thickness of the anodic coating is found to be minimum 20 microns and sealing quality is appropriate everywhere. The testing shall be done in an approved laboratory by EDDY CURRENT METHOD as per I.S. 6012for thickness. For testing the thickness of anodic coating of the anodized aluminium sections, the calibration shall be done on bare (un-anodized) aluminium sections of same type. If any material is found sub-standard, it shall be rejected.
- c. All anodized aluminium works shall conform to relevant I.S. Codes relating to materials, workmanship, fabrications, finishing, erection, installations etc. In this connection I.S. Codes including I.S. 1868 – 1982, I.S. 733 – 1983, I.S. 1948-1961, I.S. 7088-1973, I.S. 6012-1970, I.S. 1285 – 1975, I.S. 740-1975 are considered relevant and applicable.
- d. The exposed surface of the aluminium sections shall be protected against surface damage, dents, scratches etc. It shall, therefore, be provided with protective tape. After fixing and assuring of proper functioning of doors, windows, frame work for partitions / false ceiling etc. such protective tape shall be cleaned out / removed as per the directions of Engineer-in-Charge. Nothing extra shall be payable for above.

D. Glazing

- a. All glass panes shall be retained within aluminium framing by use of exterior grade neoprene gaskets. Use of glazing or caulking compounds around the perimeter of glass will not be permitted. There shall be no whistling or rattling. Before installation of glass, Contractor shall ensure the following:
- b. All glazing rebates shall be square, to plumb, true to plane, dry and free from dust.
- c. Glass edge shall be clean and cut to exact size and grounded

- d. Annealed float glass in doors, windows, ventilators and fixed glazing etc. shall be of approved make and standard quality conforming to C.P.W.D. Specifications.
- e. 4 mm thick glass panes shall be provided for openings not exceeding 0.5 sqm. For openings exceeding 0.5 sqm in area, 5.0 mm thick glass panes shall be provided unless specified otherwise.

E. Protections and Cleaning:

- f. All glass panes shall be retained within aluminium framing by use of exterior grade neoprene gaskets. Use of glazing or caulking compounds around the perimeter of glass will not be permitted. There shall be no whistling or rattling. Before installation of glass, Contractor shall ensure the following:
- g. All glazing rebates shall be square, to plumb, true to plane, dry and free from dust.
- h. Glass edge shall be clean and cut to exact size and grounded
- i. Annealed float glass in doors, windows, ventilators and fixed glazing etc. shall be of approved make and standard quality conforming to C.P.W.D. Specifications.
- j. 4 mm thick glass panes shall be provided for openings not exceeding 0.5 sqm. For openings exceeding 0.5 sqm in area, 5.0 mm thick glass panes shall be provided unless specified otherwise.

F. MEASUREMENT AND RATES:

- a. Aluminium frame work shall be measured as per CPWD specifications.
- b. For glazing, the actual area of the glass panels excluding the portion in the beading shall be measured in sqm up to two decimal places, for payment.
- c. Stainless steel adjustable friction hinges and the aluminium handles for the openable side- hung windows shall be of "Earl Bihari", make or equivalent as approved by the Engineer-in- Charge. 2 nos. friction hinges shall be provided per shutter.
- d. The cost of designing and preparation of shop drawings, all the samples, mock- up of window etc. is deemed to be included in the cost of the relevant items. Nothing extra shall be payable on this account.
- e. The item for aluminium for fixed portions for aluminium windows and frame work for partitions shall include cost of all inputs of labour, material (anodized aluminium sections, including cleats, other fixtures, weather silicone sealants, stainless steel screws, nuts, bolts, rawl plugs, backer rods, polyethylene tapes etc. which shall be required for fabrication and erection of aluminium work) T & P, all incidental charges, wastages etc. involved in the work. However, for the purpose of payment, the weight of aluminium sections for the fixed window frame and frame work for partitions, shall be measured in Kg. The aluminium cleats, stainless steel screws, nuts, bolts, separators etc. shall not be measured separately for payment and their cost is deemed to be included in the cost of this item. The item for aluminium for frame work for fixed partitions shall also include cost of providing and fixing stainless steel anchor fasteners as required.
- f. The item of aluminium for the openable aluminium shutters for windows and doors etc., shall include cost of all inputs of labour, material (anodized aluminium sections, including such as cleats / angles, other fixtures, stainless steel screws nuts, bolts, stainless steel hinges, weather silicone sealant etc. which shall be required for fabrication of aluminium work) T & P, all incidental charges, wastages etc. involved in the work. However, for the purpose of payment, the weight of aluminium sections for the window shutter (sash frame) shall be measured in Kg. The aluminium cleats, stainless steel anchor fasteners, screws, nuts, bolts, separators, stainless steel hinges, etc. shall not be measured separately for payment and their cost is deemed to be included in the cost of this item. The anodized aluminium snap beading for

fixing glass panels in the open able shutters of the windows shall be measured separately (on weight basis) and paid under this item of aluminium frame work for window shutters.

- g. The glass shall be paid for separately under relevant item. The cost providing and fixing neoprene gasket, felt etc. is included in the cost of this item and shall not be measured separately for payment.
- h. The item for the aluminium frame work includes cost of making provision for fixing fittings, wherever required, as per the item description (The cost for providing fitting (handle, lock and buffer) shall be paid for separately).

3.23 Particular specifications for waterproofing treatment

- a. All the water proofing treatment shall be got executed through one of the specialized agencies as per the list of approved agencies attached with the tender. The water proofing agency shall carry out water proofing work with one of the approved water proofing compound mentioned in the tender. If so specifically requested by the Contractor, he will be allowed to use other waterproofing compound meeting various technical parameters, subject to prior approval of Principal, Hindu College ,
- b. The work under this sub-head in general shall be carried out as per the CPWD specifications, as per the manufacturer's specifications, as per architectural drawings and as per directions of Principal, Hindu College

- 1.0 Ten years guarantee in prescribed proforma attached shall be given by the Contractor for the water proofing treatment. In addition, 10% (ten percent) of the cost of these items of water proofing under this sub head shall be retained as guarantee amount to watch the performance of the work executed. However, half of this amount (withheld) would be released after five years from the date of completion of the work, if the performance of the waterproofing works is satisfactory. The remaining withheld amount shall be released after completion of ten years from the date of completion of work, if the performance of the waterproofing work is satisfactory. If any defect is noticed during the guarantee period, it should be rectified by the Contractor within seven days of issuing of notice by the Principal, Hindu College ,/ HINDU COLLEGE and, if not attended to, the same shall be got done by Principal, Hindu College ,/ HINDU COLLEGE through other agency at the risk and cost of the Contractor and recovery shall be effected from the amount retained towards guarantee. The guarantee amount can be released in full, if bank guarantee of equivalent amount, valid for the duration of guarantee period, is produced and deposited with the HINDU COLLEGE.

3.24 Particular specifications for Glass Fibre Reinforced Concrete (GFRC)

Work in this section is subject to requirements of the Contract documents including the General Conditions, Supplementary Conditions, and applicable portions of Divisions

- a. GFRC panel fabrication shall include all labour, materials, equipment, and related services necessary to manufacture and deliver the panels as indicated and described by the Bill of Quantities, including the following:
 - i. GFRC composite panels produced by the spray-up process, including integral metal stud frame.
 - ii. Shop drawings and engineering calculations for panels, stud frame, and attachments to building structure.
 - iii. Provide loose connection hardware, and hardware for embedment in cast-in-place concrete, as indicated or required for panel attachment to building structure.
- b. GFRC panel erection shall include all labour, materials, equipment, and related services necessary for the erection of the panels as indicated and described by the BOQ, including the following:

- i. Attaching all loose connection hardware between panel frames and building structural frame.
 - ii. Installation of mock up (if required)
- c. The placement of the hardware in cast-in-place concrete will be the responsibility of the Contractor.

1.1 Related Work Specified Elsewhere

- A Architectural Precast Concrete:
- B Cast-In-Place Concrete:
- C Structural Steel Framing:
- D Metal Fabrications: Painting or Coatings:
- E Insulation and Fire Safety:
- F Flashing and Sheet Metal:
- G Sealants and Caulking:
- H Glazing and Window work (including blocking and nailers for same):

1.2 REFERENCE PUBLICATIONS

- A The publications listed below form a part of this specification to the extent referenced.
 - 1. Precast / Prestressed Concrete College MNL-128: "Recommended Practice for Glass Fibre Reinforced Concrete Panels."
 - 2. Precast/Prestressed Concrete College MNL-130-91: "Manual for Quality Control for Plants and production of Glass Fibre Reinforced Concrete Products."

1.3 REFERENCES

- A ASTM A 27-85 Steel Castings, Carbon, for General Applications
- B ASTM A 153-82 Zinc Coating (hot dip) on Iron or Steel Hardware
- C ASTM C 150-85a Portland Cement
- D ASTM C 260-86 Air-Entraining Admixtures for Concrete
- E ASTM C 494-86 Chemical Admixtures for Concrete
- F ASTM C 144 Sand
- G ASTM C 979 Concrete Pigment
- H ASTM C 33 Aggregate

1.4 QUALITY ASSURANCE Aggregate

- A Design Responsibility: Design of GFRC skin, metal frame, and connections shall be by a registered professional engineer employed or retained by the panel manufacturer and licensed to practice in state of project, using property data generated from manufacturer's actual production. Comply with procedures in Prestressed Concrete College 's. Panels shall be designed to meet all applicable local and state building codes.
- B Manufacturer Qualifications
 - 1. Manufacturer shall have been engaged in uninterrupted production of GFRC projects involving the use of panelized GFRC of the quality and scope required for this project for a minimum of five years.

2. The GFRC manufacturing plant shall be certified by the PMC/ Consultant/ Arch. The GRC manufacturer shall have at least 4 lines / machines for GRC spraying and manufacturing. Shall have at least a production capacity of 100 Sq mt /day
- C. Erector Qualifications: Regularly engaged for a minimum of four years in the installation of GFRC or architectural precast concrete panels similar to those required on this project, and shall have the present erection management capability sufficient to install the required units without causing a delay of the project.
- D. Testing: In accordance including the following:
 1. Glass content by "wash-out" test
 2. Flexural yield strength
 3. Flexural ultimate strength
 4. Flex anchor/gravity anchor strength
 5. Slurry unit weight test
 6. Slurry slump test
 7. Aggregate gradation testing
- E. Tolerances: Manufacture and install GFRC panels so that tolerances for dimensions and appearance shall be as indicated
- F. Records: Keep quality control records available for two years after final acceptance.

1.5 SUBMITTALS

- A. Shop Drawings: Manufacturer of panels shall receive all applicable drawings and specifications including structural, mechanical and related trades. Manufacturer of panels shall submit for approval complete erection drawings showing:
 1. Unit shapes (elevations and sections) and dimensions
 2. Thickness of facing and GFRC backing
 3. Finishes
 4. Steel stud frame details
 5. Joint and connection details
 6. Lifting and erection details
 7. Location and details of hardware attached to structure
 8. Size, location and details of flex and gravity anchors
 9. Other items sprayed in panels
 10. Handling procedures
 11. Sequence of erection for special conditions
 12. Relationship to adjacent material
 13. Description of all loose, cast-in, and field hardware
 14. Shop drawings shall be submitted in one copy sepia set. Show location of units on shop drawings by same identification marks placed on panels. Manufacturer shall not proceed with fabrication of any panels prior to receiving approval of erection drawings by the architect.

B Samples

1. Prior to commencement of manufacture, submit samples representative of finished face showing typical range of color and texture.
2. Sample size shall be approximately 12 inches x 12 inches and of appropriate thickness, representative of the proposed finished product.

C Mix Designs: Submit on request all backup and face mix designs.

D Engineering Calculations: Submit complete design calculations prepared and sealed by a registered engineer for typical panels including:

1. Loads used in design

2. GFRC Skin design

3. Metal stud frame design

4. Connection hardware design

5. Backup Data: Submit on request, test data on which GFRC design is based and data on GFRC insert and anchor tests.

E Test Reports: Submit on request 3 copies of all test reports required in section 1.56.

F Certification of Materials: Submit upon request, certificates of compliance with ASTM standards of all raw materials, including:

1. Aggregates
2. Admixtures
3. Fibreglass Reinforcement
4. Cement
5. Metal framing components
6. Connection Hardware

G Repair and Cleaning: Submit procedure and patch mix design for repairing and/or cleaning panels.

H Mock-up: Prior to installation of the work of this section, erect a sample at location directed by or acceptable to the architect, using specified materials and illustrating range of color, texture and workmanship to be expected in the completed work. Once mock-up has been approved by the architect, retain until the work has been completed and accepted.

1. Configuration: Two full size mock-up panels – one to be retained at the plant and one to be retained on the jobsite. The exact panel to be selected by architect.
2. Mock-up may not be incorporated into the final work; demolish and remove from site when directed by the architect.

1.6 WARRANTY/GUARANTEE

- A The GFRC contractor shall furnish a written warranty against defects in materials or workmanship for a period of 10 year after substantial completion of project.

2 PART 2 – PRODUCTS

2.1 GFRC MATERIALS

- A. Cement: Type I, White Portland Cement of one type, brand, source and lot throughout project, meeting requirements of ASTM C150.

- B. Sand: Fine, clean, dry sand, able to pass a no. 16 sieve, free of contaminants and meeting ASTM C144.
- C. Water: Fresh, clean, potable and free of any deleterious matter that would interfere with color, setting or strength of concrete.
- D. Glass Fibres: High zirconia content (minimum 16%), alkali resistant glass fibres specifically designed for use in concrete. Use 4½% to 6% by weight in GFRC mix design.
- E. Concrete Pigment: Harmless to concrete, sunlight-fast, alkali resistant, conforming to ASTM C979.
- F. Aggregate (if used): Clean, hard, strong, durable, inert and free of deleterious material, conforming to ASTM C33 except for gradation. Size to be less than ½" diameter.
- G. Acrylic Thermoplastic Copolymer: Conforming to the specifications in Appendix F of the Prestressed Concrete College MNL-128.
- H. Admixtures: Conforming to ASTM C260 for air entrainment, ASTM C494 for chemical admixtures, and ASTM C618 for fly ash or natural pozzolan admixtures. Do not use admixtures that contain more than .1% chloride ions.

2.2 STEEL FRAMING MATERIALS

Steel frame system shall be a welded prefabricated frame produced in accordance with approved shop drawings, fabricated to meet design loads, wind loads, handling and erection loads.

- A. Metal Studs and Track:
 - 1. Galvanized steel, conforming to ASTM A446.
 - 2. Galvanized coating shall conform to ASTM A525 with a minimum G-60 coating.
 - 3. Studs shall have a min. yield strength of 40 ksi.
 - 4. Track shall have a min. yield strength of 30 ksi.
 - 5. Members shall be 4" x 16 gauge and 6" x 16 gauge or as required per design calculations.
 - 6. Studs shall be indexed and shall be spaced at approx. 24" on centre.
- B. Structural Tubing: Shall be formed from steel conforming to ASTM A500. Finish – Shop Prime painted
- C. Flex Anchors: 3/8" or 1/4" diameter bent rod - ASTM A36, FY-36 ksi minimum, electroplate galvanized.
- D. Miscellaneous Steel (channels, angles, etc.): ASTM A36, FY-36 ksi minimum, Fu-58 ksi, except tube shapes. Finish – Shop Prime painted
- E. Reinforcing (deformed) Bars: ASTM A706 deformed billet steel bars, grade 60. Galvanized rebar to ASTM 767, class II, grade 40.
- F. Headed Stud Embed Anchors: ASTM A108, FY-50 ksi minimum, Fu-60 ksi minimum. Welded per TWR Nelson method.
- G. Anchor Bolts: ASTM A307 or ASTM A325.

2.3 PRODUCT CHARACTERISTICS

A. Typical Mixes

1. Combine Portland cement, glass fibres, sand and selected admixtures in proper proportions to meet design requirements.
2. Provide glass content of no less than 4½% and no more than 6%.
3. Provide average yield strength of not less than 900 psi and average ultimate strength of not less than 2,500 psi.

B. Typical Range of GFRC Properties at 28 days:

- Ultimate Flexural Strength (psi) 2500-4000
- Yield Flexural Strength (psi) 900-1500
- Ultimate Tensile Strength (psi) 1000-1600
- Yield Tensile Strength (psi) 700-1000
- Compressive Strength (edgewise), (psi) 7000-12000
- Shear Strength (interlaminar), (psi) 400-800
- Shear Strength (in-plane), (psi) 1000-1600
- Coeff. of Thermal Expansion (in/°F x 106) 6-9
- Thermal Conductivity (Btu/in/hr/ft²/°F) 3.5-7.0
- Modulus of Elasticity (106 psi) 1.5-2.9

C. Facing Mix: Thickness shall generally be the minimum possible to achieve the desired finish.

D.

GFRC Skin

1. Per skin design requirements. In no case shall the panel skin be less than ½" thick.
2. Backup mixes shall have same proportion of pigments as face mixes to eliminate the possibility of bleeding through of a different colored backup.

E. Coloring Agent: The amount of coloring agent shall not exceed 10% of the cement weight.

2.4 FABRICATION

A. Forms

1. Forms for GFRC panels shall be rigid and constructed of materials that will result in finished products conforming to the profiles, dimensions and tolerances indicated by the contract documents and on the approved shop drawings.
2. Release agents shall be applied and used according to manufacturer's instructions. Use release agent compatible with architectural finish and joint sealants.

B. Proportioning and Mixing

1. All measurements of mix constituents shall be carried out in a careful manner to achieve the desired mix proportions.

2. The glass fibre and cement slurry shall be metered to the spray head at rates to achieve the desired mix proportion and glass content. These shall be checked in accordance with standard procedures described in PCI MNL-130.
3. Cleanliness of equipment and working procedure shall be maintained at all times.

C. Hand Spray Application

1. Spray operators shall be trained personnel.
2. A mist coat consisting of the matrix without fibre may, if necessary, be sprayed onto the form. The thickness of this coating shall generally not exceed 1/16 in. in order to avoid an unreinforced surface.
3. Spray-up of the main body of material shall proceed before any mist coat or facing mix has set.
4. Application shall be by spraying such that uniform thickness and distribution of glass fibre and cement matrix is achieved during the application process.
5. Consolidation shall be by rolling or such other techniques as necessary to achieve complete encapsulation of fibres and compaction.
6. Control of thickness shall be achieved by using a pin gauge or other approved method. A minimum of one measurement per each 5 square feet of panel surface shall be made.
7. All hand-forming of intricate details, incorporation of formers or infill material, and over-spraying shall be carried out before the material has achieved its initial set so as to ensure complete bonding.

D. Inserts and Embedment

1. Inserts shall be properly embedded in built-up homogeneous GFRC bosses or bonding pads to develop their strength. Waste material such as over-spray is not acceptable to encapsulate inserts or for bonding pads.
2. Rigid embedded items bonded to the GFRC shall not create undesirable restraint to volume changes.

E. Steel Stud Frame System

1. Steel stud frame shall be a prefabricated welded frame produced in accordance with the approved erection drawings.
2. All accessible welds shall be touched up after welding.

- F. Allowable Tolerances: Manufacture units so that each panel complies with the dimensional tolerances listed below. For dimensional tolerances not listed below, those listed in PCI MNL-130, shall apply.

Dimensional Tolerances of Finished Units:

1. Overall height and width of units measured at the face adjacent to the form:
 - (a) 10 ft or under $\pm 1/8"$
 - (b) 10 ft and over $\pm 1/8"$ per 10'
2. Thickness:
 - (a) Skin thickness: $\pm 1/4"$, -0"
 - (b) Architectural facing thickness: $\pm 1/8"$, -0"

- Position Tolerances (measured from datum line locations as shown on the approved erection drawings):

1. Steel studs and tracks: $\pm 1/4"$
 2. Flashing, at edge of panel $\pm 1/4"$
 3. Reglets for glazing gaskets $\pm 1/8"$
- G. Finishes: Exposed face of panels to match approved sample on file in architect's office. Exposed face of panels shall be manufactured free from joint marks, "grain" or other obvious defects.
- H. Cover: Provide embedded anchors, inserts, and other sprayed-in items with sufficient anchorage and embedment for design requirements.
- I. Curing
1. Immediately after the completion of spraying of the panel, a curing method shall be used to ensure sufficient strength for removing the units from the form.
 2. After initial curing, remove panel from form and place in a controlled curing environment. Panels shall be kept continuously wet for a minimum of 7 days in accordance with manufacturer's standard curing practice. The temperature shall be maintained between 60° F and 120° F during this period. In lieu of moist curing, acrylic thermoplastic copolymer dispersion shall be used as a curing admixture. Only copolymers shown to eliminate the need for moist curing through published independent laboratory test data shall be used.
- J. Panel identification
1. Mark each GFRC panel to correspond to identification marks on shop drawings for panel location.
 2. Mark each GFRC panel with date cast.
- K. Acceptance: GFRC units which do not meet the color and texture range or the dimensional tolerances may be rejected at the option of the architect if they cannot be satisfactorily corrected.

- A. Preinstallation Conference: Prior to installation of work of this section, conduct a meeting at the project site to discuss quality assurance requirements. In addition to the contractor and the installer, arrange for attendance of the following:
1. Other installers affected by the work of this section
 2. The Owner's representative

3. The architect
4. Manufacturer's representative
5. Supplier
6. Superintendent for the contractor

B. General Contractor's Responsibility

1. The general contractor shall provide building lines, centre and grades in sufficient detail to allow installation of the GFRC units.
2. The General Contractor shall provide true, level load-bearing surfaces.
3. The general contractor shall provide for the accurate placement and alignment of anchor bolts, plates, dowels or other items embedded in the concrete structure or that are a part of the structural building frame.
4. Clear, well-drained unloading areas and road access around and in the building (where appropriate) shall be provided and maintained by the general contractor to a degree that hauling and erection equipment for the GFRC units are able to operate under their own power.
5. The general contractor shall provide adequate traffic control, barricades, warning lights or signs to safeguard traffic in the immediate area of hoisting and handling operations.

C. Erector Responsibility

1. Verify that all parts of the supporting structure are complete and ready to receive the panels and that site conditions are conducive to proper installation.
2. Prior to installation of the units, the erector shall check the jobsite dimensions affecting the work under his contract. Any discrepancies between design dimensions and field dimensions which could adversely affect installation shall be brought to the attention of the general contractor and architect.
3. If discrepancies exist, installation shall not proceed until they are corrected or until installation requirements are modified and reviewed by the architect and/or Engineer.

3.2 DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling

1. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses or damage.
2. Lift or support units only at the points shown on the erection shop drawings.
3. Place non-staining resilient spacers of even thickness between units.
4. Support units during shipment on non-staining shock-absorbing material.
5. Protect units from dirt and damage during handling and transport.

B. Storage at Jobsite:

1. Store units to protect them from contact with soil, staining and from physical damage.
2. Store units, unless otherwise specified, with non-staining, resilient supports located in same positions as when transported.

3. Store units on firm, level and smooth surface.
4. Place stored units so that identification marks are easily readable.

3.3 INSTALLATION OF PANELS

Only competent workmen who are properly instructed to handle and erect GFRC shall be employed.

A. Setting

1. GFRC units shall be lifted with suitable lifting devices at points provided by the manufacturer.
2. GFRC units shall be set level, plumb, square and true within allowable tolerances
3. Panel-to-panel joints shall be a minimum of 1/2".

B. Supports and Bracing

The erector shall provide temporary supports and bracing as required to maintain position, stability and alignment as units are being connected.

C. Fastening

1. Fasten GFRC units in place by bolting or welding or both as shown on the approved erection drawings.
2. Field welding shall be done by qualified welders using equipment and materials compatible to the base material.
3. Shall be completely free and independent of adjacent materials.

D. Tolerances of Erected Units: Tolerances for location of GFRC units shall be non-cumulative and as listed below. For erection tolerances not listed below, those listed in PCI MNL-130 shall apply.

Tolerance for Face Width of Joint:

Panel dimension 10 ft. or less $\pm 3/16"$

Panel dimension 10 to 20 ft $\pm 1/4"$

Panel dimension greater than 20 ft $\pm 5/16"$

- E. Warpage: Maximum permissible warpage of one corner out of the plane of the other three shall be 1/16" per foot distance from the nearest adjacent corner, or 1/4" total after installation.
- F. Bowing: Not over L/360 with a maximum of 1", where L is the panel length in the direction of the bow. Differential bowing as erected between adjacent members of the same design shall be 1/4".

3.4 PATCHING

- A. Method: Mix and place patch mixture to match color and texture of surrounding concrete. If patching is not possible or if unacceptable to architect, GFRC unit is to be replaced.
- B. Structural Adequacy: Patching will be permitted provided structural adequacy of the unit is not impaired.
- C. Damage: Damage caused by other trades that requires replacement or patching shall be performed by the GFRC manufacturer and paid for by others after written authorization to perform said work.

3.5 CLEANING

- A. Cleaning methods shall be approved by fabricator.
- B. After installation, the manufacturer shall clean any soiled GFRC surfaces with detergent and water, using fibre brush and sponge, and rinse thoroughly with clean water.
- C. Use extreme care to prevent damage to GFRC surfaces and to adjacent materials.
- D. Soiled surfaces must be thoroughly rinsed with clean water immediately after using cleaner.

3.6 PROTECTION OF WORK

- A. The erector shall be responsible for protection of the panels from damage by the erection crews, field welding or cutting operations by providing non-combustible shields as necessary during these operations.
- B. The erector shall be responsible for any chipping, spalling, cracking or other damage to the units after delivery to the jobsite unless damage is caused by others during site storage.
- C. After installation is complete and after any damaged or soiled panels have been cleaned, repaired, inspected and approved, further damage is the responsibility of the general contractor.

3.7 INSPECTION AND ACCEPTANCE

- A. Acceptance: Final inspection and acceptance of erected GFRC panels shall be made by the architect to verify conformance with plans and specifications.
- B. Rejection: Panels may be rejected for any one of the following product defects or installation deficiencies remaining after repairs and cleaning have been accomplished. "Visible" means visible to a person with normal eyesight when viewed from a distance of 20 feet in broad daylight.
 - 1. Nonconformance to specified tolerances.
 - 2. Air voids (bug-holes or blowholes) larger than 3/8" (10 mm) in diameter
 - 3. Visible casting lines
 - 4. Visible form joints
 - 5. Visible irregularities
 - 6. Visible stains on panel surface
 - 7. Visible differences between panel and approved sample
 - 8. Visible non-uniformity of textures or color
 - 9. Visible areas of backup concrete bleeding through the facing concrete
 - 10. Visible foreign material embedded in the face.
 - 11. Visible repairs or cracks
 - 12. Visible reinforcement shadow lines

3.25 Additional/Particular Specifications for Landscaping and Horticulture Works

General

- 1. Quality: Plants shall be typical of their species or variety. Plants shall have normal, well-developed branches and vigorous root systems. They shall be sound, healthy, vigorous, free

from defects, disfiguring knots, abrasions of the bark, sun-scald injuries, plant diseases, insect eggs, borers, and other forms of infections. Single stem shade trees shall have straight trunks, central leader and symmetrical heads. Plants shall be nursery grown unless otherwise stated. Woody plants shall have been grown in the same or colder climatic zone of this project for at least two years prior to the date of planting.

2. Preparation of Plants: In preparing plants for moving, all precautions customary in current horticulture trade practice shall be taken. Plants shall be dug to retain as many fibrous roots as possible. Trees shall only be dug in the spring before leaves appear unless otherwise specified. Oversize or exceptionally heavy plants are acceptable if the size of the ball or spread of the root is proportionately increased to the satisfaction of the Principal, Hindu College, Broken, loose, or manufactured balls will be rejected.

1.1 Plants and Planting Execution

A: Installation

1. Time of Planting: Start planting when other divisions of this work have progressed sufficiently to permit drainage. Planting operations shall be conducted under favorable weather conditions. At the Contractor's option and full responsibility, planting operations may be conducted under unseasonable conditions without additional compensation.
2. Layout: Planting shall be located where shown on Drawings. Verify planting bed and planting pit locations with the Principal, Hindu College, before excavating. Prior to the excavation of planting areas or plant pits, or placing tree stakes, locate utility lines, electric cables, sprinkling system, and conduits so that proper precautions may be taken not to disturb or damage subsurface improvements. Should obstructions be found, the Contractor shall promptly notify the Principal, Hindu College,
3. Shrub Beds and Tree Pits: Shrub beds and Tree pits shall be prepared as shown on drawings and as noted in the section. Damage to paving, sidewalks or other materials shall be removed and new shall be provided at the Contractor's expense and to the satisfaction of the Principal, Hindu College, Backfill perennial planting areas to a depth of 12" below finish grade. Where beds of trees are used, excavate and backfill the entire bed. When pit is nearly filled, water thoroughly and allow the water to soak away. If settling of the backfill to bring level to finish grade.
4. Pruning and Repair: Plants shall be neatly pruned and or clipped to preserve the natural character of the plants, and in a manner appropriate to the particular requirements of each plant, and to the satisfaction of the Principal, Hindu College, Broken or badly bruised branches shall be removed with a clean cut. Prune with sharp tools in accordance with instructions of the Principal, Hindu College, Accidental damage to trees and shrubs occurring during the course of planting operations which is not so great as to necessitate removal of a branch or replacement of a plant shall promptly be treated as required in accordance with current acceptable horticulture practices and the instructions of the Principal, Hindu College,
5. Protection of Trees: Immediately after planting, paint tree trunks with an approved insecticide following manufacturer's application recommendations. The trees may be wrapped at Contractor's option as shown on the drawings from October through May.
6. Watering: Thoroughly water each plant immediately following planting by soaking hole without runoff.

B: Execution

3. Top soil Adjustment:

- a. Contractor shall have soil pH tested by independent soil testing laboratory. Submit test result to Owner's Representative. Adjust topsoil, if required, to a range of 6.0 – 7.0. Contractor shall submit recommendation for adjustment from testing laboratory to Owner's Representative for approval before adjustment is performed.

b. No subsoil from building excavation shall be intermixed into the top 18" of topsoil. Extra subsoil from excavation shall be removed from the site.

2. Preparation of Topsoil: (vermicompost, rice husk and neem cake)

a. Incorporate into topsoil to a depth of 3" a fertilizer mixture with a ratio of 1:2:2 applied at the per 1000 square feet.

b. Finished grade shall be raked smooth, free from depressions or undulations to the satisfaction of the Owner's Representative.

3. Irrigation System Establishment: The irrigation system shall be tested, adjusted, repaired and operated in the manner in which it was designed to function. Components such as backflow prevention units and pressure reducing valves as well as all other appurtenances shall function properly in accordance with the requirements of the design and the special provisions, together with the recommendations of the manufacturer. No change in the system as it was accepted under the contract shall be made without written approval of the Engineer.

During landscaping establishment, emission points of emitters shall be repositioned as directed by the Engineer. Additional tubes shall be installed where necessary, as directed by the Engineer. Staking of additional tubes shall be done in accordance with the details shown on the project plans.

The irrigation system shall be tested within one week prior to each scheduled inspection. Testing of the various components shall be as specified in the special provisions or as directed by the Engineer. The contractor shall keep a record of the results of all testing and shall submit a copy of these results to the Engineer upon completion of each test.

2.1 Limestone/ kota stone/ kota stone work

- a. The Contractor shall procure and submit the samples of the Limestone/ kota stone/ kota for flooring, for the approval of the Principal, Hindu College ,prior to the execution of the item.
- b. All the Limestone/ kota stones shall have uniform colour and shade. So, the entire quantity shall be obtained, preferably, in one lot from one location (in one quarry) to keep variation to the minimum. The Contractor shall also sort, segregate and use the stone slabs, according to colour, shade, etc. at any one location to keep variation in the colour, shade etc. in stones used to the minimum. Any stone slab with a variation, not acceptable to the Engineer-in- Charge, shall not be used in the work and shall be removed and replaced by the Contractor at his own cost. Nothing extra shall be payable on these accounts. Also, no claim of any kind shall be entertained from the Contractor on this account.
- c. The exposed cut edges of the Limestone/ kota stone slab in risers and treads along its width (sides of the risers and treads of the steps i.e., along the shorter dimensions of the Limestone/ kota stone slab for the risers and treads) shall be polished in a workmanlike manner. The top exposed edge of the Limestone/ kota stone skirting shall also be polished in a workmanlike manner. Nothing extra shall be payable on this account.
- d. Nosing / edge moulding shall be provided to the front edge of the Limestone/ kota stone slab treads along its length i.e., along the longer dimensions of the Limestone/ kota stone slab, as per the architectural drawings. The payment of the same shall be made separately under relevant item.

2.2 Grass Pavers

- a. The work under this sub-head in general shall be carried out as per the CPWD specifications, as per the manufacturer's specifications, as per drawings and as per directions of Principal, Hindu College ,
- b. The Contractor shall procure and submit the samples of approved make, shade and thickness of various materials along with catalogue, for the approval of the Principal, Hindu College ,prior to execution of the item.

- c. Based on the samples approved by the Principal, Hindu College, for various paver blocks etc, the contractor shall prepare the mock-up at site for approval of material and quality of workmanship by the Principal, Hindu College, Only after the approval of mock-up, the contractor shall start the mass work. If the quality of the workmanship and the material is as per the required standards and approved by the Engineer-in- Charge, the mock up shall be allowed as part of the work and measured for payment. Otherwise, it shall be dismantled by the contractor as directed by the Principal, Hindu College, and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.
- d. Once the material and mock-up are approved, the entire quantity of various materials shall be procured from the approved manufacturer or its authorized dealer, preferably, in one lot to keep variations to the minimum.
- e. The paver shall be supplied at site only after attainment of required strength at the factory itself.
- f. The Principal, Hindu College, or his representative may, if required, shall inspect the factory during production to assess the quality of the material and also collect samples from the factory itself. The HINDU COLLEGE shall bear the cost of such visits of the officers of the HINDU COLLEGE.
- g. The material shall be transported to site well packed. These shall be handled carefully to prevent any damages. The material procured shall be free of any surface defect, edge damage and any other such defects. The defective / damaged material shall not be allowed to be used in the work. So, the contractor shall procure additional quantity of material to cover such contingencies. However, nothing extra shall be payable on this account.
- h. Adequate care for various materials shall be taken before fixing as well as afterwards till completion of the work. It shall be protected from rains, excessive humidity, chemical fumes, vibrations, dust etc. The contractor shall ensure careful handling and storage and prevent any rough handling, to prevent any edge damage or breakage. pavers with edge damaged or crack etc. shall not be allowed to be used in the work and shall be replaced by the contractor at his own cost. Similarly, adequate care shall be taken by the contractor while placing or removing and handling the material so as not to cause any damage. The finished work shall be cleaned as per manufacturer's specifications. Abrasive cleaners shall not be used to clean the marks
- i. The work shall be carried out as per the manufacturer's specifications.
- j. The contractor shall obtain and submit to the HINDU COLLEGE the manufacturer's test certificate / report for compliance of the material to the relevant standards along with each lot of material supplied for the work.
- k. For paver work, the joints between the different types of pavers shall be located as per the drawings and the measurement shall be done as per item description.
- l. The Contractor shall maintain the uniform level of the finished flooring of the different types unless specifically mentioned on the drawings.
- m. At the time of handing over, the finished areas shall be free of any scratches, stains etc. These areas shall be properly cleaned before handing over. However, abrasive cleaners shall not be used to clean the marks and other scratches.

2.3 Maintenance Method and Material

Contractor to provide necessary machineries, equipment's, manpower, transport, supervision, and all that is required for landscape maintenance activities like, training, pruning, soil loosening, weed removal, lawn mowing, irrigation, planting, fertilizer and pesticide application, hedge, edge cutting, cleaning, earthworks, etc. with optimum resources deployment for satisfactory maintenance of gardens including but not limited to the following works:

2.3.1 Landscape care and maintenance methodology

- A. Site cleaning: Daily cleaning of garden including lawn, garden pathways, shrubbery, flowerbeds etc. to keep it free from fallen leaves, and any garbage. Contractor to collect garbage and store at designated location till it is disposed out from the premises. Contractor to provide necessary manpower, vehicle, supervision, and all that is required to collect garden waste, non- Organic/organic waste from jobsite and dispose the same outside Airport premises at no extra cost to MIAL.
- B. Soil Loosening & weed removal: Regular soil loosening, uprooting of unwanted vegetation/weeds with roots from landscaped area to keep the garden weed free.
- C. Training and Pruning: Training & pruning of trees, hedge, climbers, ground covers, shrubs etc. are to be carried out as per the following instructions or as per instruction of Site-Horticulturist. Pruning operation is to be carried out with the help of proper tools like power hedge shear, bush cutter, chainsaw etc. While pruning, care should be taken to take a clean cut of branches to avoid peeling of bark. After pruning, wherever applicable plant protection measures are to be undertaken.
- D. Shrubs: Shrubbery should be healthy, weed free and disease, pest free and properly pruned to give desired shape.
- E. Ground cover: Ground cover shall be healthy, patch less and weed free. Pruning and training as and when required to keep it in a proper shape.
- F. Trailing plants: Trailing plants should be properly trimmed in such a way that it will not hide the traffic signs and also should not touch the road. Training and pruning to be done fortnightly or on need basis.
- G. Tree, Palms and Accent Plants: Training, Pruning, and thinning to be done once in a month or on need basis to give desired shape to the plant. If required staking to be done. Before every monsoon, the palms fronds to be trimmed to minimize the load to avoid damage during storm. Tying to be done as per instruction of site Horticulturist (rope will be provided by client). Fronds obstructing CC TV camera should be removed immediately.
- H. Lawn: Mowing should be carried out on need basis to maintain the grass/lawn height within the range of 40-50 mm by manual hedge shear or brush cutter, followed by cleaning of lawn to remove grass clippings.
- I. Potted plants placed in lawn: All potted plants placed in lawn to be trimmed to get desired shape. Care to be taken that the lawn should not enter/grow in pots. The damaged, unhealthy plants to be replaced in coordination with Site Horticulturist
- J. Waterlogging during monsoon: During monsoon, all planters shall be checked periodically to avoid waterlogging. If observed, the drainage hole to be cleared immediately.
- K. Fertilizers and Manure: Application of manure & fertilizers includes broadcasting or thorough mixing wherever applicable. Contractor to ensure immediate irrigation after fertilizers.

2.1.2. Points to be noted before commencement of contract.

The Contractor shall take note of the availability of the Irrigation System in landscape

areas. The damages to Irrigation system occur during horticultural operations are responsibility of Contractor. The Contractor shall be responsible for placement of drip lines in their original position after each horticulture operation.

- A. Supplementary Watering: In case of any failure of irrigation systems or of water supply or in case irrigation water is not available for any other reason, the contractor shall immediately make arrangements for manual watering by water tanker, or by other approved arrangement. The cost of tanker water shall be borne by the HINDU COLLEGE.

2.1.3. General notes for services:

The General Notes shall apply to all the Garden maintenance works. Work done checklist must get signed on 10th, 20th & 30th of every month from Site-Horticulturist. Contractor has to come to site or whenever he/she will be required.

3.26 Acoustic Wall & Ceiling Panels

3.26.1 Printed & Grooved Wall Panel

Material : Panel is made of Thermoplastic Polymer Resin material. Density of the material shall be 1900 – 2000 GSM. NRC value shall be up to 0.9. Flammability shall conform to EN 13501 (Class B s1, d0). Antifungal Activity shall conform to AATCC 30 – 2013.

Material Handling & Installation: Hands shall washed & clean, preferably Gloves shall be worn at the time of material handling & Installation to avoid staining. The corners & edges of the panel shall be protected during handling. Panel shall be fixed with adhesive. The Panel can be fixed directly to the Wall / Ply / Gypsum surface. The surface shall be levelled & no undulation shall be left before fixing the panel. Panel can be cut to desired size with cutter by skilled carpenter.

Maintenance: For cleaning dust normal duster or Vacuum Cleaner can be used. For slight contamination plain water can be sparkled on the surface and carefully wiped with regular sponge. For medium contamination upholstery cleaner can be used on the surface and carefully wiped with regular sponge. For heavy contamination chlorine or hydrogen peroxide bleach can be used on the surface and shall be wiped carefully with sponge & sparkling water.

3.26.2 Baffle Ceiling Panel

Material: Panel is made of Non-Woven Polyester Fibre material. Baffle will be a single piece with seamless bottom finish made by moulding it in the desired size with clean jointless ends. NRC value shall be up to 0.9. Flammability shall conform to EN 13501 (Class B s1, d0). Antifungal Activity shall conform to AATCC 30 – 2013.

Material Handling & Installation: Hands shall washed & clean, preferably Gloves shall be worn at the time of material handling & Installation to avoid staining. The corners & edges of the panel shall be protected during handling. Panel shall be fixed with adhesive. The Panel can be fixed directly to the Ceiling / Ply / Gypsum surface. The surface shall be levelled & no undulation shall be left before fixing the panel. Panel can be cut to desired size with cutter by skilled carpenter. The panel shall have customized Aluminium Extrusion channel fitted on top of the baffle, with sliding mechanism for screw, shall fit in the GI Powder coated perforated carrier system.

Maintenance: For cleaning dust normal duster or Vacuum Cleaner can be used. For slight contamination plain water can be sparkled on the surface and carefully wiped with regular sponge. For medium contamination upholstery cleaner can be used on the surface and carefully wiped with regular sponge. For heavy contamination chlorine or hydrogen peroxide bleach can be used on the surface and shall be wiped carefully with sponge & sparkling water.

3.27 Additional/Particular Specifications for Plumbing Works

I. S. CODE	Reaffirmation	Subject
PUBLIC HEALTH WORKS		
27 -1992	Reaffirmed 2002	Specifications for Pig Lead
269-1989	Reaffirmed 2004	Specifications for 33 grade Ordinary Portland Cement
407-1981	Reaffirmed 2001	Brass tubes for General purposes
456-2000	-	Code of practice for Plain & Reinforced concrete.
458-2003	-	Specifications for Concrete Pipes.
554-1999	-	Dimensions for pipe thread where pressure tight joints are required.
636-1988	Reaffirmed 2003	Firefighting hose, rubber lined or fabric reinforced rubber lined woven –jacketed
638-1979	Reaffirmed 2003	Sheet rubber jointing & rubber insertion jointing
651-1992	Reaffirmed 2003	Specifications for Salt glazed stoneware pipes & fittings.
771 (Pt. I & VII)		Glazed Fire Clay Sanitary Appliances.
771-1979 (Pt. I)	Reaffirmed 2003	General requirements
771-1985 (Pt. II)	Reaffirmed 2003	Specific requirements of kitchen & laboratory sinks
771-1979 (Pt. III/ Sec 1)	Reaffirmed 2003	Specific requirements of urinals (section 1-Slab urinals)
771-1985 (Pt. III/ Sec2)	Reaffirmed 2000	Specific requirements of urinals (section 2-Stall urinals)
771-1979 (Pt. IV)	Reaffirmed 2003	Specific requirements of postmortem slabs.
771-1979 (Pt. V)	Reaffirmed 2003	Specific requirements of shower trays
771-1979 (Pt. VI)	Reaffirmed 2003	Specific requirements of bed pan sinks
771-1981 (Pt. VII)	Reaffirmed 2003	Specific requirements of slop sinks
774-1984	Reaffirmed 2000	Flushing cistern for water closet and urinals.
775-1970	Reaffirmed 2000	Cast iron brackets and supports for wash basin and sink.
778-1984	Reaffirmed 2000	Specifications for copper alloy gate & Globe check valves for water works
779-1994	Reaffirmed 2004	Water meters (domestic type)
781-1984	Reaffirmed 2001	Specifications for cast copper alloy screw down bib taps & stop cocks for water services
782-1978	Reaffirmed 2003	Specification for Caulking lead.
783-1985	Reaffirmed 2001	Code of practice for laying concrete pipes.
784-2001	Reaffirmed 2002	Pre-stressed concrete pipes.
884-1985	Reaffirmed 2000	Fire aid hose reel for fire fighting (for fixed installation)
901 -1988	Reaffirmed 2003	Specification for couplings, double males & double female, instantaneous pattern for Fire Fighting

I. S. CODE	Reaffirmation	Subject
902 -1992	-	Specification for suction hose couplings for Fire Fighting purposes.
903 -1993	Reaffirmed 2003	Couplings for fire hose delivery, branch pipe, nozzles specification
904 -1983	Reaffirmed 2000	Specification for 2 way and 3 way suction collecting heads for Fire Fighting purposes.
905 -1980	Reaffirmed 2002	Specification for delivery breechings, dividing and collecting instantaneous pattern for Fire Fighting
906 -1988	Reaffirmed 2000	Specification for revolving branch pipe for Fire Fighting
907 -1984	Reaffirmed 2000	Specification for suction strainer, cylindrical type for Fire Fighting purposes.
908-1975	Reaffirmed 2000	Fire Hydrants, Stand post type
909-1992	Reaffirmed 2002	Specifications for underground fire hydrants, sluice valve type
940 -1989	-	Portable Fire Extinguisher, water Type (Gas Cartridge) - Specification
941-1985	Reaffirmed 2000	Specification for Blower and Exhauster for Fire Fighting.
1172-1993	Reaffirmed 2002	Code of basic requirements for water supply, drainage and sanitation
1200-1979 (Pt. 16)	Reaffirmed 2002	Method of measurements for Laying of water and sewer lines including appurtenant items.
1200-1981 (Pt. 19)	Reaffirmed 2002	Method of measurements for Water supply, plumbing and drains.
1230		Specifications for CI Rain Water pipes
1239-2004 (Pt I)		Specifications for Mild steel tubes
1239-1992 (Pt. II)	Reaffirmed 2002	Specifications for Mild steel Tubular & other wrought steel pipe fittings
1300-1994	Reaffirmed 2000	Phenolic moulding material specification
1536-2001	-	Specifications for Centrifugally cast iron (spun) pressure pipes for water, gas and sewage
1537-1976	Reaffirmed 2000	Specifications for Vertically cast iron pressure pipes for water, gas and sewage
1538-1993	Reaffirmed 1999	Cast iron fittings for pressure pipes for water, gas and sewage
1700-1973	Reaffirmed 2003	Drinking fountains
1701-1960	Reaffirmed 2003	Combination valve , mixing valves

I. S. CODE	Reaffirmation	Subject
1703-2000		Ball valve (horizontal plunger type) including floats for water supply.
1711-1984	Reaffirmed 2000	Self-closing taps.
1726-1991	Reaffirmed 2003	Cast iron manhole covers and Frames.
1729-2002	-	Cast /ductile iron drainage pipes & fittings for over ground NP pipeline S/S series.
1742-1983	Reaffirmed 2002	Code of practice for building drainage
1795-1982	Reaffirmed 2000	Pillar taps for water supply purposes
1879		Malleable Cast Iron Pipe Fittings
1978-1982	Reaffirmed 2002	Specification for line pipe (M S Seamless)
1979-1985	Reaffirmed 2002	Specification for high test line pipe
2065-1983	Reaffirmed 2001	Code of practice for water supply in buildings.
2097 -1983	Reaffirmed 2000	Specification for foam making branch pipe.
2104-1981	Reaffirmed 2003	Water meter boxes (domestic type)
2171 – 1999	-	Specification for portable fire extinguisher, dry powder (Cartridge Type)
2190-1992	Reaffirmed 2002	Code of practice for selection ,installation & maintenance of portable first-aid fire extinguishers
2267-1995	Reaffirmed 2000	Polystyrene moulding and extension materials – specification
2326-1987	Reaffirmed 2003	Automatic flushing cistern for urinals
2373		Specification for Water Meter (Bulk type)
2379-1990	Reaffirmed 2000	Colour code for identification of pipe lines.
2401-1973	Reaffirmed 2003	Code of practice for selection, installation & maintenance of domestic water meters
2470 (Pt. I to II)	-	Code of practice for installation of septic tanks
2470-1985 (Pt. I)	Reaffirmed 2001	Design criteria & construction
2470-1985 (Pt. II)	Reaffirmed 2001	Secondary Treatment & disposal of septic tank effluent
2527-1984	Reaffirmed 2000	Code of practice for fixing rain water gutters and down pipes for roof drainage.
2546 -1974	Reaffirmed 2000	Specification for galvanized Mild Steel Fire bucket.
2548-1996(Pt. I)	Reaffirmed 2002	Plastic water closet seats and covers.
2548-1996(Pt. II)	Reaffirmed 2002	Plastic water closet seats and covers.
2556 (Pt. 1 to XV)	-	Specification for Vitreous (Vitreous China) sanitary appliances.
2556-1994 (Pt.1)	Reaffirmed 2004	General requirements
2556-1994 (Pt.2)	Reaffirmed 1999	Specific requirements of wash down water-closets

I. S. CODE	Reaffirmation	Subject
2556-2004 (Pt.3)	-	Specific requirements of squatting pans
2556-2004 (Pt. 4)	-	Specific requirements of wash basins
2556-1994 (Pt.5)	Reaffirmed 2004	Specific requirements of laboratory sinks
2556-1995(Pt.6)	Reaffirmed 2003	Specific requirements of urinals & partition plate
2556-1995 (Pt.7)	Reaffirmed 2003	Specific requirements of accessories for sanitary appliances
2556-1995 (Pt.8)	Reaffirmed 1998	Specific requirements of pedestal close coupled & wash down and siphonic water closets
2556-2004 (Pt.9)	-	Specific requirements of pedestal type bidets
2692-1989	Reaffirmed 2003	Specification for Ferrules for water services.
2800-1991 (Pt. I)		Construction of tube well
2800-1979 (Pt. II)		Testing of tube well
2871-1983	Reaffirmed 2000	Specification for Branch pipe, universal, for fire fighting purposes
2878 -2004	-	Fire Extinguisher, Carbon Dioxide Type (Portable and Trolley Mounted) – Specification.
2951 (Pt. I to II)	-	Recommendation for estimate of flow of liquids in closed conduits.
2951-1965 (Pt. I)	Reaffirmed 2003	Head loss in straight pipes due to frictional resistance
2951-1965 (Pt. II)	Reaffirmed 2003	Head loss in valves & fittings.
3006-1979	Reaffirmed 2003	Specification for Chemically resistant glazed S.W. pipes and Fitting
3076-1985	Reaffirmed 2003	Low density polyethylene pipes for potable water supply
3114-1994	Reaffirmed 2004	Code of practice for laying of Cast Iron pipes.
3311-1979	Reaffirmed 2003	Waste plug & its accessories for sinks & wash basins.
3328-1993	Reaffirmed 2003	Quality tolerances for water for swimming pools
3389-1994	Reaffirmed 2000	Urea formaldehyde moulding materials
3486-1966	Reaffirmed 2000	Specification for Cast iron spigot and socket drain pipes
3489-1985	Reaffirmed 2000	Specifications for enameled steel bath tubs
3589-2001	-	Specifications for steel pipes for water & sewage (168.3 to 2540 mm outside dia.)
3597-1998	-	Method of test for concrete pipes.
3844-1989	Reaffirmed 2000	Code of practice for installation and maintenance of internal fire hydrants Hose Reels in premises.
3950-1979	Reaffirmed 2003	Specification for Surface boxes for sluice valve.
3989-1984	Reaffirmed 2000	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings & accessories.

I. S. CODE	Reaffirmation	Subject
4038-1986	Reaffirmed 2000	Foot valves for water works purposes.
4111 (Pt. I to V)		Code of practice for ancillary structures in sewage system.
4111-1986 (Pt. I)	Reaffirmed 2001	Manholes
4111-1985 (Pt. II)	Reaffirmed 2001	Flushing tanks
4111-1985 (Pt. III)	Reaffirmed 2001	Inverted syphon
4111-1968 (Pt. IV)	Reaffirmed 2001	Pumping stations & pumping mains (rising mains)
4111-1993 (Pt. V)	Reaffirmed 2004	Tidal out-falls
4120-1967	Reaffirmed 2000	Tubs and baths.
4127-1983	Reaffirmed 2001	Code of practice of laying of glazed stone ware pipes.
4308 -2003	-	Dry Chemical Powder for Fighting B & C class Fires– Specification.
4350-1967	Reaffirmed 2001	Specification for concrete porous pipes for under drainage.
4733-1972	Reaffirmed 1992	Methods of sampling & test for sewage effluents
4736-1986	Reaffirmed 2001	Specification for hot–dip zinc coating on mild steel tubes.
4854 (Pt. I to III)		Glossary terms for valves and their parts
4854-1969 (Pt. I)	Reaffirmed 1999	Screw down stop, check & gate valves & their parts
4854-1968 (Pt. II)	Reaffirmed 1999	Plug valves & cocks & their parts
4854-1974 (Pt. III)	Reaffirmed 1999	Butterfly valves
4927-1992	Reaffirmed 2002	Unlined flax canvass hose for fire fighting
4947 -1985	Reaffirmed 2000	Specification for gas cartridge for use in Fire extinguishers.
4984-1995	Reaffirmed 2002	Specifications for HDPE pipes for water supply
4985-2000	-	Specifications for unplasticised PVC pipes for potable water supplies
5290-1993	Reaffirmed 2003	Specifications for Landing valves.
5312 (Pt. I)		Swing check type reflux (non return) valves
5312-1984 (Pt. I)	Reaffirmed 2000	Reflux (non return) valves – single door pattern
5329-1983	Reaffirmed 2001	Code of Practice for sanitary pipe work above ground for building
5330-1984	Reaffirmed 2000	Criteria for design for anchor blocks for penstocks with expansions joints.
5382-1985	Reaffirmed 2003	Specifications for rubber sealing rings for water, gas & sewer mains
5455-1969	Reaffirmed 2003	Cast iron steps for manholes
5600-2002	-	Specifications for Sewage and drainage pumps
5611-1987	Reaffirmed 2002	Code of Practice for waste stabilization ponds (Facultative type)
5714-1981	Reaffirmed 2002	Specifications for Hydrant stand-pipe for fire fighting
5822-1994	Reaffirmed 2004	Code of Practice for laying of welded steel pipes for water supply

I. S. CODE	Reaffirmation	Subject
5961-1970	Reaffirmed 2003	Specifications for Cast Iron grating for drainage purposes
6234 -2003	-	Portable fire Extinguisher water Type (Stored Pressure) – Specification.
6279-1971	Reaffirmed 2001	Equipment for grit removal
6280-1971	Reaffirmed 2001	Sewage screens
6295-1986	Reaffirmed 2001	COP for water supply & drainage in high altitude & / or sub-zero region
6392-1971	Reaffirmed 1998	Steel pipe flanges
6411-1985	Reaffirmed 2000	Specifications for gel coated glass fiber reinforced polyester resin bath tubs
6418-1971	Reaffirmed 2000	Cast Iron & malleable flanges for general engg. Purpose
6494-1988	Reaffirmed 2000	COP for water proofing of under ground water tanks & swimming pools
6587-1987	Reaffirmed 2003	Specifications for Spun hemp yarn
7181-1986	Reaffirmed 2000	Horizontally Cast Iron Double Flanged pipe for water, gas & sewage.
7231-1994	Reaffirmed 2004	Specifications for Plastic Flushing Cisterns for w.c. & urinals
7558-1974	Reaffirmed 2001	Code of Practice for domestic hot water installations
7634 (Pt. I to III)		Code of Practice for Plastic pipe work for potable water supplies
7634-1975 (Pt. I)	Reaffirmed 2002	Choice of materials & general recommendations
7634-1975 (Pt. II)	Reaffirmed 2002	Laying & jointing polyethylene (PE) pipes
7634-2003 (Pt. III)	-	Laying & jointing un plasticised PVC pipes
7740-1985	Reaffirmed 2001	Code of Practice for road gullies
7834 (Pt. I to VIII)		Injection moulded PVC socket fittings with solvent cement joints for water supplies
7834 -1987(Pt.I)	Reaffirmed 2003	General requirements
7834-1987 (Pt.II)	Reaffirmed 2003	Specific requirements for 45 0 elbows
7834-1987 (Pt. III)	Reaffirmed 2003	Specific requirements for 90 0 elbows
7834-1987 (Pt. IV)	Reaffirmed 2003	Specific requirements for 90 0 tees
7834-1987(Pt.V)	Reaffirmed 2003	Specific requirements for 45 0 tees
7834-1987 (Pt. VI)	Reaffirmed 2003	Specific requirements for sockets
7834-1987(Pt. VII)	Reaffirmed 2003	Specific requirements for unions
7834-1987 (Pt. VIII)	Reaffirmed 2003	Specific requirements for caps
8008 (Pt. I to VII)		Injection moulded HDPE fittings for potable water supplies
8008-2003 (Pt. I)	-	General requirements for fittings
8008-1976 (Pt. II)	Reaffirmed 1997	Specific requirements for 90 0 bends
8008-2003 (Pt. III)	-	Specific requirements for 90 0 tees
8008-2003 (Pt. IV)	-	Specific requirements for reducers
8008-2003 (Pt. V)	-	Specific requirements for ferrule reducers

I. S. CODE	Reaffirmation	Subject
8008-2003 (Pt. VI)	-	Specific requirements for pipe ends
8008-2003 (Pt. VII)	-	Specific requirements for sandwich flanges
8090-1976	Reaffirmed 2000	Coupling, branch pipe, nozzle used in hose reel tubing for fire fighting
8329-2000	-	Centrifugally cast (spun) ductile iron pressure pipes & fittings for water, gas & sewage
8413 (Pt. I)		Requirements for biological treatment equipment
8413-1977 (Pt. I)	Reaffirmed 2001	Trickling Filter
8718-1978	Reaffirmed 2000	Specifications for vitreous enameled steel kitchen sinks
8727-1978	Reaffirmed 2000	Specifications for vitreous enameled steel wash basin
8835-1978	Reaffirmed 1999	Guideline for planning and design of surface drains.
8931-1993	Reaffirmed 2003	Specifications for copper alloys Fancy single taps, combination tap assembly & stop valves for water services
9140-1996	Reaffirmed 2002	Method of sampling of vitreous & fire clay sanitary appliances
9293-1991	Reaffirmed 1996	Specifications for flax canvas
9338-1984	Reaffirmed 2000	Specifications for Cast Iron screw down stop valves and stop & check valves for water works purposes
9668-1990	Reaffirmed 2000	Code of practice for provision & maintenance of water supplies for Fire Fighting
9739-1981	Reaffirmed 2003	Specifications for Pressure reducing valves for Domestic water supply system.
9758-1981	Reaffirmed 2003	Flush valves and Fittings for water closets and urinals
9762-1994	Reaffirmed 2004	Specifications for polyethylene floats for float valves
9763-2000	-	Specifications for Plastic Bib taps, pillar taps, angle valves and stop valves for hot & cold water service.
9972 -2002	-	Specification for Automatic sprinkler Heads for Fire Protection Service.
10221-1982	Reaffirmed 1997	Code of practice for coating and wrapping of underground M.S. steel pipeline,
10500-1991	Reaffirmed 2003	Specification of Drinking water
11108 -1984	Reaffirmed 2000	Specification for portable fire Extinguisher Halon 1211 Type.
11189-1985		Method of tube well development
11606 -1986	Reaffirmed 2000	Method for sampling of cast iron pipes and fittings.
11632 -1986		Rehabilitation of Tube well
12183-1987 (Pt. I)	Reaffirmed 2004	Code of practice for Plumbing in multistoried buildings (for water supply)
12231 -1987	Reaffirmed 2003	UPVC pipes for section & delivery lines of agricultural pumps–Specification.
12235 -1986	Reaffirmed 1998	Method of test for UPVC pipe for potable water supply
12288 -1987	Reaffirmed 2002	Code of practice for use and laying of Ductile Iron pipes.

I. S. CODE	Reaffirmation	Subject
12469 -1988	Reaffirmed 2002	Specifications for pumps
12592-2002	-	Precast concrete frame & cover (SFRC frame & cover)
12701-1996	Reaffirmed 2002	Specifications for rotational moulded polyethylene water storage tanks
12709 -1994	Reaffirmed 2004	Glass fiber reinforce plastic (GRP) pipes, joints & fittings for use for potable water supply – Specification.
12818 -1992	Reaffirmed 2002	Spn. for UPVC ribbed screen casing & plain casing pipes for bore / tube well
12820 -1989	Reaffirmed 1999	Dimensional Requirements of Rubber Gaskets for Mechanical Joints & push in joints for use with Cast Iron Pipes & fittings for carrying water, Gas & sewerage.
13095 -1991	Reaffirmed 2003	Butterfly valves for general purposes
13114 -1991	Reaffirmed 2003	Spn. for forged brass gate, globe & check valves for water works purposes
13382-2004	-	Cast Iron specials for mechanical & push-on flexible joints for pressure pipelines for water, gas & sewage
13592-1992	Reaffirmed 2002	Specifications for PVC soil, waste & rain water (SWR) including ventilation pipes
13593 -1992	Reaffirmed 2002	UPVC pipes fittings for use with section and delivery lines for Agricultural pumps – Specification.
13916 – 1994	Reaffirmed 2004	Code of practice for installation of GRP piping system.
13983-1994	Reaffirmed 2004	Specifications for stainless steel kitchen sinks & drain boards for domestic purpose
14333-1996	Reaffirmed 2001	Specification for HDPE pipes for sewerage system.
14402-1996	Reaffirmed 2001	GRP pipes, joints & fittings – Specification.
14735-1999	Reaffirmed 2004	UPVC injection moulded fittings for UPVC – SWR pipes – Specifications.
14845-2000	Reaffirmed 2004	Resilient seated cast iron air relief valves for water works purposes – Spn
14846-2000	-	Specifications for sluice valve for water works purposes (50 to 1200 mm size)
15265 – 2003	-	Specifications for flexible PVC pipes or polymer reinforcement thermo plastic hoses for suction and delivery lines for Agricultural pumps.
15328 – 2003	-	UPVC non pressure pipes for use in underground drainage and sewerage system – Specifications.

1.0. SANITARY INSTALLATIONS

1.1. INDIAN WATER CLOSET

1.1.1. GENERAL: The item pertains for providing white or colour glazed vitreous chinaware Indian water closet of size and colour as specified in the schedule including fixing.

1.1.2. MATERIAL: Squatting Pan (Orissa Pattern) is of white or colour glazed vitreous China conforming IS 2556 Part III. Pan shall have flushing rim and are inlet of self draining type. It shall have weep hole at the following inlet to the Pan. The flushing inlet shall be in front unless otherwise specified. The inside of the bottom of the pan shall have sufficient slope from the front to the outlet and surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have groove at right angle to the axis of the outlet. In all the cases pan shall have be provided with 100 mm Glazed Vitreous China `P` or `S` trap with 50 mm water seal and 40 mm size vent

1.1.3. FIXING: The water closet pan shall be placed in position as shown in the drawing. The IWC shall be supported on brick masonry in CM 1:4 or as directed by the Engineer-in-charge. The pan shall be fixed slightly lower than the floor level. If the pan or trap is damaged during handling of fixing, it shall be replaced by the contractor at his own cost. The pan, trap and C.I. pipe shall be jointed in 1:1 Cement Mortar with hemp yarn caulked. The gap between W.C. and floor shall be finished with white/matching cement as directed.

1.1.4. PROTECTION AND FINAL CLEANING: The IWC shall be covered with husk and sand till all the civil and electrical works are completed and shall be removed and cleaned on completion of civil and electrical works prior to testing and handing over. However the contractor should ensure that the out let is plugged with gunny bags or similar materials to avoid the pipe getting blocked.

1.1.5. THE RATE INCLUDES FOR :

1. Water Closet pan with SCI trap `P` or `S` type and jointing in 1:1 cement mortar with hemp yarn caulked.
2. Cutting wall / slab / beam etc. and making all the damage goods to original condition after completion of work.
3. Testing the entire system and rectification of defects, if any.
4. All necessary labour, material and use of tools.

1.1.6. MODE OF MEASUREMENT: The measurement shall be for each unit of W.C. Pan fixed.

1.1.7. MODE OF PAYMENT: The contract rate shall be for each unit of W.C. pan fixed.

1.2. EUROPEAN/ ANGLO INDIA WATER CLOSET :

1.2.1. GENERAL: The item pertains for providing white or colour glazed vitreous chinaware European or Anglo Indian water closet with seat and cover of size and colour as specified in the schedule including fixing.

1.2.2. MATERIAL: European type water closet shall be wash down pattern unless otherwise specified. Water closet shall be vitreous china conforming to IS 2556 (Part-I & II). The closet shall be of one piece construction and shall have minimum two hole of 6.5 mm diameter for fixing closet to floor. Closet shall have an integral flushing rims of self-draining type. Each water closet shall have an integral trap with either `S` or `P` outlet with and trap shall be uniform and smooth in order to enable an efficient flush. Plastic seat and cover shall be of black colour or as specified, they shall have conformity to IS2548 Part I&II.

1.2.3. FIXING: The water closet pan shall be placed in position as shown in the drawing. If the pan trap is damaged during handling or fixing, it shall be replaced by the contractor at his own cost. The pan, soil pipe shall be jointed in 1:1 Cement Mortar with hemp yarn caulked. The gap between W.C. and floor shall be finished with white/matching cement and sand as directed. Seat and cover shall be fixed to the Pan by two corrosion resistance hinge with 65 mm shank and threaded to within 25 mm

from of flange. Seat shall be fixed in level by providing the washers of rubber with nonferrous or stainless steel washer to bolt.

1.2.4. THE RATE INCLUDES FOR :

1. European type water closet with an integral 'P' or 'S' trap, plastic seat cover, etc. jointing in 1:1 cement mortar with hemp yarn caulked.
2. Cutting hole in wall / slab / beam etc. wherever required. and making all damages good to original condition after completion of work
3. Testing the entire system and rectification of defect if any.
4. All necessary labour, material and use of tools.

1.2.5. MODE OF MEASUREMENT: The measurement shall be for each unit of W.C. fixed.

1.2.6. MODE OF PAYMENT: The contract rate shall be for each unit of W.C. fixed.

1.3. WASH BASIN

1.3.1. GENERAL The item pertains for providing colour or white glazed vitreous chinaware wash basin with or without pedestal of size and colour as specified in the schedule including fixing.

1.3.2. MATERIAL: Wash basins shall be of vitreous china conforming to IS : 2556(Part-IV) of flat back or angle back as specified shall be of one piece construction including combined over flow, basin shall be provided with single or double tap holes of size 28 mm square or 30 mm rounded. Each basin shall have circular waste hole or 5 sq.cm slot type over flow. Pedestals for wash basin shall be exactly same glazing that of basin. Pedestal shall be capable of supporting the basin and completely recessed at the back to accommodate supply and waste pipes and fittings. The basin shall be supported on pan of C.I cantilever brackets conforming to IS 775. Use of MS angle or Tee Section as bracket is not permitted.

1.3.3. FIXING The wash basin shall be fixed in position as indicated in the drawing. Basin shall be supported on a pair of C.I brackets which is embedded in cement concrete (1:2:4) block 100 x 75 x 150 mm.

Oval shape or round shape wash basins are required to be fixed in RCC platform with stone tapping either fully sunk in stone top or flush with stone topping.

The wall plaster on seat shall be cut to rest over the top edge of the basin so as not to leave any gap for water seepage through between wall plaster & skirting of basin. The gap between basin and wall shall be finished with white matching cement.

1.3.4. THE RATE INCLUDES FOR:

1. Wash Basin with pair of C.I bracket as required.
2. Cutting hole in wall / slab / beam etc. wherever required. and making all damages good to original condition after completion of work.
3. All necessary material, labour and use of tools.

1.3.5. MODE OF MEASUREMENT: The measurement shall be for each unit of wash basing fixed.

1.3.6. MODE OF PAYMENT: The measurement shall be for each unit of wash basin fixed.

1.4. URINAL

1.4.1. GENERAL: The item pertains for providing colour or white glazed vitreous chinaware urinal in single or range (1,2 & 3) and size as specified in the schedule with necessary fittings and appliances including fixing.

1.4.2. MATERIAL :

1.4.2.1. BOWL TYPE (WITH FLUSHING RIM) : Urinal basin shall be flat back or corner wall type lipped in front. The vitreous china conforming to IS 2556 (Part VI). Urinal shall have an integral flushing rim and inlet or supply horn for connecting flush pipe. Flushing rim and inlet shall be of the self-draining type. At bottom of basin and outlet horn for connecting outlet shall be provided. The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing.

1.4.2.2. BOWL TYPE FLAT BACK WITHOUT FLUSHING RIM : They shall be of vitreous china conforming to IS:2556 (Part-VI) constructed in one piece with providing slot or alternative fixing arrangement at flat back and where the integral flushing rim is not provided, they shall be provided with ridges in side the bowl to divert towards the front line of the urinal.

1.4.2.3. STALL URINALS: The stall urinal and its screen shall be glazed fire clay conforming IS :771 (Part-III, Sec-2). The inside surface of stall and screen shall be regular and smooth throughout to ensure efficient flushing.

1.4.2.4. CP BRASS FLUSH PIPE: The flushing arrangement to urinals for single or in range shall be of CP brass with CP brass spreader of 15 mm dia conforming to IS : 407. The capacity of flush pipe for urinal in a range shall be as follows :

	Capacity of flush tank	Size of C.P. brass Flush pipe	
		Main	Distribution
One	5 litres	15mm	15 mm
Two	10 litres	20 mm	15 mm
Three	10 litres	25 mm	15 mm

1.4.3. FIXING :

1.4.3.1. BOAL TYPE FLAT BACK URINAL WITHOUT FLUSHING RIM (Single or Range): Urinal shall be fixed in position by using rawl plug, wooden plug, C.P screws etc. It shall be fixed at height of 65 cm from the standing level to the top of the lip of urinal or as directed by the Engineer-in-charge. Each urinal shall be connected with 32 mm size waste pipe which shall discharge into channel or a floor trap.

1.4.3.2. STALL URINALS : The lip of the stall urinal shall be flush with the finished floor level. The stallurinal shall be laid over a fine sand cushion on average 25 mm thickness. The gap between wall surface, finished floor level and urinals shall not be more than 3mm and filled with water proofing plastic compound

1.4.3.3. CP BRASS FLUSHING ARRANGEMENT : The flushing arrangement to urinal in single or range shall be of CP brass from 25 mm dia to 15 mm dia and CP brass spreader of 15 mm size to each urinal including the cost of CP brass elbows, tees, coupling, crosses, clamps, clips, union CP brass check nut and screws etc. CP brass

1.4.4. THE RATE INCLUDES FOR :

1. Glazed Urinals (single or in range) and CP brass pipe flushing arrangement including the cost of jointing material.
2. Cutting hole wherever required and making all damage good to original condition after completion of work.
3. Testing the entire system and rectification of defects if any.
4. All necessary materials, labour and use of tools.

1.4.5. MODE OF MEASUREMENT: The measurement shall be for each unit of urinal set (single or range) fixed.

1.4.6. MODE OF PAYMENT: The contract rate shall be for each unit of urinal set (single or range) fixed.

1.5. URINAL SQUATTING PLATE :

1.5.1. Material : The squatting plates shall be of white vitreous china conforming to IS : 2556 (Part-I), IS : 2556 (Part-VI) with internal flushing rim with front or side inlet. Each squatting plate shall have integral longitudinal flush pipe. There shall be of 100 mm dia white glaze vitreous china channel with slope and outlet piece in front.

1.5.2. FIXING: The plate shall be fixed in position. The top edge of squatting plate shall be flush with the finished floor level adjacent to it. It shall be embedded on a layer of 25 mm thick cement mortar 1:6 laid over a bed of cement concrete 1:3:6. Gap between wall, floor etc. shall be finished with white/matching cement.

1.5.3. THE RATE INCLUDES FOR :

1. Urinals(single or in range) squatting plate.
2. Cutting hole wherever required and making all damage good to original condition after completion of work.
3. Testing the entire system and rectification of defects if any.
4. All necessary materials, labour and use of tools.

1.5.4. MODE OF MEASUREMENT : The measurement shall be for each unit of squatting plate (single or range) fixed.

1.5.5. MODE OF PAYMENT: The contract rate shall be for each unit of urinal squatting plate (single or range) fixed.

1.6. MARBLE PARTITION

1.6.1. GENERAL : The item pertains for providing marble partition of size and colour as specified in the schedule including fixing

1.6.2. MATERIAL : The partition shall be of 20 mm thick marble slab of size as specified in the schedule. it shall be polished on both sides with exposed to proper shape the exposed edges of Marble shall be made smooth corners rounded. Cracked or damaged marble slab shall not be used in the work and shall be replaced if any by the contractor at his own cost and charges +/-3mm tolerance shall be permissible for thickness of slab.

1.6.3. FIXING : Partition shall be fixed vertically in position as indicated in the drawing at proper height. 100 mm wide chases shall be cut in the wall and the partition shall embedded at least 50 mm in the wall using 1:2:4 cement concrete. After fixing the partition slab, the chases cut in the wall shall be made good to original condition.

1.6.4. THE RATE INCLUDES FOR

1. Marble partition slab including cost of cement concrete, cement mortar etc.
2. All necessary labour, material and use of tools.

1.6.5. MODE OF MEASUREMENT : The measurement shall be for each unit of marble partition fixed.

1.6.6. MODE OF PAYMENT The contract rate shall be for each unit of marble partition fixed.

1.7. DIVISION PLATE / PARTITION PLATE :

1.7.1. GENERAL : The item pertains for providing white or colour glazed vitreous chinaware division plate of size and colour as specified in the schedule including fixing.

1.7.2. MATERIAL : Division plate shall be white or colour glazed of size as specified in the schedule, and shall conform to IS .2556 PART VI.

1.7.3. FIXING : Division plate shall be fixed vertically in position at proper height with expandable anchor fasteners, CP brass screws, wooden plugs etc.

1.7.4. THE RATE INCLUDES FOR :

1. Glazed division plate including the cost of CP brass screws, wooden plugs, expandable anchor fasteners etc.
2. All necessary labour, material and use of tools.

1.7.5. MODE OF MEASUREMENT : The measurement shall be for each unit of division plate fixed.

1.7.6. MODE OF PAYMENT : The contract rate shall be for each unit of division plate fixed.

1.8. HALF ROUND CHANNEL :

1.8.1. GENERAL : The item pertains for providing colour or white glazed vitreous chinaware half round channel of size and colour as specified in the schedule including laying and fixing.

1.8.2. MATERIAL: The half round channel shall be of white or colour glazed vitreous chinaware of size as mentioned in the schedule with or without dead end and shall conform to IS 2556 part VII.

1.8.3. FIXING : The channel shall be laid to the correct alignment to required slope. It shall be fixed on 80 mm thick bed of 1:2:4 cement concrete. The channel shall be used in standard length. Pieces are not allow except where it is necessary to make up exact length. The joint and gap shall be finished with white / matching colour cement.

1.8.4. THE RATE INCLUDES FOR :

1. Cement concrete, cutting the channel and wastage etc.
2. Supplying & fixing vitreous china half round channel
3. All necessary labour, material and used of tools.

1.8.5. MODE OF MEASUREMENT : The measurement shall be for unit running meter length of half round channel of specified diameter fixed.

1.8.6. MODE OF PAYMENT : The contract rate shall be for unit running meter of half round channel fixed.

1.9. GLAZED FLOOR TRAP WITH DOME SHAPED GRATING:

1.9.1. GENERAL : The item pertains for providing white glazed vitreous chinaware floor trap with dome shaped C.P. Brass grating of size as specified in the schedule including fixing.

1.9.2. MATERIAL : The trap shape be of white vitreous chinaware of 100 mm dia. or as specified in the schedule with hinged type dome shaped grating of chromium plated brass or stainless steel as specified.

1.9.3. FIXING : The trap shall be laid to the correct alignment and to required slope. The trap shall be fixed on 80 mm thick bed or 1:2:4 cement concrete. The caulking shall be done using 1:1 cement concrete. The caulking shall be done using 1:1 cement mortar and hemp yarn.

1.9.4. THE RATE INCLUDES FOR :

1. Floor trap, dome shaped grating, concrete, cement mortar etc.
2. Caulking with 1:1 cement mortar with hemp yarn.
3. All necessary labour, material and use of tools.

1.9.5. MODE OF MEASUREMENT : The measurement shall be for each unit of floor trap fixed.

1.9.6. MODE OF PAYMENT : The contract rate shall be for each unit of floor trap fixed.

1.10. TOILET PAPER ROLL HOLDER :

1.10.1. GENERAL : The item includes providing white or colour glazed vitreous chinaware toilet roll holder of size as mentioned in the schedule including fixing.

1.10.2. MATERIAL : The toilet paper roll holder shall be of CP brass or vitreous china on specified and of size and design as approved by the Engineer-in-charge. Toilet paper roll holder shall conform as per IS standard and should have ISI mark.

1.10.3. FIXING : Toilet paper roll holder shall be fixed in position by means of C.P brass covers and rawl plug embedded in the wall. Vitreous china toilet paper roll holder shall fixed into the wall with 1:2 cement mortar. The pocket shall be cut in wall for toilet paper roll holder if not left finishing the gap with white/matching cement.

1.10.4. THE RATE INCLUDES FOR :

1. Toilet paper roll holder, cement, sand, curing etc.

2. Cutting the pocket if they are not left.

3. All necessary labour, material and use of tools.

1.10.5. MODE OF MEASUREMENT : The measurement shall be for each unit of toilet paper roll holder fixed.

1.10.6. MODE OF PAYMENT : The contract rate shall be for each unit of toilet paper roll holder fixed.

1.11. PVC WATER INLET CONNECTION :

1.11.1. GENERAL : The item pertains to providing colour or white PVC water inlet connection for cistern and wash basins.

1.11.2. MATERIAL : PVC water inlet connection shall conform to IS specifications and shall be of standard pattern with nylon insulation of minimum 450 mm long with CP brass check nut at both the end and shall be able to withstand the testing pressure of 1 MPa (10 kg/sq.cm.)

1.11.3. FIXING : The PVC water inlet connection shall be fixed in position as indicated in the drawing or as directed by the Engineer-in-charge for flushing cistern and wash basins.

1.11.4. THE RATE INCLUDES FOR :

1. Supplying and fixing of PVC water inlet connection.

2. All necessary labour, material and use of tools.

1.11.5. MODE OF MEASUREMENT : The measurement shall be for each unit of water inlet connection fixed.

1.11.6. MODE OF PAYMENT : The contract rate shall be for each unit of PVC water inlet connection fixed.

1.12. GLAZED FIRE-CLAY/ VITREOUS CHINA SINK:

1.12.1. GENERAL : Item includes providing white or colour glazed -fire clay sink for kitchen or vitreous china sink for lab as specified in the schedule of quantities including fixing.

1.12.2. MATERIAL : Laboratory sink shall be of vitreous china confirming to IS 2556 (PART-V) and kitchen sink shall be of glazed fire-clay conforming to IS 771 (Part-II) and shall have combined over flow of the weir type and invert shall be 30 mm below the top edge. These shall be of one-piece construction and floor of sink shall gently slope towards the outlet. The outlet of sink should be suitable for waste fitting having flanges 88 mm diameter and waste hole of 65 mm diameter. the waster hole shall be either rebated or bevelled having the depth of 10 mm. C.I brackets for supporting sink shall confirm to IS:

1.12.3. FIXING : The sink shall be supported on C.I cantilever brackets, embedded in cement concrete 1:2:4 block of size 100 x 75 x 150 mm. Bracket shall be fixed in the position before dado work is done. The height of front edge of sink from floor level shall be 80 cm or as directed by the Engineer-in-charge. The gap between floor/wall and sink shall finish with white cement.

1.12.4. THE RATE INCLUDES FOR :

1. Sink & C.I brackets (Pair) cement, sand etc.

2. All necessary labour, material and use of tools.

1.12.5. MODE OF MEASUREMENT : The measurement shall be for each unit of sink fixed.

3.12.6. MODE OF PAYMENT : The contract rate shall be for each unit of sink fixed.

1.13. STAINLESS STEEL SINK :

1.13.1. GENERAL : Item includes providing the stainless steel sink with or without drain board of size as specified in the schedule including fixing.

1.13.2. MATERIAL The sink shall be manufactured from stainless steel of Salem or equivalent steel conforming to IS: 13983. Stainless steel sink shall be of one piece construction moulded out of 19 SWG (1mm) stainless steel sheet of grade AISI 304 (18/8) with stainless steel choke – stop strainer (waste coupling) checknuts conforming to IS 13983.

1.13.3. FIXING : The sink shall be fixed in position as indicated in the drawing. The sink shall be placed over the brackets or on the platform. Gap between sink and platform / wall shall be finished with white / matching cement.

1.13.4. THE RATE INCLUDES FOR :

1. S.S. sink with waste coupling cement sand etc.
2. All necessary labour, material and use of tools.

1.13.5. MODE OF MEASUREMENT : The measurement shall be for each unit of s.s. sink fixed.

1.13.6. MODE OF PAYMENT : The contract rate shall be for each unit s.s. sink fixed.

1.14. SINK DRAIN BOARD :

1.14.1. GENERAL : The item includes providing white or colour glazed / fire clay drain board of size mentioned in the schedule fixing.

1.14.2. MATERIAL : The drain board shall be manufactured from stainless steel of Salem or equivalent steel conforming to IS: 13983. Stainless steel sink shall be of one piece construction and its thickness not less than 1 mm.

1.14.3. FIXING : The drain board shall be fixed in the position as indicated in the drawing. It shall be place over the brackets or on the platform. Gap between board and platform / wall shall be finished with white /matching cement.

1.14.4. THE RATE INCLUDES FOR :

1. Drain board, cement, sand etc.
2. All necessary labour, material and use of tools.

1.14.5. MODE OF MEASUREMENT : The measurement shall be for each unit of drain board fixed.

1.14.6. MODE OF PAYMENT : The contract rate shall be for each unit of drain board fixed.

1.15. SOAP DISH:

1.15.1. GENERAL : The item includes providing white or colour glazed chinaware type soap dish of size as mentioned in the schedule including fixing.

1.15.2. MATERIAL : Soap Dish shall be of CP brass or vitreous China on specified and of size, design approved by the Engineer-in-charge. Soap Dish shall conform to relevant IS standard and should have ISI certification mark.

1.15.3. FIXING : Soap Dish shall be fixed in position by means of C.P brass covers and rawl plug embedded in the wall. Vitreous china Soap Dish shall be fixed into the wall with 1:2 cement mortar. The pocket shall be cut in wall, if not left, finishing the gap with white/matching cement.

1.15.4. THE RATE INCLUDES FOR :

1. Soap dish, cement, sand, curing etc.
2. Cutting the pocket if they are not left.
3. All necessary labour, material and the use of tools.

1.15.5. MODE OF MEASUREMENT : The measurement shall be for each unit of soap dish fixed.

1.15.6. MODE OF PAYMENT : Contract rate shall be for each unit of soap dish fixed.

1.16. GLASS MIRROR :

1.16.1. GENERAL : The item providing bevelled or plain edges mirror with or without frame of size as mentioned in the schedule including fixing.

1.16.2. MATERIAL : The mirror shall be of superior sheet glass with edges rounded off or bevelled, size 600 x 450 mm unless specified in the schedule. It shall be free from flaws, specks or bubbles and thickness plated and should not be less than 5.0 mm. The back of mirror shall be uniformly silver plated and should be free from silvering defects. Silvering shall now have a protective uniform covering of red lid paint, where bevelled edge mirror are not available. Fancy looking mirrors with PVC beading/border or aluminum beading on stainless steel beading/border based on manufacturer's specification, provided nothing extra shall be paid on this account. The backing of mirror shall be provided with 6mm thick marine plywood or environmentally friendly material other than asbestos cement sheet.

1.16.3. FIXING : Mirror shall be fixed in position with 6mm thick marine ply wood backing. It shall be fixed by means of 4 nos. of CP brass screws & caps over rubber washers and rawl plug or as per the manufacturer's specification unless specified otherwise the longer side shall be fixed horizontally.

1.16.4. THE RATE INCLUDES FOR :

1. Glass mirror with plywood backing CP screws and CP caps etc.
2. All necessary labour material and the use of tools.

1.16.5. MODE OF MEASUREMENT : The measurement shall be for unit square meter or each unit to glass mirror of size as specified in the schedule.

1.16.6. MODE OF PAYMENT : The contract rate shall be for unit square meter or each unit of glass mirror of size as specified in the schedule.

1.17. GLASS SHELF :

1.17.1. GENERAL : The item includes providing glass shelf of size as mentioned in the schedule including fixing.

1.17.2. MATERIAL : Glass shelf shall consist of an assembly of glass shelf frame of size 600 x 125 mm or as specified in the schedule. It shall be with a pair of CP Brass brackets fixed to the wall with CP screws and CP brass rails all-round with guard bar of 6 mm diameter fixed to the glass shelf frame with five numbers CP brass brackets. . The glass shall not be less than 5 mm thick. PVC stainless steel shelf or as per manufacturer`s specification and size as specified in the schedule of work shall be provided.

1.17.3. FIXING : The complete accessories shall be fixed to proper line and level as indicated in drawing with 40 mm long CP brass screws, wooden rawl plug, drilling hole and making good the wall to original condition after fixing the glass shelf.

1.17.4. THE RATE INCLUDES FOR:

1. Glass shelf with glass, CP bracket, guard bars, CP screws etc.
2. All necessary labour material and the use of tools.

1.17.5. MODE OF MEASUREMENT : The measurement shall be for each unit of glass shelf fixed.

1.17.6. MODE OF PAYMENT : The contract rate shall be for each unit glass shelf fixed.

1.18. LIQUID SOAP DISPENSER :

1.18.1. GENERAL: The item includes providing CP liquid soap dispenser of shape as mentioned in the schedule including fixing.

1.18.2. MATERIAL : Liquid Soap Dispenser shall be of C.P brass of heavy quality and from list of approved make.

1.18.3. FIXING : The liquid soap dispenser shall be fixed to proper height and level as indicated in drawing with 40 mm long CP brass screws, wooden rawl plug, drilling hole etc. and making good the wall to original condition after fixing.

1.18.4. THE RATE INCLUDES FOR :

1. Liquid soap dispenser with CP brackets CP screws etc.
2. All necessary labour, material and the use of tools.

1.19. TOWEL ROD/TOWEL RING :

1.19.1. GENERAL: The item includes providing Towel rod / towel ring of size as mentioned in the schedule including fixing.

1.19.2. MATERIAL : Towel rail shall be of C.P brass with two CP brass bracket coated with chromium plating of thickness not less than grade No.2 of IS 4827. The size of rail shall be 600 mm x 20 mm dia unless otherwise specified in the schedule. Towel ring of CP brass with one CP brass bracket with thickness not less than Grade No.2 of IS 4827. The diameter of the ring shall be 175 mm unless otherwise specified in the schedule. The diameter of ring rod shall not be less than 8 mm.

1.19.3. FIXING : The towel rod/ ring shall be fixed to proper line and level as indicated in drawing with CP brass screws, wooden raw plug, drilling hole etc. and making good the wall to original condition after fixing the towel rod.

1.19.4. THE RATE INCLUDES FOR :

1. 1 Towel rod rail/ring CP brackets & screws etc.
2. All necessary labour, material and the use tools.

1.19.5. MODE OF MEASUREMENT : The measurement shall be for each unit of towel rod fixed.

1.19.6. MODE OF PAYMENT : The contract rate shall be for each unit of towel rod fixed.

1.20. SHOWER ROSE :

1.20.1. GENERAL : The item pertains to provide chromium plated brass shower rose of specified diameter with accessories including fixing.

1.20.2. MATERIAL : The shower rose shall be CP brass of approved and heavy quality. It's accessories shall conform to IS 1239 Part II.

1.20.3. FIXING : Shower rose shall be fixed to be water supply pipe line with necessary G.I fittings etc. as required by the Engineer-in-charge. Jointing shall be done with the zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof at his risk & cost.

1.20.4. THE RATE INCLUDES FOR :

1. Shower rose, bend, socket, union/nuts, nipple etc.
2. All necessary labour, material and the use of tools.

1.20.5. MODE OF MEASUREMENT : The measurement shall be for each unit of shower rose fixed.

1.20.6. MODE OF PAYMENT : The contract rate shall be for each unit of shower rose fixed.

1.21. BIB TAP, STOP COCK & ANGLE STOP COCKS:

1.21.1. GENERAL : The item pertains to provide chromium plated brass bib tap and stop cock and angle stop cocks, free flanges (if joined to concealed pipe) including fixing

1.21.2. MATERIAL : Bib cock (Bib tap) is drawn off tap with a horizontal inlet and free out let and a stop cock is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. These shall be of size 15 mm size or as specified and shall be of screw down type. The closing device shall work by means of disc. carrying a renewable non-metallic washer with shuts against the water pressure on a seating right angles to the axis of the threaded spindle which operates it. The handle shall be crutch, butterfly or fancy design type securely fixed to the spindle. The tap shall open anti clock wise direction.

Brass bib taps and stop cocks and angle stop cocks shall conform to IS 781, they shall be polished bright. The minimum finished weight of different sizes of bib tap weight of 15 mm size bib tap and stop cock shall be as per table given below. They shall be sound and free from taps, blow hole and fitting. Internal & External surface shall be clean, smooth and free from sand and neatly dressed. Taps shall be nickel chromium plated and thickness of coating shall not be less than service grade No.2 of IS 4827 and plating shall be capable of taking high polish which shall not be easily tarnished.

MINIMUM FINISHED MASS OF BIB TAPS AND STOP VALVES AS PER IS 781:1984 (Reaffirmed 2001)

	Minimum Finished Mass			
	bib taps	Stop Valves		
		Internally threaded	Externally threaded	Mixed end
1	2	3	4	5
Mm	kg	kg	kg	Kg
8	0.250	0.220	0.250	0.235
10	0.330	0.330	0.350	0.325
15	0.400	0.330	0.400	0.365
20	0.750	0.675	0.750	0.710
25	1.250	1.180	1.300	1.250
32	-	1.680	1.800	1.750
40	-	2.090	2.250	2.170
50	-	3.700	3.850	3.750

Every tap complete with its component shall with stand an internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) maintained for a period of 2 minutes during the period it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from contractor.

1.21.3. **FIXING** : Bib tap stop cock shall be fixed to the pipe line with C.P. brass or G.I. specials, if required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.

1.21.4. **THE RATE INCLUDES FOR** :

1. Bib tap and stop cock, special etc.
2. All necessary labour, material and the use of tools.

1.21.5. MODE OF MEASUREMENT : The measurement shall be for each unit of bib tap and stop cock fixed.

3.21.6. MODE OF PAYMENT : The contract rate shall be for each unit of bib tap or stop cock angle stop cock fixed.

1.22. COMBINATION TAP ASSEMBLY (WALL / PILLAR MOUNTED) :

1.22.1. GENERAL : The item pertains to provide chromium plated brass combination tap assembly, wall mounted hot & cold mixing for bath ,pillar mounted hot & cold mixing for sink ,basin, tub etc. including free flanges and fixing.

1.22.2. MATERIAL : The combination tap assembly shall be 15 mm nominal size or as specified in the schedule. It shall be of C.P. brass approved and heavy quality, and shall conform to I.S. 8931.

Combination tap assembly shall be chromium plated-brass and shall conform to IS 8931. The nominal size of combination tap assembly shall be 15 mm nominal size or as specified. Casting of combination tap assembly shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall be axial, parallel and cylindrical with surfaces smoothly finished. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

1.22.3. TESTING : Combination tap assembly shall withstand and internally applied hydraulic pressure of 1.6Mpa (16 kg/ sq.cm) for period of 1 minutes during which, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof.

1.22.4. FIXING : Combination tap assembly shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.

1.22.5. THE RATE INCLUDES FOR :

1. Combination tap assembly (wall mounted / pillar mounted as specified in the schedule of work) including free flanges and fixing.

2. All necessary labour, material and the use of tools.

1.22.6. MODE OF MEASUREMENT : The measurement shall be for each unit of combination tap assembly fixed.

1.22.7. MODE OF PAYMENT : The contract rate shall be for each unit of combination tap assembly fixed.

1.23. PILLAR TAP : (Non fancy & Fancy Type)

1.23.1. GENERAL : The item pertains to provide chromium plated brass pillar tap including fixing.

1.23.2. MATERIAL : The pillar tap shall be 15 mm nominal size or as specified in the schedule. Fancy type pillar tap shall be of C.P. brass approved quality and shall conform to I.S. 8931. Non fancy pillar tap shall be chromium plated-brass and shall conform to IS 1795. The nominal size of Pillar tap shall be 15 mm or as specified.

Casting of Pillar tap shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall be axial, parallel and cylindrical with surfaces smoothly finished. The minimum of finish weight of Pillar tap shall not be less than 650 grams (body weight 250 gms, washer plate loose valve 150 gms and back nut 40 gms. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale.

1.23.3. TESTING: Pillar tap shall withstand and internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) for period of 2 minutes during which period, it shall neither leak nor sweat. Leaky joint shall be remade to make it leak proof without any extra cost from the contractor.

1.23.4. FIXING: Pillar tap shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.

1.23.5. THE RATE INCLUDES FOR :

- 1 Pillar tap including fixing.
- 2 All necessary labour, material and the use of tools.

1.23.6. MODE OF MEASUREMENT : The measurement shall be for each unit of pillar tap fixed.

1.23.7. MODE OF PAYMENT : The contract rate shall be for each unit of pillar tap fixed.

1.24. FLUSH VALVE :

1.24.1. GENERAL : The items pertains to provide chromium plated brass flush valve or brass concealed type flush valve with necessary accessories including fixing. (Free flanges if joined to concealed pipes)

1.24.2. MATERIAL : The Flush valve shall be nominal diameter as specified in the schedule of quantities. It shall be of C.P. brass approved and heavy quality, and shall conform to I.S. 9758. The flush valve shall have working pressure of 0.15 to 0.5 MPa. The valve shall be tested to a Hydraulic pressure of 2 MPa for 2 minutes.

1.24.3. FIXING : Flush valve shall be fixed to the pipe line as indicated in the drawing with necessary special as required or as ordered by Engineer-in-charge. Jointing shall be done with white zinc, sun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.

1.24.4. THE RATE INCLUDES FOR :

1. Flush valve, connecting pipe, socket, union, nipple, wall flanges if connected to concealed pipe.
2. All necessary labour, material and the use of tools.

1.24.5. MODE OF MEASUREMENT : The measurement shall be for each unit of flush valve fixed.

1.24.6. MODE OF PAYMENT : The contract rate shall be for each unit of flush valve fixed.

1.25. BATH TUB (Enamelled steel sheet):

1.25.1. GENERAL : Item includes providing sheet steel bath tub of size and without side panel as specified in the schedule of quantities including fixing or placing.

1.25.2. MATERIAL : The bath tub shall conform to IS 3489. The bath tub shall be constructed of the fewest practicable number of sections which shall be such as to ensure a suitable finished surface for the reception of the enamel coating. Any welded surface shall be adequately cleaned off inside and outside the bath tub. The necessary surface shall be free from undulations, drawing line and other defects deleterious to the provision of a satisfactory enamel coating.

The interiors of the bath tub shall be adequately and evenly coated with vitreous enamel. The enamelling shall conform to IS : 772. Thickness of the enamel shall not be less than 0.2 mm and not more than 0.5 mm, External surface of the bath tub shall be given one ground or primer enamel coating. Gloss, colour & opacity shall be uniform and visually satisfactory. The finish shall be free from crazing, dimples, rundown sagging tilters not more than two in number on the interior surface, pinholes not more than two in number for coloured bath tubs and not more than four for white enamelled bath tubs, specks shall be less than one mm in size and max. five in number and there shall be no grouping of pinholes and specks. Warpage of edges set against wall or floor and edges of roll rims shall not exceed 5 mm/m., warpage of all other edges shall not exceed 7.5 mm/m.

In forming the roll the outer edges shall be flanged or rolled back underneath sufficiently to prevent exposure of sharp edges. The vertical height of the flanged or rolled edges shall be not more than 30 mm. At the tap end of the roll, there shall be a level area within a radius of at least 25mm from the centre of each tap hole.

1.25.3. FIXING : The bath tubs shall be as flat bottomed as practicable. The fall (slope) long the bottom head end to outlet shall be adequate for complete emptying. The waste hole shall be so formed as to be suitable for receiving 40 mm waste fitting. The bath tubs shall be provided at the tap end, with effective means of attaching an earth continuity conductor. With each bath tub, two spacing washers of suitable thickness to take up the difference between the thickness of the metal of the bath tub and the depth of the seating on pillar taps shall be supplied. In addition, two fibre or lead washers for each tap shall be supplied for fitting above and below the tap roll to prevent the enamel from erasing when the taps are tightened in position.

1.25.4. THE RATES INCLUDES FOR :

1. Enamelled sheet steel bath tub.
2. Placing/fixing the tub on C.I./MS supports.
3. Fixing the side panel if specified in schedule of quantities.
4. All necessary labour, material and use of tools.

1.25.5. MODE OF MEASUREMENT :-The measurement shall be for each unit of bath tub fixed or placed.

1.25.6. MODE OF PAYMENT : The contract rate shall be for each unit of bath tub fixed or placed.

1.26. BATH TUB : (Gel coated G.R.P. resin)

1.26.1. GENERAL : Item includes providing gel coated glass fibre reinforced polyester resin bath tub of size and with or without panel as specified in the schedule of quantities including fixing or placing.

1.26.2. MATERIAL : The bath tub shall conform to IS 6411. The fibre glass used in the manufacture of bath tubs shall be non alkaline conforming to 'E' type or 'A' type Grade. The proportion of the glass fibre shall not be less than 25% of the glass fibre reinforced polyester layer including gel coated layer. Unsaturated polyester resin used in the manufacture of bath tubs shall be resistant to not water and weathering. When filler and colouring materials are used, their quality and proportion should be compatible to the polyester and the materials shall not have any harmful effect on the quality and performance of bath tubs. The bath tub shall possess a uniform gel-coat on the working surface. The resin used in the gel-coat shall be isophthalic grade of polyester or epoxy resin or any equally suitable chemical resistant grade of resin. The get-coat shall not be less than 0.25 mm thickness nor more than 1.00 mm thickness.

In forming the roll, the outer edges shall be flanged or rolled back underneath sufficiently to prevent exposure of sharp edges. The vertical height of the flanged or rolled edges shall be not more than 30 mm. At the tap end of the roll, there shall be a level area within a radius of at least 25mm from the centre of each tap hole.

1.26.3. FIXING : The bath tub shall be one piece unit with an opening for waste outlet with floor sloping towards the outlet. An overflow shall normally be provided on the side near the waste outlet. An apron (side panel) may be provided, integrally or separately with the bath tub as specified in schedule of quantities. The waste opening shall be suitable for the proper installation of waste fittings which are ordinarily used for the purpose. The bath tub shall be provided with a supporting structure integral to the unit in between the space between the bottom of the bath tub and the floor of the building on which the bath tub rests unless otherwise specified. The materials of the supporting structure shall be at least equal to the material of the bath tub in resistance to deterioration with age and shall meet the requirement of fungus and vermin.

1.26.4. THE RATES INCLUDES FOR:

1. Gel-coated G.R.P.R. bath tub.
2. Placing/fixing the tub on supports.
3. Fixing the side panel if specified in schedule of quantities.
4. All necessary labour, material and use of tools.

3.26.5. MODE OF MEASUREMENT : The measurement shall be for each unit of bath tub fixed or placed.

1.26.6. MODE OF PAYMENT : -The contract rate shall be for each unit of bath tub fixed or placed.

1.27. WASTE COUPLING :

1.27.1. GENERAL : The item pertains to provide chromium plated brass waste coupling including fixing.

1.27.2. MATERIAL : Waste Coupling shall confirm to IS 3311.Waste fittings shall be of CP with thickness of CP coating not less than service Grade No.2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall sound, free from laps below, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed. The waste fitting for wash basin shall be of nominal size of 32 mm and for sink shall be nominal size 50 mm.

1.27.3. FIXING : Waste coupling shall be fixed to wash basin, sink or urinal as ordered with necessary specials. Jointing shall be done with white zinc, yarn etc. A few turns of fine hemp yarn dipped in the linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall be remade to make it leak proof.

1.27.4. THE RATE INCLUDES FOR :

1. Waster coupling with necessary specials.
2. All necessary labour, material and the use of tools.

1.27.5. MODE OF MEASUREMENT : The measurement shall be for each unit of waste coupling fixed.

1.27.6. MODE OF PAYMENT : The contract rate shall be for each unit of waste coupling fixed.

1.28. BOTTLE TRAP :

1.28.1. GENERAL : The item pertains to provide chromium plated brass bottle trap including fixing.

1.28.2. MATERIAL : Bottle trap shall be of C.P with thickness of CP coating not less than service grade No. 2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect of IS 2963 and shall be sound, free from laps below, holes and fittings and other manufacturing defects. External and internal surface shall be clean and smooth. They shall be neatly dressed and be truly machined so that nut smoothly moves on the body. The Bottle trap for wash basin shall be of nominal size of 32 mm and for sink shall be nominal size 50 mm.

1.28.3. FIXING : Bottle trap shall be fixed to wash basin, sink or urinal as indicated in the drawing with necessary specials or as ordered by the Engineer-in-charge. Jointing shall be done with white zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness. Leaky joint shall remade to make it leak proof.

1.28.4. THE RATE INCLUDES FOR :

1. Bottle trap with necessary specials.
2. All necessary labour, material and the use of tools.

1.28.5. MODE OF MEASUREMENT : The measurement shall be for each unit of bottle trap fixed.

1.28.6. MODE OF PAYMENT : The contract rate shall be for each unit of bottle trap fixed.

1.29. COAT AND HAT HOOK :

1.29.1. GENERAL : The item pertains to provide chromium plated brass coat and hat hook including fixing

1.29.2. MATERIAL : Coat & Hook shall be of three way type of approved and heavy quality. Coat & Hat Hook shall be CP brass and three way hook type or minimum six way patti type of 125 mm x 30 mm x 6mm size. CP coating shall not be less than service grade No.2 of IS 4827.

1.29.3. FIXING : The Coat and hat hook shall be fixed to proper line & level as indicated in drawing with CP brass screws.

1.29.4. THE RATE INCLUDES FOR :

1. Coat and hat hook with CP screws etc.
2. All necessary labour, material and the use of tools.

1.29.5. MODE OF MEASUREMENT : The measurement shall be for each unit of coat and hat book fixed.

1.29.6. MODE OF PAYMENT : The contract rate shall be for each unit of coat and hook fixed.

1.30. FLUSHING CISTERN :

1.30.1. GENERAL : The item pertains to provide white or colour glazed chinaware / PVC / Cast Iron flushing cistern with all inside syphonic fitting including fixing.

1.30.2. MATERIAL : The flushing cistern shall be automatic or manually of rates high level or low level as specified for water closets and urinals.

Cisterns shall be of PVC concealed in wall for Automatic flushing cistern and Plastic (IS 7231). Cistern shall be mosquito proof. All working parts shall be designed to operate smoothly and efficiently. the cistern shall have removable covers which shall fit closely on it and be screwed against top displacement where operating mechanism is attached to the cover. This may be made in two section, but the section supporting the mechanism shall be securely fitted or screwed to the body. The outlet fitting of the cistern shall be securely connected to the cistern. The nominal internal diameter of the cistern outlet shall not be less than 32 mm and 38 mm for high level and low level respectively. Length of outlet cistern shall be 37 +/-2 mm. Ball valve shall be screwed type 15 mm in diameter and shall conform of IS 1703. The flat shall be made of polyethylene as specified in IS 9762. A high-level cistern is intended to operate with minimum height of 125 cm and a low-level cistern with maximum height of 30 cm between the top of the pan and under side of the cistern. A G.I chain strong enough to sustain a sudden applied pull of 10 kg or a dead load of 50 kg without any apparent or permanent deformation of the chain rings shall be attached to the ring or hook of the level manually operated high level C.I cistern. In case of low-level cistern handle shall be of CP brass. In case of Plastic cistern, operation of cistern shall be through Push Button at the top for dual system and beyond plastic handle.

The discharge rate of the cistern as per IS 774 shall be 10 +/-0.5 litres 6 second and 5 +/-0.5 litres in 3 second for cistern capacity 10 ltrs. and 5 ltrs. respectively. Flush pipe shall be of class `B` G.I pipe of 32 +/-mm diameter for high level. Polyethylene flush pipe shall be low density confirming to IS 3076 or high density confirming to IS 4984 or UPVC pipe confirming to IS 4965 of 40 mm outer diameter. Over flow pipe shall be of G.I. / PVC with mosquito proof jalli of 15 mm dia.

1.30.3. FIXING: The chinaware flushing cistern shall be placed over a pair of C.I. brackets. C.P. brass flush pipe shall be fixed to cistern and W.C. pan using check nut, spun yarn, cement mortar etc.

The cast iron flushing cistern shall be placed over a pair of C.I. or G.I. or PVC flush pipe of specified diameter shall be fixed to cistern and W.C. pan by using check nut, white zinc, spun yarn, cement mortar etc.

The PVC flushing cistern shall be placed or fixed as recommended by the manufacturer, PVC flush pipe of specified diameter shall be fixed to cistern and W.C. pan by using check nut, white zinc, spun yarn, cement mortar etc.

1.30.4. THE RATE INCLUDES FOR :

1. Supply and fixing flush tank, flush pipe and over flow pipe.
2. Painting all the metallic parts with two coats of flat oil paint over a coat of primer.
3. Cutting hole in wall / slab / beam etc. wherever required and making good the same to original condition after fixing.
4. Cost of jointing materials such as zinc, spun yarn, cement mortar 1:1 etc.
5. Testing the entire system and rectification of defects, if any.
6. All necessary materials, labour and use of tools.

1.30.5. MODE OF MEASUREMENT : The measurement shall be for each unit of flushing cistern fixed as a whole.

1.30.6. MODE OF PAYMENT : The contract rate shall be for each unit flushing cistern fixed as a whole.

1.31. BRACKET :

1.31.1. GENERAL : The item pertains to provide a pair of bracket for wash basin, sink, flushing cistern etc. including fixing.

1.31.2. GENERAL : The item pertains to provide a pair of bracket for wash basin, sink, cistern etc, including fixing.

1.31.3. FIXING : Brackets shall be embedded into or fixed to the wall with plugs, screws, nails etc. Hole shall be made in the wall, if they are not left for fixing the brackets and shall be made good after fixing. The gap shall be filled with 1:2 cement mortar and finishing shall be done with white / matching colour cement.

1.31.4. THE RATE INCLUDES FOR :

1. Supplying and fixing the brackets.
2. Painting brackets with two coats of flat oil paint over a coat of primer.
3. Cutting hole in wall beam etc. wherever required and making good the same to original condition after fixing.
4. All necessary materials, labour and use of tools.

1.31.5. MODE OF MEASUREMENT : The measurement shall be for each pair of bracket fixed included in the items of sink, wash basin, cistern etc. as specified in schedule of quantities.

1.31.6. MODE OF PAYMENT : The contract rate shall be for each pair of bracket fixed.

2.0. WATER SUPPLY SYSTEM

2.1. G.I. PIPING WORK (Exposed) :

2.1.1. GENERAL : The item includes provision of G.I. pipes with G.I. fitting of specified nom. bore and class as mentioned in the schedule including laying, fixing. The G.I. pipes and fittings shall run on the surface of the walls or ceilings unless otherwise specified.

4.1.2. MATERIAL : The pipes and fittings shall be of M.S. galvanised as specified in the schedule. They shall conform to IS 1239 (P-I). All the pipes and fitting shall have ISI certification mark. The specified nominal bore of the pipe shall refer to inside approximate bore according to the thickness corresponding to outside fixed diameter. The pipe and fittings shall be smooth, sound, free from any imperfections and neatly dressed. The pipe and fitting shall be able to withstand a hydrostatic test pressure of 5 MPa (50 Kg/cm²) maintained for at least 3 seconds at manufacturing works (lab test). The table showing the dimensions and different bores of pipes are given below.

WEIGHT OF GALVANISED & BLACK (BOTH) M.S. TUBES FOR ORDINARY USES IN WATER CONFORMING TO IS: 1239 (PART-1) 2004

Bore	Class	Outside Diameter		Wall thickness	Nominal Weight (Kg/M)	
		Maximum	Minimum			
		Mm	mm	in mm	Plain Ended	Screwed & Socketed
15	L	21.4	21.0	2.0	0.947	0.956
	M	21.8	21.0	2.6	1.21	1.22
	H	21.8	21.0	3.2	1.44	1.45
20	L	26.9	26.4	2.3	1.38	1.39
	M	27.3	26.5	2.6	1.56	1.57
	H	27.3	26.5	3.2	1.87	1.88
25	L	33.8	33.2	2.6	1.98	2.00
	M	34.2	33.3	3.2	2.41	2.43
	H	34.2	33.3	4.0	2.93	2.95
32	L	42.5	41.9	2.6	2.23	3.27
	M	42.9	42.0	3.2	3.10	3.13

Bore	Class	Outside Diameter		Wall thickness	Nominal Weight (Kg/M)	
	H	42.9	42.0	4.0	3.79	3.82
40	L	48.4	47.8	2.9	3.23	3.27
	M	48.8	47.9	3.2	3.56	3.60
	H	48.8	47.9	4.0	4.37	4.41
50	L	60.2	59.6	2.9	4.08	4.15
	M	60.8	59.7	3.6	5.03	5.10
	H	60.8	59.7	4.5	6.19	6.26
65	L	76.0	75.2	3.2	5.71	5.83
	M	76.6	75.3	3.6	6.42	6.54
	H	76.6	75.3	4.5	7.93	8.05
80	L	88.7	87.9	3.2	6.72	6.89
	M	89.5	88.0	4.0	8.36	8.53
	H	89.5	88.0	4.8	9.90	10.10
100	L	113.9	113.0	3.6	9.75	10.00
	M	115.0	113.1	4.5	12.20	12.50
	H	115.0	113.1	5.4	14.50	14.80
125	M	140.8	138.5	4.8	15.90	16.40

Bore	Class	Outside Diameter		Wall thickness	Nominal Weight (Kg/M)	
	H	140.8	138.5	5.4	17.90	18.40

Mark	Class	Colour Code	TOLERANCES					
					WEIGHT			
					For Single Tube		For 10 tones load	
					(+)	(-)	(+)	(-)
L	"Light " class	Yellow Band	Not limited	8.0%	10.0%	8.0%	7.5 %	5.0%
M	"Medium" class	Blue Band	Not limited	10.0 %	10.0%	10.0%	7.5 %	7.5%
H	"Heavy" class	Red Band	Not limited	10.0 %	10.0%	10.0%	7.5 %	7.5%
Random length of tube:unless otherwise specified 4.0 to 7.0 m includes one socket for screwed & socketed tubes				COATING:Zinc coating as per IS 4736 (latest revision)				

2.1.3. LAYING : The plumbing contractor shall set the layout of the plumbing approved by the Engineer-in-charge as may be required by the bye-laws. Pipes shall be laid in plumb and in straight and parallel lines. When unavoidable, pipes may be buried for short distances provided additional protection is given against damage and where so required joints are not buried. Where directed by the Engineer –in-charge, A M.S. tube sleeve shall be fixed at a place the pipe is passing through a wall or floor for reception of the pipe and to allow freedom for expansion, contraction and other movements. In case the pipe is embedded in walls or floors the pipes shall be painted with anticorrosive bitumastic paints of approved quality. The pipe shall not come in contact with mortar or lime concrete as the pipe is affected by lime. Under the floors the pipe shall be laid in layer of sand filling as done under concrete floors.

2.1.4. FIXING : The entire pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-In-Charge. All pipes shall be fixed truly vertical and horizontal unless unavoidable. The pipe line shall be supported with "U" type G.I. clamps not less than 2 mm thick and G.I. nails not less than 40 mm long, wooden gutties etc keeping the pipe about 15 mm clear of the wall.

Spacing between clamps for fixing internal piping shall be as per IS 2065 – 1983 as given below:

	For Horizontal Runs	For Vertical Runs
15mm	2.0 M	2.5 M
20 mm to 32 mm	2.5 M	3.0 M
40 mm to 50 mm	3.0 M	3.5 M
65 mm to 80 mm	3.5 M	5.0 M

No joints shall be located inside the wall. If the pipe is required to be cut and the end threaded, the ends of the cut end shall be filed smooth and any obstruction in bore shall be entirely eliminated, down take line shall be provided with union of every floor for easy maintenance. This shall be made of line threaded pipe ends and coupler with check nut to avoid leakage. Die cast union shall not be permitted in the shaft.

2.1.5. JOINTING : While fixing the pipe line the joints shall be made by applying a few turns of hemp yarn dipped in linseed oil shall be taken over the threaded end of the pipe and socket screwed home using the pipe wrench, pipe connected shall touch each other and the socket covering each end about equally. The branch connection shall not protrude in the bore of parent pipe.

2.1.6. PAINTING : G.I. pipes and fittings running exposed shall be painted with two coats of oil paint of approved make and shade over a coat of approved primer.

2.1.7. TESTING : The pipes and fittings after they are laid and jointed shall be tested to hydraulic pressure of 1 MPa (10 Kg/sq.cm). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually, Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least 2 (two) hours. The pipes and fittings shall be tested in sections as the work of paying proceeds, having the joints exposed for inspection during the testing. Pipes or fittings which are found leaking shall be replaced and joints found leaking shall be redone, without extra payment.

2.1.8. THE RATE INCLUDES FOR :

- 1 Supplying GI pipes and GI fittings such as sockets, elbows, bends, tees, enlargers, reducers, checknuts, plugs, unions etc. of specified diameter & class including hemp yarn, linseed oil, clamps, screws, wooden gutties etc.
- 2 Laying, jointing and fixing the pipe with fittings including threading, cutting pipes, wastage etc.
- 3 All necessary materials, labour and use of tools

2.1.9. MODE OF MEASUREMENT : The measurement shall be for unit running metre length of pipe line of specified nom. bore laid or fixed and shall be taken along Centre line of the pipe line.

.1.10. MODE OF PAYMENT : The contract rates shall be for unit running metre length of pipe line of specified nom. bore laid or fixed. No extra payment shall be made for fitting and fixtures.

2.2. G.I. PIPING WORK (Concealed) :

4.2.1. GENERAL : The item includes provision of G.I. pipes with concealed type fittings of specified nom. bore and class mentioned in the schedule including laying, fixing, wrapping with hessian cloth, painting and testing.

2.2.2. MATERIAL : Please refer clause 4.1.02

2.2.3. CHASES : Chases of size 75 mm x 75 mm shall be cut in the wall, floor, slab wherever required or as directed by chases cutting machine. After testing the pipe line the chases shall be filled with cement mortar 1:3 and surface made good to its original condition.

2.2.4. LAYING : : The plumbing contractor shall set the layout of the plumbing approved by the Engineer-in-charge as may be required by the bye-laws. Pipes shall be laid in plumb and in straight and parallel lines. No lime plaster or composition containing lime shall be allowed to come in direct contact with the pipe, which are to be concealed as the pipe is affected by lime.

2.2.5. FIXING : The entire pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-In-Charge. All pipes and fittings, which are to be concealed, shall be properly embedded in the wall, flooring etc. after being treated. No moulding or plaster design or any ornamental plaster work shall be done over the walls or flooring or ceiling where concealed pipes have been laid.

If the pipe is required to be cut and the end threaded, the burns of the cut end shall be filed smooth and any obstruction in bore shall be entirely eliminated.

2.2.6. JOINTING : Please refer Clause No. 4.1.05

2.2.7. PAINTING : All the concealed piping work shall be thoroughly painted with two coats of anti-corrosive black bitumastic paint of approved quality shade over a coat of approved primer before concealing and filling the mortar.

2.2.8. INSULATION : The hot water pipe line concealed on the wall, floor etc. after painting shall be insulated with 2.5 mm thick 95% asbestos magnesia compound of approved make all round the pipe and fittings.

2.2.9. WRAPPING : After painting the cold water pipe line, it shall be wrapped with two layers of hessian cloth of approved quality.

2.2.10. TESTING : Please refer clause No.4.1.07

2.2.11. THE RATE INCLUDES FOR :

- 1 Supplying GI pipes and concealed type G.I. fittings such as sockets, elbows, bends, tees, enlargers, reducers, checknuts, plugs, unions etc. of specified diameter and class including hemp yarn, linseed oil etc.
- 2 Laying, jointing and fixing the pipe with fittings including threading, cutting pipes, wastage, etc.
- 3 Wrapping the cold water pipe line with hessian cloth including painting and testing.
- 4 Wrapping the hot water pipe line with asbestos cloth

5 Cutting 75 mm x 75 mm size chases in the wall, floor, slab, etc. and making good the same using 1:3 cement mortar after the pipeline is laid.

6 All necessary materials, labour and use of tools.

2.2.12. **MODE OF MEASUREMENT** : The measurement shall be for unit running metre length of pipe line of specified nom. bore laid or fixed and shall be measured along the Centre line of the pipe line.

2.2.13. **MODE OF PAYMENT** : The contract rate shall be for unit running metre length of pipe line of specified nom. bore laid or fixed. No extra payment shall be made for fittings and fixtures.

2.3. UNDER GROUND G.I. PIPING WORK :

2.3.1. **GENERAL** : The item includes supplying G.I. pipes and fittings of specified nom. bore and class as mentioned in the schedule including laying, jointing and painting.

2.3.2. **MATERIAL** : Please refer clause 4.1.02

2.3.3. **TRENCHES** : The galvanised iron pipes and fittings are to be laid in trenches. The widths and depths of the trenches for different diameter of the pipes shall be as given below :

	Min. Width of trench (mm)	Min. Depth of trench (mm)
15 to 50	300	600
65 to 100	450	750

When excavation is done in rock, it shall be cut deep enough to permit the pipes to be laid on a cushion of sand of min. 7.5 cm.

At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for earth work in trenches as per clause 2.0.

2.3.4. **LAYING** : Where a pipe is to be laid under ground, the particular length of pipe should be protected by first painting before laying and then wrapping around the pipe a layer of jute or hessian cloth in the form of bandage, so that this cloth in the form of bandage, stick to the composition which has been freshly applied.

The pipe shall be laid into the trench and screwed with sockets, elbows, tees, bends etc. as necessary. The pipe line laid near electric train lines, power transmission lines, electric railway, power houses etc. should be provided with insulating joints at frequent intervals to guard against electrolysis.

Pipes shall be so laid as not to expose to sun or be subjected to any injury or risk to the pipe. As far as possible pipes shall be laid in straight and parallel lines. They shall be used in standard length pipe pieces being used only where necessary to make up the exact length.

2.3.5. **JOINTING** : Please refer clause No. 4.1.05

2.3.6. **DEWATERING** : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

2.3.7. TESTING : Same as clause 4.1.07

2.3.8. PAINTING : G.I. pipes and fittings shall be painted with two coat of anticorrosive paint before pipe line is laid and wrapping the pipe and fitting with jute or hessian cloth in the form of bandage.

2.3.9. THE RATE INCLUDES FOR :

1. Supplying G.I. pipes and fittings such as sockets, elbows, bends, tees, enlarges, plugs, reducers, checknuts, unions etc. of specified diameter including hemp yarn, linseed oil etc.
2. Laying, jointing and fixing the pipe with fittings including threading, cutting pipes, wastage etc.
3. Covering with hessian cloth, painting and testing the pipe line.
4. Dewatering the trench or pit till completion of work.
5. All necessary labour, material and use of tools.

2.3.10. MODE OF MEASUREMENT : The measurement shall be for unit running metre length of pipe line of specified nom. bore laid or fixed and shall be measured along the Centre line of the pipe line.

2.3.11. MODE OF PAYMENT : The contract rate shall be for unit running metre length of pipe line of specified nom. bore laid or fixed. No extra payment shall be made for fittings and fixtures.

2.4. HIGH DENSITY POLYETHYLENE PIPING WORK FOR WATER SUPPLY :

2.4.1. GENERAL : The item includes supplying of HDPE pipes with fittings of specified diameter including laying, fixing, cutting, jointing.

2.4.2. MATERIAL : The pipes and fittings shall conform to series IV of IS 4984. HDPE pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.

2.4.3. EXAMINING : Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

2.4.4. LAYING : The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

The entire length of pipe shall be evenly supported on bed of the trench throughout. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of day's work the open end shall be suitably plugged.

2.4.5. FIXING : The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable diameter HDPE clamps. The clamps shall be fixed into the wall with M.S. nails not less than 40 mm long./ Wooden gutties etc. chromium plated screws with wooden gutties fixing the pipe line on internal wall surface. MAKING JOINT: The joining of pipes and fittings generally shall be done by Butt weld with heat mirror jointing. The pipe shall be cut to desired length, Care shall be taken that profile of cut surfaces is not changed and the fibrous material shall be removed with scraper or knife. The butt weld jointing shall be made with electrical heated plated at the required temperature around 205, + or -5 degree Centigrade. While jointing, care shall be taken that formation of the rim at end of pipe after

heating by hot plate should be made uniform and complete on both the ends. Holding and pressing of pipe is done manually or mechanically to give the leak proof joint.

2.4.6. DETACHABLE JOINT : Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and a rim is made by heating the pipe end in a suitable device to 70-180 Centigrade and welding pre-heated rim of the Pipe.

2.4.7. DEWATERING : In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

2.4.8. TESTING : Solvent welded pipe shall not be pressure tested until at least 24 hours after the last solvent cemented joint has been done. All control valves shall be positioned open for the duration of the test and open end closed with water tight fittings. The testing pressure on completion of the work shall not be less than 1.5 time the working pressure of the pipes.

Pressure shall be applied either by hand pump or power driven pump. Pressure guages shall be correctly positioned and closely observed to ensure that at no time are the test pressure exceeded. The systems shall be slowly and carefully filled with water to avoid surge pressure or water hammer. Air vents shall be open at all high points so that air may be expelled from the system during filling.

When the system has been fully charged with water and air displaced from the line air vent shall be closed and the line initially inspected for seepage at joints and firmness of supports under load. Pressure is reached. Without any additional requirement of make-up-water the test pressure should not fall more than 0.02 MPa (0.2 kg./sq.cm) at the end of one hour test duration.

2.4.9. THE RATE INCLUDES FOR :

1. Supplying of HDPE pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Making the solution joint or mirror joint, painting if mentioned in schedule of quantities.
4. Fixing the pipe line with G.I. clamps not less than 20 mm x 1 mm thick and G.I./M.S. nails length not less than 40 mm or HDPE clamps, screws, rawl plug etc.
5. In case of underground pipes, dewatering the pit or trench till completion of work.
6. All necessary labour, materials and use of tools.

2.4.10. MODE OF MEASUREMENT: The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fitting, making joint, painting if mentioned in schedule of quantities and testing.

2.4.11. MODE OF PAYMENT: The contract rate shall be for unit running meter length of pipe line laid.

2.5. PVC PIPING WORK FOR WATER SUPPLY :

2.5.1. GENERAL : The item includes supplying of PVC pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting etc. for vent, over flow, waste water pipe line etc.

2.5.2. **MATERIAL** : The pipes and fittings shall conform to series IV of IS 4985-1978, PVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule of quantities.

2.5.3. **EXAMINING** : Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

2.5.4. **CLEANING** : All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side surfaces.

2.5.5. **TRENCHES** : The trench bottom shall be carefully examined for the presence of hard objects such as flints, rock projection or tree roots etc. Pipe shall be embedded in sand or soft soil, free from rock & gravel, back fill 150mm above the pipe shall also be of fine sand or soft soil. Pipe shall not be painted. The width of trench shall not be less than out side diameter of pipe plus 300 mm in case of gravel soils. Pipe shall be laid at-least 900 mm below the ground level (measured from the surface of the ground to the top of pipe).

2.5.6. **LAYING** : The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

The entire length of pipe shall be evenly supported on bed of the trench through out. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of day's work the open end shall be suitably plugged.

2.5.7. **FIXING** : The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-in-charge. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable PVC clamps, The clamps shall be fixed into the wall with G.I. nails not less than 40 mm long and wooden gutties.

Spacing between clamps for fixing internal piping shall be as given below

	For Horizontal Runs	For Vertical Runs
20 mm	700 mm	1050 mm
25 mm	750 mm	1125 mm
32 mm	825 mm	1240 mm
40 mm	975 mm	1460 mm
50 mm	975 mm	1460 mm

MAKING JOINT : The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough. The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

DETACHABLE JOINT : Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

PAINTING : If mentioned in schedule of work, the exposed pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer. Underground pipe line shall not be painted.

DEWATERING : In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

TESTING : Please refer clause No.4.4.09

THE RATE INCLUDES FOR :

Supplying of PVC pipes and fittings of specified diameter.

Laying and cutting the pipe wherever necessary and wastage.

Fixing the pipe line with G.I. clamps not less than 2 mm thick and G.I./M.S. nails length not less than 40mm or with PVC clamps, screws, wooden gutties etc.

Making the solution joint, painting the pipe line if mentioned in schedule of quantities.

In case of underground piping, dewatering till completion of work.

All necessary materials, labour and use of tools.

MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the Centre line of pipe. No measurement shall be recorded separately for fittings, making joint, painting if mentioned in schedule of work and testing.

MODE OF PAYMENT: Unit length of pipe line laid or fixed.

GUN METAL/ BRASS COPPER ALLOY FULL WAY VALVE :

GENERAL : The item includes provision of full way (gate or globe) valve of specified diameter as mentioned in the schedule including fixing. Full way valve is a valve suitable for controlling or stopping the flow in water supply lines.

MATERIAL :

Full way valve shall be of either Brass fitted with a cast iron hand wheel or Gun metal fitted with a C.I. hand wheel or copper alloy as the case may be and shall be of Gate valve type opening full way and of the size as specified conforming to IS 778. The weight of the full way gate valve shall be as per the table given below with a tolerance of 5 percent.

	Flanged arch (Kg)	Screwed arch (Kg)
15	1.021	0.567

20	1.503	0.680
25	2.495	1.077
32	3.232	1.559
40	4.082	2.268
50	6.691	3.232
65	10.149	6.804
80	13.381	8.845

2.6.3. **FIXING** : The valves shall be fixed in position in the pipeline as shown in the drawing or as directed with necessary socket or union, nuts etc. The screwed, flanged joint shall be made with few turns of fine hemp yarn dipped in linseed oil taken over the threaded ends to obtain complete water tightness.

2.6.4. **TESTING** : The joints shall be tested to a hydraulic pressure of 1 MPa (10 kg/cm²) along with the testing of pipe line.

2.6.5. **THE RATE INCLUDES FOR** :

1. Valve, G.I. fittings, hemp yarn, linseed oil, zinc, fixing and testing.
2. All necessary labour, materials and use of tools.

2.6.6. **MODE OF MEASUREMENT** : The measurement shall be for each unit valve of specified diameter fixed.

2.6.7. **MODE OF PAYMENT** : The contract rate shall be for each unit of valve of specified diameter fixed. No extra payment shall be made for G.I. fittings used in fixing of the valve.

2.7. **WATER METER** :

2.7.1. **GENERAL** : The item includes provision of Water meter with or without end flanges or non-return valve of specified diameter as mentioned in the schedule with strainer, sockets, flange, union, nuts etc. including fixing and testing.

2.7.2. **MATERIAL** : Water Meter shall conform to IS 779 (Domestic type) or IS 2373 (Bulk type) as specified in Schedule of Quantities and should have ISI certification mark. Non return valve and strainer shall be of the same diameter as that of water meter. Strainer, sockets, flange, union, union nuts, rubber packing etc. shall be as per the description of item.

2.7.3. **FIXING** : Water meter shall be fixed in position on the inlet pipe line and the joints shall be made either screwed or flanged with necessary sockets, flanges and union nuts as required or as directed by the Engineer-in-charge.

2.7.4. SCREWED JOINT : A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tight joint.

2.7.5. FLANGED JOINT : The flange joint shall be made for flange type water meter and the joint shall be as per the specification of flanged joint.

2.7.6. TESTING : The joints shall be tested to a hydraulic pressure of 1 MPa (10 kg/cm²) along with testing of pipe line for a minimum duration of two hours.

2.7.7. THE RATE INCLUDES FOR :

1. Water meter, hemp yarn, linseed oil, zinc, fixing and testing.
2. Supplying of strainer non-return valve, sockets, union nut etc.
3. Making screwed or flanged joints.
4. All necessary labour, material and use of tools.

2.7.8. MODE OF MEASUREMENT : The measurement shall be for each unit of water meter of specified diameter fixed.

2.7.9. MODE OF PAYMENT : The contract rate shall be for each unit Water Meter of specified diameter fixed. No extra payment shall be made towards making flanged and other joints and G.I. fittings used in fixing of the water meter.

2.8. PRESSURE REDUCING VALVE :

2.8.1. GENERAL : The item includes provision of pressure reducing valve of specified diameter as mentioned in the schedule including fixing.

2.8.2. MATERIAL: Pressure reducing valve is a device with suitable means of connection for insertion in a vertical pipe line for controlling the water pressure. Valve shall be of brass and shall be vertical flow type, conforming to IS 9739-1981.

2.8.3. FIXING : The valve shall be fixed in position on the pipe line as shown in the drawing or as directed. The screwed or flanged joint shall be made to obtain complete water tight joint.

2.8.4. TESTING : The joints shall be tested to a hydraulic pressure of 1MPa (10 kg/cm²) along with testing of pipe line for a minimum duration of 2 hrs.

2.8.5. THE RATE INCLUDES FOR :

1. Supplying Valve including fixing and testing.
2. All necessary labour, materials and use of tools.

2.8.6. MODE OF MEASUREMENT : The measurement shall be for each unit of valve of specified diameter fixed.

2.8.7. MODE OF PAYMENT : The contract rate shall be for each unit of valve of specified diameter fixed.

2.9. CAST IRON WATER QUALITY PIPING WORK :

2.9.1. GENERAL : The item includes the provision of supplying water quality cast iron pipe of specified diameter including cutting, laying, fixing, and painting the pipe line.

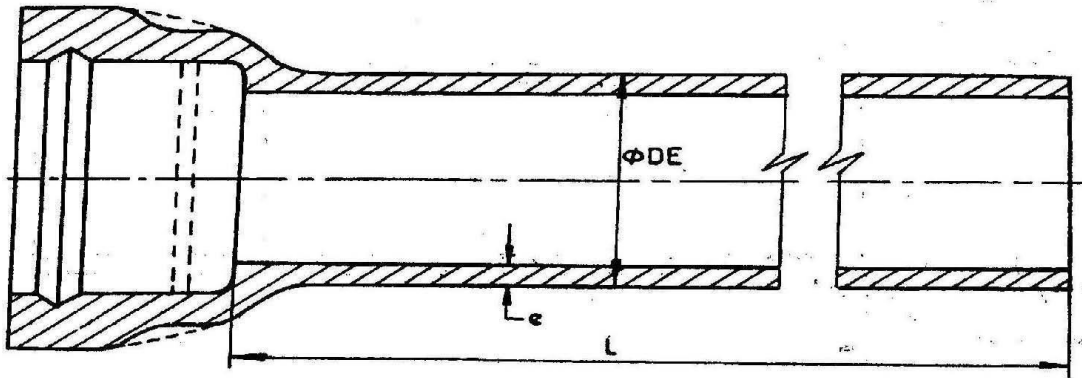
2.9.2. MATERIAL : The pipes shall be centrifugally cast (spun) Iron Pressure pipe conforming to IS 1536 and shall be of class "LA", 'A' or "B". These shall be of socket and spigot or double flanged. All the pipes shall be cylindrical reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections. The pipes shall be treated with solution of Dr. Angus Smith's solution. The coated surface shall give glossy finish. The table showing the dimensions & weight of different diameter of pipes is given below:

CENTRIFUGALLY CAST (SPUN) IRON 'WATER QUALITY' PIPES Tolerances: a) Length ± 25 mm (b) weight 5% (c) Thickness $\pm (1+0.05e)$ mm Value of 'e' for

a. LA class pipe $e = 10/12 (7 + 0.02 \text{ DN})$

(i) A class pipe $e = 11/12 (7 + .02 \text{ DN})$

(ii) B class pipe $e = (7 + 0.02 \text{ DN})$



CENTRIFUGALLY CAST (SPUN) IRON 'WATER QUALITY' PIPES WEIGHT FOR SOCKET & SPIGOT PIPES (IS 15362001)

Dia	Class	Barrel			Socket Mass		Total weight for one working length ' L ' in meter					
DN		Lead joint	Push-on joint	Thickness	Mass for 1 Mt		3.66	4	4.5	5	5.5	6
M m		DE mm	DE mm	e mm	kg	Kg.	Kg	Kg.	Kg.	Kg.	Kg.	Kg.
80	LA	98	95	7.2	14.7	5.5	59.0	64.0		79.0		
	A	98	95	7.9	16.0	5.5	64.0	70.0	78.0	86.0		
	B	98	95	8.6	17.3	5.5	69.0	74.0	83.0	92.0		
100	LA	118	115	7.5	18.6	7.1	75.0	82.0	91.0	100.0	109.0	119.0
	A	118	115	8.3	20.5	7.1	82.0	89.0	99.0	109.0	120.0	130.0
	B	118	115	9.0	22.0	7.1	88.0	95.0	106.0	117.0	128.0	139.0
125	LA	144	141	7.9	24.2	9.2	98.0	106.0	118.0	130.0	142.0	154.0
	A	144	141	8.7	26.4	9.2	106.0	115.0	128.0	141.0	155.0	168.0
	B	144	141	9.5	28.7	9.2	114.0	124.0	138.0	153.0	167.0	181.0
150	LA	170	167	8.3	30.1	11.5	122.0	132.0	147.0	162.0	177.0	192.0
	A	170	167	9.2	33.2	11.5	133.0	144.0	161.0	178.0	194.0	211.0
	B	170	167	10.0	35.9	11.5	143.0	155.0	173.0	191.0	209.0	227.0

Dia	Clas s	Barrel			Socket Mass		Total weight for one working length ' L ' in meter					
20 0	LA	222	219	9.2	44.0	16.5	178.0	193.0	215.0	237.0	259.0	281.0
	A	222	219	10.1	48.1	16.5	193.0	209.0	233.0	257.0	281.0	305.0
	B	222	219	11.0	52.1	16.8	207.0	225.0	251.0	278.0	304.0	329.0
25 0	LA	274	271	10.0	59.3	22.9	240.0	260.0	290.0	319.0	349.0	379.0
Dia	Clas s	Barrel			Socket Mass		Total weight for one working length ' L ' in meter					
	A	274	271	11.0	65.0	22.9	261.0	283.0	315.0	348.0	380.0	413.0
	B	274	271	12.0	70.6	22.9	281.0	305.0	341.0	376.0	411.0	447.0
30 0	LA	326	323	10.8	76.5	29.8	310.0	336.0	374.0	412.0	450.0	489.0
	A	326	323	11.9	84.0	29.8	337.0	366.0	408.0	450.0	492.0	534.0
	B	326	323	13.0	91.4	29.8	364.0	395.0	441.0	487.0	533.0	578.0
35 0	LA	378	375	11.7	96.3	37.5	390.0	423.0	471.0	519.0	567.0	615.0
	A	378	375	12.8	105.0	37.5	422.0	458.0	510.0	563.0	615.0	668.0
	B	378	375	14.0	114.5	37.5	457.0	495.0	553.0	610.0	667.0	725.0
40 0	LA	429	426	12.5	116.9	46.3	474.0	514.0	572.0	631.0	690.0	748.0
	A	429	426	13.8	128.7	46.3	517.0	561.0	625.0	690.0	754.0	819.0

Dia	Class	Barrel			Socket Mass		Total weight for one working length ' L ' in meter					
	B	429	426	15.0	139.5	46.3	557.0	604.0	674.0	744.0	814.0	883.0
450	LA	480	477	13.3	141.0	56.0	572.0	620.0	690.0	761.0	832.0	902.0
	A	480	477	14.7	156.0	56.0	627.0	680.0	758.0	836.0	914.0	992.0
	B	480	477	16.0	169.0	56.0	675.0	732.0	816.0	901.0	986.0	1070.0
500	LA	532	529	14.2	165.2	66.0	671.0	727.0	809.0	892.0	974.0	1057.0
	A	532	529	15.6	181.0	66.0	728.0	790.0	880.0	971.0	1061.0	1152.0
	B	532	529	17.0	196.7	66.0	786.0	853.0	951.0	1049.0	1148.0	1246.0
600	LA	635	632	15.8	219.8	89.3	894.0	968.0	1162.0	1188.0	1298.0	1408.0
	A	635	632	17.4	241.4	89.3	973.0	1055.0	1141.0	1272.0	1404.0	1544.0
	B	635	632	19.0	262.9	89.3	1052.0	1141.0	1272.0	1404.0	1535.0	1667.0

2.9.3. UNLOADING : The pipe shall be unloaded where they are required. Where mechanical handling facility are not available, pipes weighing upto 60 kg shall be handled by two persons by hand passing and heavier pipes shall be unloaded from the lorry or wagon by holding them in loops, formed with ropes and sliding over plank set not steeper than 45 degrees. Two ropes always shall be used and only one pipe shall be unloaded at a time. Under no circumstances shall pipes be thrown down from the carriers or be dragged or rolled along hard surfaces. The pipes shall be checked for any visible damage while unloading and shall be sorted out for reclamation.

2.9.4. STORING : The pipes shall be lined upon on one side of the alignment of the trench, socket facing upgrade when line runs uphill and up stream when line runs on level ground. Each stack shall contain pipes of same class and size. Storage shall be done on firm, level and clean ground. Wedges shall be provided at the bottom layer to keep the stack stable.

2.9.5. **CLEANING** : The pipes shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and inside of socket and outside of the spigot shall also be cleaned in similar way.

2.9.6. **EXAMINATION** : Before pipe is laid it shall be first examined for damage and cracks. No cracked or damaged pipe shall be used. The pipe shall be tested with a hammer to prove its soundness.

2.9.7. **DAMAGED MATERIAL** : If any material found damaged or cracked, the same shall not be used in the work. The contractor has to replace the same at his own cost and charges.

2.9.8. **TRENCHES** : The depth of the trenches shall not be less than 1000 mm measured from the top of the pipe to the surface of the ground under roads and not less than 750 mm elsewhere. The width of the trench shall be the nominal diameter of the pipeline plus 400mm, but it shall not less than 550 mm in case of all kind of soil, excluding rock and not less than 1000 mm in case of rock.

Trench shall be so deep that the pipes may be laid to the required alignment and at required depth. The width of trench at bottom between face of sheeting shall be such as to provide not less than 200 mm clearance on either side of the pipe. Trenches shall be of such extra width, when required as will permit the convenient placing of timber supports strutting and planking handling of specials etc. The bed of trench, in soft or made up earth, shall be well watered and rammed before laying the pipes and depression, if any, shall be properly filled with earth and consolidated in 20 cm layers.

If the trench bottom is extremely hard or rocky or loose stoney soil, the trench shall be excavated 150mm below the trench grade. Rocks, stones or other hard substances from the bottom of the trench shall be removed & trench brought back to the required grade by filling with selected fine earth or sand or fine murrum & compact so as to provide a smooth bedding for pipe.

After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipe. The barrels of the pipes shall rest through their entire length on the solid ground that sufficient space left for jointing the under side of the pipe joints. These socket holes shall be refilled with sand after jointing the pipe.

The trench shall be kept free from water shoring and timbering shall be provided wherever required. Excavation below water table shall be done after dewatering the trenches.

The road crossing shall be excavated half at a time and where the pipe line/drain crosses on existing road after the pipe have been laid in the first half and the trench refilled. Care shall be taken not to disturb the electrical & communication cable net with during the course of excavation.

2.9.9. **LOWERING** : The pipe shall then be placed in trenches by means of proper sheer legs, chains and other tacts and shall be properly driven home. In no case pipe shall be rolled or dropped into the trench. One end of rope may be tied to a wooden or steel Pag or driven into ground and other end hold by men which when slowly released till lower the pipe into trench.

2.9.10. **LAYING** : The pipes shall be carefully laid straight to correct alignment in raising or falling gradients. The socket end of the pipe shall face uphill. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length. While jointing the spigot it should be neatly placed into the socket for full length and properly supported. The pipe shall be carefully packed underneath so that they shall bear loads arising from traffic evenly through out their whole length. The entire length of pipe shall be supported on bed of the trench evenly through out. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of the day's work the open end shall be suitably plugged.

No pipe shall be laid until the trench has been excavated to its required depth for a distance of about 5 M in front of the pipe to be laid. No pipe shall be covered until it has been passed by the Engineer-In-Charge.

In unstable soils, such as soft soil and dry lumpy soil it shall be checked whether the soil can support the pipe and if required, suitable special foundation shall be provided.

Where the soils are drastically affected by extremes of saturation and dryness, those soils are subjected to extraordinary shrinkage which from wide and deep cracks in the earth surface may result in damage to underground pipe because of tight gripping bond between pipe and clay, subjecting to it excessive stresses as the clay shrinks. In such case an envelop of minimum 100 mm of tamped sand shall be made around the pipe line to avoid any bonding.

In places where rock is encountered, cushion of fine earth or sand shall be provided for a depth of 150mm by excavating extra depth of the trench where the gradient of the bad slopes is more than 30 depths, it may necessary do and or fine pipe against sliding downwards.

2.9.11. **FIXING:** The contractor shall first get the layout for pipe line approved by the Engineer-In-Charge as may be required by the bye-laws. The pipe line shall be so fixed / laid as not to expose to the heat or subject to any injury or risk to the pipe. The socket end of the pipe shall be facing up. All the pipes shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

2.9.12. **THRUST BLOCK :** Thrust blocks are required to transfer the resulting hydraulic thrust from the fittings of pipe on to a larger load bearing soil section. Thrust blocks shall be installed wherever there is a change in the direction/size of the pipe line or the pressure line diagram, or the pipe line ends at a dead end. If necessary, thrust blocks may be constructed at valves also. Thrust block shall be constructed taking into account the pipe size, water pressure, type of filling, gravity component when laid on slopes and the type of soil. In case of pipe line laid in soft soil, joints/couplings are to be anchored on each side by providing side thrust blocks without restricting the coupling.

Pipes on slopes need be anchored only when there is a possibility of the backfill around the pipe sloping down the hill and carrying the pipe with it. Generally for slopes up to 30 degrees, good, well drained soil carefully damped in layers of 100mm under and over the pipe, right up to the top of trench will not require anchoring.

For steeper slopes, one out of every three pipes shall be held by straps fastened to vertical supports anchored in concrete.

2.9.13. **BACK FILLING:** Back filling shall follow the pipe installation as closely as possible to protect pipe from falling boulders, eliminating possibility of lifting of the pipe due to flooding of open trench and shifting pipe out of line by caved in soil.

The soil under the pipe and coupling shall be solidly tamped. The initial back fill material shall be free of large stones and dry lumps.

In bags and Monshers gravel or crushed stone may be used for this purpose. The initial back fill shall be placed evenly in a layer of 100 mm thick and consolidated up to a cushion of at least 300 mm cover over the pipe. Joints shall be taken care to resist the movement of the pipe due to pressure while testing.

2.9.14. **TESTING :**

After a new pipe has been laid, jointed and back filled (or any valved section thereof), it shall be subjected to the following two tests:

- a) Pressure test at a pressure of at least double the maximum working pressure-pipe and joints shall be absolutely water tight under the test.
- b) Leakage test (to be conducted after the satisfactory completion of the pressure test) at a pressure to be specified by the authority for a duration of two hours.

Hydrostatic Tests:

Portions of the line shall be tested by subjecting to pressure test as the laying progresses before the entire line is completed. In this way any error of workmanship will be found immediately and can be corrected at a minimum cost. Usually the length of the section to be tested shall not exceed 500 m.

Where any section of a main is provided with concrete thrust blocks or anchorages, test shall not be made until atleast two days have elapsed.

Prior to testing, enough back fill as described in 4.9.12 shall be placed over the pipe line to resist upward thrust. All thrust blocks forming part of the finished line shall have been sufficiently cured and no temporary bracing shall be used.

The open end of the section shall be sealed temporarily with an end cap having an outlet which can serve as an air relief vent or for filling the line, as may be required. The blind face of the end cap shall be properly braced during testing by screw jacks and wooden planks or steel plate.

The section of the line to be tested shall be filled with water manually or by a low pressure pump. Air shall be vented from all high spots in the pipe line before making the pressure strength test because entrapped air gets compressed and causes difficulty in raising the required pressure for the pressure strength test.

The test pressure shall be gradually raised at the rate of approximately one kg/ sq cm/ mm. The duration of the test period if not specified shall be sufficient to make a careful check on the pipe line section.

Procedure for pressure test:

Each valved section of the pipe shall be slowly filled with water and all air shall be expelled from the pipe through hydrants and blow offs. If these are not available at high places, necessary tapping may be made at points of highest elevation before the test is made and plugs inserted after the tests have been completed.

If the trench has been partially back-filled the specified pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer-in-Charge. The duration of the test shall not be less than 5 minutes.

Examination under Pressure: All exposed pipes, fittings, valves, hydrants and joints should be carefully examined during the open-trench test. When the joints are made with lead, all such joints showing visible leaks shall be recaulked until tight. When the joints are made with cement and show seepage or slight leakage, such joints shall be cut out and replaced as directed by the authority. Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by sound material and the test shall be repeated until satisfactory to the Engineer--in-Charge.

If the trench has been back-filled to the top, the section shall be first subjected to water pressure normal to the area and the exposed parts shall be carefully examined. If any defects are found, they shall be repaired and the pressure test repeated until no defects are found. The duration of the final pressure tests shall be at least one hour.

Procedure for Leakage Test:

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

No pipe installation shall be accepted until the leakage is less than the number of cm³/h determined by the formula :

$$ql = ND\sqrt{P}$$

3.3 Where ql = the allowable leakage in cm³/h.

N = number of joints in the length of the pipe line.

D = diameter in mm, and

P = the average test pressure during the leakage testing kg/cm².

Variation from Permissible Leakage : Should any test of pipe laid in position discloses leakage greater than that specified in above para., the defective joints shall be repaired until the leakage is within the specified allowance.

4.9.15. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

2.9.16. THE RATE INCLUDES FOR :

1. Supplying spigot and socket or monolithic double flanged C.I. Pipe of specified class & diameter.
2. Laying the pipe and cutting the pipe wherever necessary and wastage.
3. Dewatering the Trench or pit if found necessary till completion of work.
4. Fixing the pipe line using M.S. clamps not less than 3 mm thick with wooden gutties etc. if required.
5. Testing the pipe line.
6. All necessary labour, materials and use of tools.

2.9.17. MODE OF MEASUREMENT : The measurement shall be for unit running metre length of pipe line laid or fixed. .Measurement shall be taken along the centre line of the pipe deducting outer to outer length of specials.

2.9.18. MODE OF PAYMENT : Contract rate shall be for unit running meter length of pipe line laid or fixed.

2.10. SPECIALS FOR C.I. WATER SUPPLY PIPE LINE :

2.10.1. GENERAL : The item includes supplying cast iron water quality or M.S. specials of specified diameter for C.I. water supply pipe including laying, fixing and painting the specials.

2.10.2. MATERIALS : The specials for cast iron water quality pipe shall be conforming to IS 1538 & 13382 with socket and spigot or monolithic double flanged. All the fittings shall be cylindrical, reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections.

M.S. specials shall be made out of M.S. plate of thickness of 6 mm for pipes up to 100mm and 8 mm thick for pipes above 100 mm to 300. 10 mm thick for pipe above 300 mm.

2.10.2. A.:M.S. specials shall be treated with Anticorrosive coating of Bituminous based coro coat.

2.10.3. CLEANING : The specials and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside the socket and outside of the spigot.

2.10.4. EXAMINING : Before special is laid, it shall be first examined for damage and cracks. No cracked or damaged pipe shall be used. The pipe shall be tested with a hammer to prove its soundness.

2.10.5. DAMAGED MATERIAL : If any material found damaged or cracked, the same shall not be used in the work. The contractor has to replace the same at his own cost and charges.

2.10.6. LOWERING : The specials shall then be placed in trenches by means of proper sheer legs, chains and other tacts and shall be properly driven home.

2.10.7. FIXING : The specials shall be fixed by means of lead or flanged joint on C.I. Pipe line wherever required and as shown in the drawing or as directed by the Engineer-In-Charge.

2.10.8. TESTING : Joints shall be tested to a hydraulic pressure of 10 kg/cm² along with testing of pipe line and shall be maintained for minimum two hours. All leakages, defects etc. shall be rectified.

2.10.9. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.

2.10.10. THE RATE INCLUDES FOR :

1. Supplying spigot and socket or monolithic double flanged C.I. or M.S. specials.
2. Fixing the specials wherever necessary.
3. Dewatering the trench or pit if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

2.10.11. MODE OF MEASUREMENT : The measurement shall be on the basis of IS 1538 for standard weight of specials and/or on the basis of actual unit weight for fixed specials.

2.10.12. MODE OF PAYMENT : The contract rate shall be on the basis of unit weight.

2.11. LEAD JOINT :

2.11.1. GENERAL : The item includes making lead joints for C.I. water quality pipes and fittings/specials including testing etc.

4.11.2. MATERIAL : Lead shall be conforming to IS 782 and of good quality manufactured by Hindustan zinc or equivalent. Fine hemp yarn shall be the best available in the market.

2.11.3. PREPARATION : Outside of the spigot and inside of the socket shall be thoroughly cleaned with brush. The spigot shall be carefully centred in the socket by one or more laps of spun hemp yarn twisted into ropes of uniform thickness thoroughly soaked in hot coal-tar or bitumen and cooled before use.

2.11.4. POURING : Pouring of lead shall be done by means of ropes covered with clay or by using special leading rings. The lead shall be melted rendering it thoroughly fluid and each joint shall be filled in one pouring.

2.11.5. CAULKING : The caulking shall be carried out with molten lead. Hemp yarn shall be driven into the bottom of the socket and leave the space required. The molten lead shall then be run in sufficient quantity so that after being caulked solid, the lead may project 3 mm beyond the face of the socket against the outside of the spigot, but must be flushed with the outside edge of the socket.

The lead taken from the pot shall be run hot into the joint and the joint filled in one running. The joint shall be caulked well, by a suitable caulking tool and 2 kg hammer and the joint left neat and smooth. In case C.I. fittings are also conforming to the same specification that of pipes, the consumption of lead will be worked out on the basis of actual consumption for each joints.

The following table shows consumption of the weight of lead & yarn per joint as per IS 3114: 1994

NOTE :

- i) The quantities of lead given are on average basis and a variation of 10 percent is permissible
- ii) Before pipe are jointed on large scale, three a four sample joints shall be made and the average consumption of lead per joint shall be got approved by the Engineer-In-Charge.

2.11.6. TESTING : The pipe line after being laid and jointed shall be tested under the supervision of the Engineer-In-Charge. The testing shall be carried out by the contractor at his own cost and charges. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost.

The length of pipes to be tested shall be first filled with water from a higher section of pipe and the test pressure is applied. The test pressure shall be 10 kg per square centimetres and shall be maintained for two hours continuously.

2.11.7. DEWATERING : The contract rate shall include bailing out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.

2.11.8. THE RATE INCLUDES FOR :

1. Pig lead and treated yarn, fuel, wood, etc.
2. Winding the rope on spigot and centering the pipe, caulking, casting molten lead etc.
3. Testing and making good the defective joints.
4. Dewatering the trench or pit till completion of work.
5. All labour, material and use of tools.

2.11.9. MODE OF MEASUREMENT : The measurement shall be for each unit of lead joint made.

2.11.10. MODE OF PAYMENT : The contract rate shall be for each unit of lead joint made.

2.12. G M GATE VALVE CHAMBER :

2.12.1. GENERAL : The item includes construction of brick masonry valve chamber of size as specified in this schedule including providing M.S./G.I. frame and cover over R.C.C pre-cast cover with or without surface box.

2.12.2. MATERIAL : Brick work, plastering, concreting etc. shall be as per general specification under section II. Precast RCC cover slab, surface box, C.I./M.S frame and cover etc. shall be size and weight as specified in the schedule.

2.12.3. CONSTRUCTION :

a) Foundation concrete of mix 1:4:8 shall be of 150 mm thick with 150 mm offset all-round or as specified in the schedule.

b) Brick masonry in cement mortar 1:4 as specified.

c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:3 of thickness as specified mixed with water proofing compound of specified Quality including inner surfaces finished smooth with neat cement punning.

2.12.4. RCC PRECAST/CAST IRON COVERS

2.12.4.1. RCC PRECAST COVER (for chambers of size up to 600 x 600 mm) : Chamber cover shall be casted as shown in the drawing having minimum 75 mm thick in cement concrete 1:2:4 or as specified in the schedule by using nominal reinforcement 100 kg/ Cum of concrete including shuttering, finishing, curing, placing in position etc.

2.12.4.2. CAST IRON/ M.S COVER : Cast iron/M.S cover of specified size and weight shall be supplied and placed over the chamber as directed. The cover shall be painted with 3 coats of black bitumastic paint.

2.12.5. DEWATERING : The water accumulated in the pit due to rain, seepage, springs or any other cause during the progress of work shall be pumped/bailed out till the completion of work.

2.12.6. THE RATE INCLUDES FOR :

1. Bed concrete, Brick masonry, cement plaster, RCC pre-cast cover slab with or without surface box cast /MS cover etc.

2. Dewatering the trench or pit if necessary.

3. All necessary labour, materials and use of tools.

2.12.7. MODE OF MEASUREMENT : The measurement shall be for each unit of valve chamber of specified internal size and depth constructed.

2.12.8. MODE OF PAYMENT : The contract rate shall be for each unit of valve chamber of specified internal size and depth constructed.

2.13. C.I. SLUICE VALVE CHAMBER :

2.13.1. GENERAL : The item includes construction of brick masonry valve chamber of size as specified in this schedule including providing M.S./G.I. frame and cover over R.C.C pre-cast cover with or without surface box.

2.13.2. MATERIAL : Brick work, plastering, concreting etc. shall be as per general specification under section II. Precast RCC cover slab, surface box, C.I./M.S frame and cover etc. shall be size and weight as specified in the schedule.

2.13.3. CONSTRUCTION :

a) Foundation concrete of mix 1:4:8 shall be of 150 mm thick with 150 mm offset all-round or as specified in the schedule.

b) Brick masonry in cement mortar 1:4 as specified.

c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:3 of thickness as specified mixed with water proofing compound of specified Quality including inner surfaces finished smooth with neat cement punning.

2.13.4. RCC PRECAST/CAST IRON COVERS

2.13.4.1. RCC PRECAST COVER (for chambers of size above 1000 x 1000 mm)

Chamber cover shall be coated in minimum three equal parts or more as directed with lifting hooks as shown in the drawing. RCC slab shall be casted along with galvanised M.S. angle iron frame with stiffness and anchors made out of the sizes as specified in the schedule. The exposed portion of the angle frame shall be painted with the coats of silver paint over a coat of primer.

RCC pre-cast slab shall be of 100 mm thick (unless otherwise specified) in cement concrete 1:2:4 of size as specified in the drawing schedule by using nominal reinforcement 100 kg/ Cum of concrete including shuttering, curing etc. and shall be placed in position as directed. cast iron road surface of prescribed weight shall be fixed to the cover slab during casting the slab for key rod operation.

Road surface box shall be of size 100x125x150 mm conforming to IS 3950 having hinged and weighting not less than 14 kg. The surface box shall be fixed on top of the RCC cover slab during the casting of slab for key rod operation. The surface box shall be painted with 3 coats of black bitumastic paint.

2.13.4.2. CAST IRON/ M.S COVER: Cast iron/M.S cover of specified size and weight shall be supplied and placed over the chamber as directed. The cover shall be painted with 3 coats of black bitumastic paint.

2.13.5. DEWATERING: The water accumulated in the pit due to rain, seepage, springs or any other cause during the progress of work shall be pumped/bailed out till the completion of work.

2.13.6. THE RATE INCLUDES FOR :

1. Bed concrete, Brick masonry, cement plaster, RCC pre-cast cover slab with or without surface box cast /MS cover etc.
2. Dewatering the trench or pit if necessary.
3. All necessary labour, materials and use of tools.

2.13.7. MODE OF MEASUREMENT: The measurement shall be for each unit of valve chamber of specified internal size and depth constructed.

2.13.8. MODE OF PAYMENT: The contract rate shall be for each unit of valve chamber of specified internal size and depth constructed.

2.14. FLANGES & FLANGED JOINT : (Screwed or welded Flanges)

2.14.1. GENERAL: The item includes supplying flanges and providing flanged joint for G.I./ M.S./ C.I pipes, fittings and specials including testing.

2.14.2. MATERIAL: The CI flanges shall be confirming to IS 3516 or IS 1536. The heavy quality G.I./ M.S. flanges shall be conforming to I.S.6392 having thickness not less than 20 mm for pipes having diameter beyond 80 mm and 12 mm for pipes having diameter below 80 mm including drilling holes in new flanges, jointing with the pipe by means of welding or screwed joint. Rubber insertion shall be of three ply not less than 3 mm thick of approved make or fiber board impregnated with chemically neutral mineral oil having smooth & hard surface weighing not less than 112 gm/mm thickness. Bolts, nuts and washers used shall be of good quality.

2.14.3. MAKING JOINT : Flanged joints shall be made by jointing the facing of the flange with the packing of rubber insertion and boiling up evenly on all sides. A thin layer of lead wool shall be provided for making the joints water tight where facing of the pipe is not true. The packing shall be of rubber insertion of three ply and of approved make and thickness. The packing should be of full diameter of the flange with proper pipe hole and bolt hole; cut even at both the inner and outer edges.

2.14.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.

2.14.5. TESTING : The joints shall be tested along with pipe line after the pipe line is laid and jointed. The testing shall be as per the clause of testing of the pipe line

2.14.6. THE RATE INCLUDES FOR :

1. Cost of flanges, making bolt holes in flanges, supplying rubber insertion, making flanged joint.
2. Testing and making good the defective joints.
3. Dewatering the trench or pit till completion of work.
4. All labour, material and use of tools.

2.14.7. MODE OF MEASUREMENT : The measurement shall be for each unit of flange joint of specified size made with supplying one or two new flanges as specified in the schedule of quantities.

2.14.8. MODE OF PAYMENT: The contract rate shall be for each unit of flange joint made.

2.15. FLEXIBLE PUSH-ON JOINT (TYTON/ RING JOINT)

2.15.1. GENERAL: The item includes push-on joint with rubber ring for C.I. pipes, fittings and including testing.

2.15.2. MATERIAL : Rubber ring shall be moulded or tubular natural or synthetic rubber gasket conforming IS 12820.

2.15.3. JOINTING : The groove and the socket shall be thoroughly cleaned before inserting the rubber gasket while inserting the gasket it shall be made sure that it faces the proper direction and that it is correctly seated in the groove. After cleaning dirt or foreign materials from the plain end, non petroleum lubricant shall be applied in accordance with the pipe manufacturer's recommendations. The plain end of the pipe is pushed into the socket of the pipe and while pushing, the pipe shall be kept straight. If any deflections are to be made in the alignment, it may be made after the joint is assembled. The permissible deflection shall not be exceeded as per IS 3114 for socket and spigot rubber joint is 5 ° for 80 to 300 mm nom. bore, 4° for 350 to 400 mm nom bore and 3° for 450 to 750 mm nom bore pipe. A timber header shall be used between the pipe and crowbar or jack to avoid damage to the pipe while the plain end of the pipe is pushed into the socket either with a crowbar or jack or lever puller.

2.15.4. TESTING : The joints shall be tested along with pipe line after the pipe line is laid and jointed. The testing shall be as per the clause of testing of the pipe line.

2.15.5. DEWATERING : The contract rate shall include bailing out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till the completion of work.

2.15.6. THE RATE INCLUDES FOR :-

1. Rubber ring, lubricant etc.
2. Testing and making good the defective joints.
3. Dewatering the trench or pit till completion of work.
4. All labour, material and use of tools.

2.15.7. MODE OF MEASUREMENT : The measurement shall be for each unit of rubber ring joint made.

2.15.8. MODE OF PAYMENT : The contract rate shall be each unit of rubber ring joint made.

2.16. C. I. SLUICE VALVE :

2.16.1. GENERAL : The item includes supplying of C.I. Sluice Valve of specified diameter as mentioned in the schedule including fixing.

2.16.2. MATERIAL : The Sluice valve shall be of Class or pressure rating as specified in the schedule of quantities and conforming to I.S. 14846. The valve shall be of cast iron and / or spheroidal iron having non-rising spindle with hand wheel & spindle of stainless steel.

2.16.3. FIXING : The C.I. sluice valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted with the tail pieces on both sides by means of flange joints.

2.16.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either form rain, seepage, springs or any other cause till completion of the work.

2.16.5. TESTING : The Sluice Valve and the joints shall be tested as per the clause of testing of the pipe line The testing shall be done along with the pipe line testing.

2.16.6. THE RATE INCLUDES FOR :

1. Supplying and fixing of C.I. Sluice Valve of specified diameter.

2. Dewatering the trench or pit till completion of work.
3. All necessary labour, materials and use of tools.

2.16.7. MODE OF MEASUREMENT : The measurement shall be for each unit of Sluice Valve fixed. Tail piece, making flange joint and lead joint shall be measured under the relevant items.

2.16.8. MODE OF PAYMENT : The contract rate shall be for each unit of Sluice Valve fixed.

2.17. C.I. NON RETURN VALVE :

2.17.1. GENERAL : The item includes supplying of C.I. Non-Return Valve of specified size in the schedule of quantities including fixing.

2.17.2. MATERIAL : Non-return valve shall be conforming to IS 9338 or IS 5312 as specified in schedule of quantities. The body, domes, covers, stuffing box, thrust plates, hand wheel, wedges, gland and cap shall be of cast iron not less than of grade FG200 and all in side working parts should be of any non ferrous or ferrous materials such as gun metal. Valve of single door pattern swing type shall have test pressure of PN1.6(50 to 125 mm size), PN1.0 (150 to 300mm size),PN0.6 (350 to 600 mm size)as per IS 5312 (part.1). Valve of multi door pattern swing type shall have test pressure of PN0.6(400 to 1200 mm size), PN1.0 (400 to 1200mm size)as per IS 5312 (part 2).Valve shall be tested for the body and seat and the defective valve shall be replaced by the contractor at his own cost.

2.17.3. FIXING : The C.I. Non-Return valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted with the tail pieces on both sides by means of flange joints.

2.17.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

2.17.5. TESTING : The C.I. Non-Return valve shall be fixed in position shall be tested hydraulically to a minimum pressure as per testing clause of piping work. The testing shall be done along with the testing of pipe line.

2.17.6. THE RATE INCLUDES FOR :

1. Supplying and fixing of C.I. Non-Return Valve of specified dia.
2. Dewatering the trench or pit till completion of work.
3. All necessary labour, materials and use of tools.

2.17.7. MODE OF MEASUREMENT : The measurement shall be for each unit of Non-Return Valve fixed. Tail piece, making flange joint and lead joint shall be measured under the relevant items.

2.17.8. MODE OF PAYMENT : The contract rate shall be for each unit of Non-Return Valve fixed.

2.18. FOOT-VALVE :

2.18.1. GENERAL : The item includes supplying of C.I. body. Foot-Valve of specified diameter as mentioned in the schedule including fixing.

2.18.2. MATERIAL : Foot-Valve shall be conforming to IS 4038 and with C.I. body not less than of grade FG200 and strainer with internal gun metal working parts. The valve shall be screwed end (25 to 150 mm size),flanged end (50 to 450 mm size), single disc type (up to 150 mm size), two disc type (exceeding 150 mm size), lift type (up to 100 mm size) The valve shall be tested for housing 0.6 MPa

(6 kg/cm²)and for seat 0.2 MPa (2 kg/cm²) for 2 minutes as per IS 4038. The ball type foot valve with nitrile rubber ball and with bronze seat may be used as specified in the schedule of quantities. The defective Foot-Valve shall be replaced by the contractor at his own cost.

2.18.3. FIXING : Foot-valve shall be fixed in position as shown in the drawing or as directed. They shall be fitted by means of flange joints.

2.18.4. TESTING : The C.I. Foot-Valve and the joints shall be tested hydraulically to a minimum pressure as per testing clause of piping work .The testing shall be done along with the testing of pipe line.

2.18.5. THE RATE INCLUDES FOR :

1. Supplying and fixing of C.I. Foot-Valve of specified diameter.
2. All necessary labour, material and use of tools.

2.18.6. MODE OF MEASUREMENT : The measurement shall be for each unit of Foot-Valve fixed. Tail piece, making flange joint and lead joint shall be measured under the relevant items.

2.18.7. MODE OF PAYMENT : The contract rate shall be for each unit of Foot-Valve fixed.

2.19. AIR VALVE :

2.19.1. GENERAL : The item includes supplying of single, double action or kinetic air Valve of specified diameter as mentioned in the schedule including fixing.

2.19.2. MATERIAL : The Air Valve shall be of heavy quality conforming to IS 14845 with IS certification mark and isolation valve.. The body, domes, covers, stuffing box, thrust plates, wedges, gland and cap shall be of cast iron not less than of grade 20 and inside working parts should be of any non-ferrous or ferrous materials.

2.19.3. FIXING : The Air Valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted by means of flange joints or screwed joint to the pipe line.

2.19.4. TESTING : The Air Valve and the joints shall be tested hydraulically to a minimum pressure as per testing clause of piping work. The testing shall be done along with the testing of pipe line.

2.19.5. THE RATE INCLUDES FOR :

1. Supplying and fixing Air Valve of specified diameter and type.
2. Supplying G.I. pipe and fittings if required.
3. All necessary labour, material and use of tools.

2.19.6. MODE OF MEASUREMENT : The measurement shall be for each unit of Air Valve fixed C.I. and G.I. specials, making lead or flange joint etc. shall be measured under the relevant items.

2.19.7. MODE OF PAYMENT : The contract rate shall be for each unit of air valve fixed.

2.20. BUTTER FLY VALVE :

2.20.1. GENERAL : The item includes supplying and fixing of butterfly valve of specified diameter as mentioned in the schedule.

2.20.2. MATERIAL : The butterfly valve shall be flanged type or as specified conforming to IS 13095 & BS -5155. The valve shall be bubble tight, resilient sealed suitable for flow in either direction with accompanying flanges and steel handle.

2.20.3. FIXING : The butterfly valve shall be fixed to the pipe line in position as indicated in the drawing and as directed by the Engineer-In-Charge.

2.20.4. TESTING : The valve and the joints shall be tested to a minimum hydraulically pressure of 10kg/sqcm for a duration of two hours or as per testing clause of piping work. The testing shall be done along with the testing of pipe line. The leaky joints shall be rectified to the satisfaction of the Engineer-In-Charge.

2.20.5. THE RATE INCLUDES FOR :

1. Supplying and fixing Butterfly Valve of specified diameter.
2. Supplying G.I. pipe and fittings if required.
3. All necessary labour, material and use of tools.

2.20.6. MODE OF MEASUREMENT: The measurement shall be for each unit of butterfly Valve fixed. C.I. and G.I. specials, making lead or flange joint etc. shall be measured under the relevant items.

2.20.7. MODE OF PAYMENT: The contract rate shall be for each unit of butterfly valve fixed.

2.21. STAND POST TYPE FIRE HYDRANT :

2.21.1. GENERAL : The item includes supplying of C.I. Stand Post type Fire hydrant, C.I. sluice valve etc. including fixing.

2.21.2. MATERIAL : Stand post column shall be fitted with 65 mm size instantaneous male coupling and 80 mm size C.I. duck-foot bend, C.I. sluice valve etc.. Stand post hydrant shall conform to the relevant IS code. 80 mm socketed or flanged tail piece shall be as per site requirements. Sluice valve shall conform to the relevant IS code with necessary flanged/lead joints.

2.21.3. FIXING : Hydrant and C.I. sluice valve shall be fixed in position as indicated in the drawing or as directed. They shall be fitted by means of flange joints on the pipe line.

2.21.4. TESTING : The Hydrant and the joints shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.

2.21.5. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

2.21.6. THE RATE INCLUDES FOR :

1. Supplying and fixing 80 mm dia. Stand post column fitted with 65 mm size instantaneous male coupling, C.I. duck-foot bend, C.I. sluice valve, making lead/flanged joints etc.
2. Dewatering the trench or pit till completion of work.
3. All necessary labour, material and use of tools.

2.21.7. MODE OF MEASUREMENT : The measurement shall be for each unit of stand post hydrant fixed. Tail piece, making additional flange joint, lead joint for extension piece etc. shall be measured under the relevant items.

2.21.8. MODE OF PAYMENT : The contract rate shall be for each unit of stand post hydrant with C.I. Sluice valve fixed.

2.22. FERRULE CONNECTION :

2.22.1. GENERAL : The item includes making ferrule connection with existing C.I. or G.I. water supply line including fittings and fixtures.

2.22.2. MATERIAL : The ferrule shall be of gun metal or hard brass of diameter as specified in the schedule. It shall be fitted with screwed plug or valve capable of completely shutting off water supply. Coupling shall be casted in one piece with cast iron bell mouth cover.

2.22.3. FIXING : The ferrule shall be fixed to the water supply pipe line of specified diameter without protruding inside including making hole in the water main and covering with cast iron bell mouth cover. The ferrule shall be fitted water tight.

2.22.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till completion of the work.

2.22.5. TESTING : Ferrule shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.

2.22.6. THE RATE INCLUDES FOR :

1. Ferrule, coupling and cast iron bell mouth cover.
2. Boring hole in the water main and fixing ferrule.
3. Dewatering the trench or pit till completion of work.
4. All necessary labour, materials use of tools.

2.22.7. MODE OF MEASUREMENT : The measurement shall be for each unit of ferrule connection.

2.22.8. MODE OF PAYMENT : The contract rate shall be for each unit of ferrule connection.

2.23. MAKING CONNECTION WITH WATER MAIN:

2.23.1. GENERAL : The item includes connection with the existing C.I. or G.I. water supply line including fittings & fixtures.

2.23.2. MATERIAL : C.I. or G.I. specials shall be conforming to relevant IS code and flange joint or lead joint shall be as per specifications described herein before.

2.23.3. MAKING CONNECTION : The connection shall be made with existing C.I. or G.I. water pipe line of specified diameter. The existing water supply pipe line shall be cut or disjointed carefully where the connection is to be made. The connection shall be made with providing C.I. or G.I. specials as per site requirement including making flanged joint or lead joint.

2.23.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause till completion of the work.

2.23.5. TESTING : The connection shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.

2.23.6. THE RATE INCLUDES FOR :

1. Cutting, disjointing the C.I. or G.I. water supply line.
2. Supplying of C.I. or G.I. specials
3. Making flanged joint, lead or screwed joint including providing new flange.
4. Dewatering the trench or pit till completion of the work.
5. All necessary labour, material and use of tools.

2.23.7. MODE OF MEASUREMENT : The measurement shall be for one job making connection with existing water supply line complete in all respect. Including required fittings, fixtures, specials, making flanged joint or lead joint etc. which shall not be measured separately.

2.23.8. MODE OF PAYMENT : The contract rate shall be for one job making connection with existing water supply line complete in all respect. No payment shall be made for any required fittings, fixtures, and specials and making flanged joint or lead joint used in the connection.

2.24. MAKING CONNECTIONS WITH MUNICIPAL WATER MAIN :

2.24.1. GENERAL : The item includes connection with existing C.I. or G.I. water supply line including fittings and fixtures.

2.24.2. MATERIAL : C.I. or G.I. specials shall be conforming to relevant IS code and flange joint or lead joint shall be as per specifications described herein before.

2.24.3. MUNICIPAL CHARGES : If the connection shall be made with the water supply line of Municipal Corporation, the contractor shall obtain necessary permission from the concerned municipal authorities. He shall pay all the necessary charges towards the connection being permitted by the Municipality.

2.24.4. MAKING CONNECTION : The connection shall be made with existing C.I. or G.I. water pipe line of specified diameter. The existing water supply pipe line shall be cut or disjointed carefully where the connection is to be made. The connection shall be made with providing CI or GI. specials as per site requirement including making flanged joint or lead joint.

2.24.5. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

2.24.6. TESTING : The connection shall be tested under the testing clause of pipe line. The testing shall be done along with the testing of pipe line.

2.24.7. THE RATE INCLUDES FOR :

1. Cutting, disjointing the C.I. or G.I. water supply line.
2. Supplying C.I. or G.I. specials.

3. Making flanged joint, lead joint or screwed joint including providing new flange.
4. Dewatering the trench or pit till completion of work.
5. All necessary labour, material and use of tools.

2.24.8. MODE OF MEASUREMENT : The measurement shall be for one job of making connection with existing water supply line complete in all respect, including required fittings, fixtures, specials, making flanged joint or lead joint etc. Which shall not be measured separately.

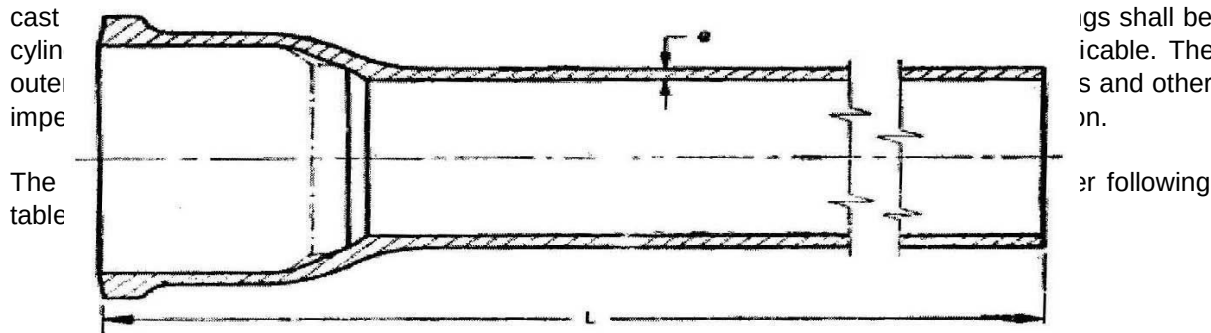
2.24.9. MODE OF PAYMENT: The contract rate shall be for one job of making connection with existing water supply line.

3.0. DRAINAGE SYSTEM

3.1. CAST IRON SOIL QUALITY PIPING WORK :

3.1.1. GENERAL The item includes supplying of soil quality CAST IRON pipe of specified diameter with fittings and fixtures including laying, fixing, cutting, jointing and painting the pipe line.

3.1.2. MATERIAL Cast Iron soil quality pipes and fittings shall have ISI certification mark. Sand - Cast, Cast Iron Soil quality or rain water pipes and fittings shall confirm to IS 1729 and centrifugally cast cylinders shall be available. The s and other on.



Tolerance : Mass (-) 5% , thickness (-) -2mm, pipe length (+/-) 20 mm, fitting length (+/-) 10 mm

The Dimensions, weight of Spun cast pipes and fittings shall be as per following table of IS 3989 - 1984 or its latest revision.

	Nominal dia	Thickness of wall
1	50 mm	5mm

2	75mm	5mm
3	100mm	5mm
4	150mm	5mm

Tolerances : ((a) Thickness (-)15% (b) Weight (-) 10% (c) Length (+ / -) 20 mm) shall as per IS 3989

	Nominal dia	Thickness
1	50 mm	3.5mm
2	75mm	3.5mm
3	100mm	4mm
4	150mm	5mm

3.1.3. **EXAMINING** : Before laying the pipe line, it shall be first examined for damages and cracks. No cracked or damaged pipe and fittings shall be used in the work and they shall remove from the site by the contractor at his own cost & charge.

3.1.4. **CLEANING** : All pipes and fittings shall thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side of piping material.

3.1.5. **FIXING** : The pipe shall be fixed as shown in the drawing. If the holes are not left in parapet, wall, beam, slab, floor, etc., they shall be cut and cavity surrounding the pipe made good properly after fixing the pipe. The pipe shall be fixed with nails and M.S. clamps having thickness not less than 3 mm , 20 mm wide or as specified in the schedule with socket facing up.

Spacing between clamps for fixing internal piping shall be as per IS 2065 – 1983 as given below :

	Horizontal Runs	Vertical Runs
50mm	2 M	2 M
80 & 100mm	2.5 M	2.5 M

The pipe and fitting shall be kept 50 mm away from the wall face to facilitate cleaning and painting etc. For rain water pipe the inlet end shall be carefully fixed to admit water from roof and shoe shall be fixed at outlet. Cowl shall be fixed at top end of the vent pipe.

3.1.6. MAKING LEAD JOINT : The spigot shall be carefully centered in the socket by one or more laps of spun hemp yarn twisted into ropes of uniform thickness thoroughly soaked in hot coal-tar or bitumen and cooled before use. The joints shall be made with molten lead and hemp yarn. The lead shall be melted rendering it thoroughly fluid and each joint shall be filled in one pouring. The lead may project 3 mm beyond the face of the socket against the outside of spigot, but must be flushed with the outside edge of the socket.

After the lead has been run into the joint, the lead shall be thoroughly caulked by a suitable caulking tool and 2 Kg hammer and the joint left neat and smooth. The consumption of lead will be worked out on the basis of actual observation at sit. The following table shows consumption of lead and yarn per joint.

3.1.7. TESTING : The pipe line which is laid on the ground or below the ground level, the joints shall be tested with two meter head of water from a higher section of pipe line.

The pipe line fixed vertically on the wall shall be tested by the smoke test. The Greasy cotton waste shall be burnt in a smoke machine consisting of bellows and a burner. If any lead joint is found to be sweating or leaking, the contractor shall rectify the same till water tightness is attained to the full satisfaction of the Engineer-In-Charge.

3.1.8. DEWATERING : In case of underground piping, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause,

3.1.9. THE RATE INCLUDES FOR :

1. Supplying of C.I. soil quality Pipes and fittings, cowl for vent and shoe for rain water pipe of specified diameter with M.S. clamps and nails.
2. Laying, fixing, cutting and joining the pipe wherever necessary and wastage.
3. Making the lead joint including cost of fuel, wood, jointing with lead, spun yarn etc.
4. Fixing the pipe line with M.S. clamps not less than 3 mm thick, 20 mm wide and M.S. nails length not less than 60 mm and painting the clamps and nails.
5. Supplying and fixing rubber gasket to every cleaning access of cast iron pieces.
6. Painting the pipe line with two coats of black anti corrosive bitumastic paint or painting with synthetic enamel paint over appropriate primer, in case the pipe line exposed in elevation.
7. Testing the pipe line with smoke test or with two meter head of water.
8. Dewatering if necessary till completion of work.
9. All necessary materials, labour and use of tools.

3.1.10. MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the Centre line of pipe. No measurement shall be recorded separately for fittings. Making lead joint, painting and testing.

3.1.11. **MODE OF PAYMENT:** The contract rate shall be for unit running meter length of pipe line laid or fixed.

3.2. **UPVC-SWR PIPING WORK :**

3.2.1. **GENERAL :** The item includes supplying of UPVC soil, waste and rain water (SWR) and ventilation pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting if required etc.

3.2.2. **MATERIAL :** The pipes shall conforming to IS 13592, UPVC -SWR (Type 'A' or 'B' as specified) and fittings conforming to IS 13591 shall be free from cracks, flaws and defects and shall be U. V. stabilized and able to withstand a pressure as mentioned in the schedule of work. Rubber sealing rings conforming to IS 5382 with lubricant for sliding socket joints as mentioned in the schedule of work.

3.2.3. **EXAMINING :** Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

3.2.4. **CLEANING :** All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side surfaces.

3.2.5. **LAYING :** The pipes shall be carefully laid straight to the correct alignment in gradients as indicated in the drawing. All the pipe shall be used in standard length as far as possible. Cut length may be used only where it is necessary to make up exact length.

The entire length of pipe shall be evenly supported on bed of the trench through out. Care shall be taken to prevent any sand, earth or other materials from entering into the pipes during laying. At the end of day's work the open end shall be suitably plugged.

3.2.6. **FIXING :** The pipe line shall be fixed in position as shown in the drawing or as directed by the Engineer-In-Charge. The pipe shall be fixed with G.I. clamps not less than 2.0 mm thick of with suitable UPVC clamps/clips, The clamps/clips shall be fixed into the wall with G.I. nails not less than 40 mm long and wooden gutties keeping the pipe about 15 mm clear of the wall.

3.2.7. **MAKING JOINT :** The jointing of pipes and fittings generally shall be done with approved make cement solvent including making surface rough or rubber sealing rings with lubricant for sliding socket joints . The pipe shall be cut to desired length. Care shall be taken that that profile or cut surfaces shall not be changed and the fibrous material shall be removed with scraper or knife.

3.2.8. **DETACHABLE JOINT :** Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

3.2.9. **PAINTING :** In case of underground piping, the pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer.

3.2.10. **DEWATERING :** In case of underground pipes ,the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

3.2.11. **TESTING :** Please see clause no.5.3.10

3.2.12. **THE RATE INCLUDES FOR :**

1. Supplying of UPVC-SWR pipes and fittings of specified diameter.

2. Laying and cutting the pipe wherever necessary and wastage.
3. Fixing the pipe line with G.I. clamps not less than 2mm thick and G.I./M.S. nails length not less than 40mm or with UPVC clamps, screws, wooden gutties etc.
4. Making the solution joint and painting if mentioned in schedule of work the pipe line.
5. In case of underground pipes , dewatering if necessary till completion of work.
6. All necessary materials, labour and use of tools.

3.2.13. **MODE OF MEASUREMENT** : The measurement shall be for unit running meter length of pipe line laid of fixed. The measurement shall be taken along the Centre line of pipe. No measurement shall be recorded separately for fittings, making joint, painting if mentioned in schedule of work and testing.

3.2.14. **MODE OF PAYMENT** : The contract rate shall be for unit running meter length of pipe line laid or 3

3.3. HIGH DENSITY POLYETHYLENE PIPING WORK FOR DRAINAGE:

3.3.1. **GENERAL** : The item includes supplying of HDPE pipes with fittings of specified diameter including laying, fixing, cutting, jointing.

3.3.2. **MATERIAL** : The pipes and fittings shall conform to IS 14333. HDPE pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.

3.3.3. **EXAMINING** : Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

3.3.4. **LAYING** : Please refer clause 4.4.03

3.3.5. **FIXING** : Please refer clause 4.4.05

3.3.6. **MAKING JOINT** : Please refer clause 4.4.06

3.3.7. **DETACHABLE JOINT** : Please refer clause 4.4.07

3.3.8. **ANTISYPHONAGE** : The HDPE pipes shall be used for anti-syphonage including provision, cutting, wastage, bending, dressing, jointing with cement solution, necessary plugs, brass fittings such as brass thimbles, brass union, brass cleaning caps and other brass fittings as required.

3.3.9. **DEWATERING** : In case of under ground piping works, the contract rate shall include bailing or pumping out all the water till completion of work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

3.3.10. **TESTING** : The joints shall be tested by either smoke test for vertical stacks or 2.5 m head of water at the highest point of the section under test for horizontal drainage pipes. Smoke shall be pumped into the pipes at the lowest end from a smoke machine which consists of a bowl and burner. The material usually burnt is greasy cotton waste which gives out a clear pungent smoke which is easily detectable by sight as well as by smell, if there is leak at any point of the drain. The water head test shall be carried out by suitably plugging the lower end of the drain and the ends of the connection if any and filling the system with water. A knuckle bend shall be temporarily jointed to it so as to provide required test head , or the top may be plugged with a connection to a hose ending in a funnel

which could be raised or lowered till the required head is obtained and fixed suitable for observation. The leaky joints shall be remade and section re-tested at no extra cost.

3.3.11. THE RATE INCLUDES FOR :

1. Supplying of HDPE pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Making the solution joint or mirror joint, painting if mentioned in schedule of work
4. Fixing the pipe line with G.I. clamps not less than 20 mm x 1 mm thick and G.I./M.S. nails length not less than 40mm or HDPE clamps, screws, rawl plug etc.
5. In case of underground pipes , dewatering the pit or trench till completion of work.
6. All necessary labour, materials and use of tools.

3.3.12. MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the centre line of pipe. No measurement shall be recorded separately for fitting, making joint, painting if mentioned in schedule of work and testing.

3.3.13. MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid.

3.4. PVC PIPING WORK :

3.4.1. GENERAL : The item includes supplying of PVC pipes with fittings of specified diameter including laying, fixing, cutting, joining, painting etc. for vent, over flow, waste water pipe line etc.

3.4.2. MATERIAL : The pipes and fittings shall conform to series IV of IS 4985, PVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure as mentioned in the schedule.

3.4.3. EXAMINING : Before laying the pipe line, it shall be first examined for damages and cracks, No cracked or damaged pipe and fittings shall be used in the work and they shall be removed from the site by the contractor at his own cost and charge.

3.4.4. CLEANING : All the pipes and fittings shall be thoroughly cleaned with brush and washed if necessary to remove any accumulated stone, soil or dirt inside and out side surfaces.

3.4.5. LAYING Please refer clause 4.5.05

3.4.6. FIXING : Please refer clause 4.5.06

3.4.7. MAKING JOINT : Please refer clause 4.5.07

3.4.8. DETACHABLE JOINT : Detachable joints shall be made where pipes of different materials have to be jointed or as specified in the schedule. The flanges are first pushed over the pipe ends and jointing shall be made by cement solvent.

3.4.9. PAINTING : If mentioned in schedule of work, the pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer.

3.4.10. DEWATERING : In case of underground pipes, the contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

3.4.11. TESTING : Please refer para 5.3.10.

3.4.12. THE RATE INCLUDES FOR :

1. Supplying of PVC pipes and fittings of specified diameter.
2. Laying and cutting the pipe wherever necessary and wastage.
3. Fixing the pipe line with G.I. clamps not less than 2mm thick and G.I./M.S. nails length not less than 40mm or with PVC clamps, screws, wooden gutties etc.
4. Making the solution joint and painting the pipe line if mentioned in schedule of work.
5. In case of underground piping, dewatering if necessary till completion of work.
6. All necessary materials, labour and use of tools.

3.4.13. MODE OF MEASUREMENT : The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the Centre line of pipe. No measurement shall be recorded separately for fittings, making joint, painting and testing.

3.4.14. MODE OF PAYMENT : The contract rate shall be for unit running meter length of pipe line laid or fixed.

3.5. GULLY TRAP :

3.5.1. GENERAL : The item includes provision of S.W. Gully trap with C.I. frame including construction of Gully Trap Chamber.

3.5.2. MATERIAL : The Gully Trap shall be of salt glazed stoneware with 150 mm nominal square inlet or as specified in the schedule with 100mm diameter outlet. Brick work, plastering, concreting shall be as per general specifications under section-II.

3.5.3. CONSTRUCTION :

1. Internal dimension of the Gully trap chamber shall be as specified in the schedule.
2. Foundation of 1:4:8 concrete shall be 150 mm thick, and shall have 100mm offset.
3. Brick masonry shall be of 230 mm thick in cement mortar 1:6 and masonry shall be plastered with 15mm thick plaster in 1:3 cement mortars inside and outside surface with smooth finish.

3.5.4. C.I. FRAME AND COVER : C.I. frame and cover shall be fixed with the cement concrete 1:2:4 at the top of Gully trap chamber, the weight of frame and cover shall not be less than 7.5 kg. and they shall be painted with two coats of black bitumastic paint.

3.5.5. DEWATERING : The contract rate shall include bailing or pumping out all the water till completion or work if accumulated during the progress of work either from seepage, springs, rain or any other cause.

3.5.6. THE RATE INCLUDES FOR :

1. Supplying of stoneware gully trap with C.I. frame and cover.

2. Concreting, brick work, plastering, fixing frame and cover.
3. Dewatering if necessary till completion of work.
4. All necessary materials, labour and use of tools.

3.5.7. **MODE OF MEASUREMENT:** The measurement shall be for unit of Gully Trap chamber of specified internal size and depth constructed including stoneware Gully Trap and C.I. frame and cover fixed.

3.5.8. **MODE OF PAYMENT:** The contract rate shall be for unit of Gully Trap chamber constructed as a whole.

3.6. **C.I. NAHANI / FLOOR TRAP :**

3.6.1. **GENERAL :** The item includes supplying of cast iron nahani / floor trap with CP brass/stainless steel grating of specified diameter with fittings and fixtures including fixing and jointing with the pipe line.

3.6.2. **MATERIAL :** 65 mm nominal outlet dia C I Nahani trap weighing not less than 4.5 kg with an effective water seal of 20 mm or 75mm nom. outlet dia. floor trap (100mm inlet dia.)/ nahani trap (165mm inlet dia.) conforming to IS 3989 or IS1729 shall be provided as specified in the schedule of quantities. Top grating shall be of CP brass or stainless steel of heavy quality of size and shape to suit the trap.

3.6.3. **FIXING :** C.I. nahani/ floor trap with the bend and pipe piece shall be fixed in position over the bed of 1:2:4 cement concrete. The jointing trap and pipe shall be caulked with 1:1 cement mortar. The grating shall be fixed over the nahani / floor trap flush with the floor level and the gap finished with matching cement.

3.6.4. **THE RATE INCLUDES FOR :**

1. C.I. nahani/ floor trap with CP brass or stainless steel grating as specified in the item.
2. Fixing the trap and getting with cement mortar or concrete.
3. All necessary materials, labour and use of tools.

3.6.5. **MODE OF MEASUREMENT :** The measurement shall be for unit of nahani trap fixed.

3.6.6. **MODE OF PAYMENT:** The contract rate shall be for unit of nahani trap fixed.

3.7. **RAIN WATER GRATING :**

3.7.1. **GENERAL:** The item includes supplying of cast iron grating of specified diameter including fixing and painting.

3.7.2. **MATERIAL:** The rain water grating shall be Cast Iron with closed grained without any casting defects. The thickness should be uniform throughout, one shaped C.I. grating.

3.7.3. **FIXING:** C.I. rain water grating shall be fixed in position with 1:1 cement mortar.

3.7.4. **THE RATE INCLUDES FOR :**

1. The cast iron rain water grating cement, sand etc.
2. Fixing the grating.

3. All necessary materials, labour and use of tools.

3.7.5. MODE OF MEASUREMENT: The measurement shall be for each unit of grating fixed.

3.7.6. MODE OF PAYMENT: The contracts rate shall be for each unit of grating fixed.

3.8. LEAD SHEET FLASHING :

3.8.1. GENERAL : The item includes supplying lead sheet flashing of specified size including laying, fixing, cutting, jointing and laying.

3.8.2. MATERIAL : Lead sheet flashing shall not be less than 3 mm thick & weight should not be less than 38 Kg. per sqm.

3.8.3. FIXING : The lead sheet shall be fixed all around the rain water pipe. The sheet shall project one diameter of socket all-round beyond the outer face of the socket & shall project inside the socket at least half the diameter of the rain water pipe socket. It shall be fixed by bending & breaking the sheet to shape, placing, tucking below waterproofing courses etc.

3.8.4. THE RATE INCLUDES FOR :

1. The lead sheet flashing, cement concrete and cement mortal etc.

2. Fixing the lead sheet in position.

3. All necessary materials, labour and use of tools.

3.8.5. MODE OF MEASUREMENT : The measurement shall be for each unit of lead sheet flashing fixed.

3.8.6. MODE OF PAYMENT : The contract rate shall be for each unit of lead sheet flashing fixed.

3.9. RAIN WATER G.I. SPOUT :

3.9.1. GENERAL : The item include supplying of G.I. rain water spouts of specified diameter with or without fitting at outlet including fixing. Cutting and painting.

3.9.2. MATERIAL : The rain water spout shall be of heavy quality G.I. pipe of approximate 400 mm length or as specified in the schedule of work. The 'T' of same diameter shall be fixed at the out let of spout. G.I. Pipe and fitting shall be as per specifications under section IV.

3.9.3. FIXING : G.I. rain water spout shall be fixed in the position as shown in the drawing including breaking, cutting RCC pardi, brick wall, RCC floor etc. It shall be fixed with 1:1 cement mortar and 1:2:4 cement concrete.

3.9.4. PAINTING : The exposed part of spout shall be painted with two coats of approved flat oil paint over a coat of primer.

3.9.5. THE RATE INCLUDES FOR :

1. The G.I. rain water spout, cement concrete and cement mortar.

2. Fixing and painting the spout.

3. All necessary materials, labour and use of tools.

3.9.6. MODE OF MEASUREMENT : The measurement shall be for each unit of G.I. spout fixed.

3.9.7. MODE OF PAYMENT : The contract rate shall be for each unit of G.I. spout fixed.

3.10. RAIN WATER C.I. SPOUT :

3.10.1. GENERAL : The item include supplying of C.I. spouts of specified diameter including fixing, cutting, and painting,

3.10.2. MATERIAL : The spout shall be of heavy quality C.I. pipe of approximate 600 mm long or as specified in the schedule of work. Pipe shall be as per specifications of C.I. piping work under Section-V.

3.10.3. FIXING : C.I. rain water spout shall be fixed in the position including breaking, cutting RCC/ brick structure etc. It shall be fixed with 1:1 cement mortar and 1:2:4 cement concrete.

3.10.4. PAINTING : The exposed part of spout shall be painted with two coats of anticorrosive black bitumastic paint over a coat of primer.

3.10.5. THE RATE INCLUDES FOR :

1. The C.I. Spout, cement concrete and cement mortar.
2. Fixing and painting the spout.
3. All necessary materials, labour and use of tools.

3.10.6. MODE OF MEASUREMENT : The measurement shall be for each unit of C.I. spout fixed.

3.10.7. MODE OF PAYMENT : The contract rate shall be for each unit of C.I. spout fixed.

3.11. GARBAGE CHUTE :

3.11.1. GENERAL : The item include supplying of A.C. garbage chute of specified diameter including fixing & cutting.

3.11.2. MATERIAL : Garbage chute shall be of asbestos cement of dimension as mentioned in the schedule. The refuse disposal system shall consist of A.C. pipes, A.C. refuse junction, A.C. adapter of suitable size and M.S. or Aluminum hopper of 18 gauge suitably capped with vent covers and providing the AC junction at terrace floor opening for periodical flushing / cleaning purpose. Inlet hopper which is to be located at each floor shall be closed with rubber seal along the shutter and shall be of 18 gauge aluminum / M.S. sheet and suitable for all diameter of shafts.

3.11.3. FIXING : A.C. refuse junction shall be fixed at convenient height and it should not exceed 75 cms. From floor level or as directed by the Engineer-In-Charge.

Square opening of refuse junctions shall be embedded in masonry or in cement concrete and M.S. Aluminum hoppers shall be fitted with nuts and bolts to the square junction opening and the frame shall flush with the wall.

The refuse disposal system shall be supported by M.S. flats not less than 20 mm x 3 mm thick encircling the pipe or junction below the socket and fixed to the wall with two screws of suitable length on each end of M.S. flats. The entire fixing of the garbage chute shall be carried out as directed by the Engineer-In-Charge.

3.11.4. JOINTING : Joints of sockets and spigot shall be caulked to about 25 mm in depth with bitumastic jointing compound and remaining gap may be grouted with 1:2 cement mortar.

3.11.5. THE RATE INCLUDES FOR :

1. The A.C. garbage chute with all fittings
2. Fixing the garbage chute and joining with 1:1 cement mortar.
3. All necessary materials, labour and use of tools.

3.11.6. MODE OF MEASUREMENTS : The measurement shall be for per running meter length of garbage chute fixed.

3.11.7. MODE OF PAYMENT : The contract rate shall be for per running meter length of garbage chute fixed.

3.12. INSPECTION CHAMBER :

3.12.1. GENERAL : The item includes provision of brick masonry Inspection Chamber of internal size as specified in the schedule.

3.12.2. MATERIAL : Concreting, Brick work, plastering etc, shall be as per specification as given in general specification under section II.

3.12.3. CONSTRUCTION :

1. Internal dimensions and initial depth shall be as specified in the schedule or as shown in the drawing.
2. Foundation of 1:2:4 concrete shall be 150 mm thick and shall have 150 mm offset.
3. The concrete 1:2:4 shall be laid to necessary shapes to form the channel for the pipe being received in the channel. It shall be of appropriate diameter and shall be half round. The sides shall be kept sloping towards the channel.
4. Brick masonry shall be 230 mm thick in cement mortar 1:2 or as specified in the schedule of work, making brick tapering for longitudinal wall 450 mm from top of cover of the chamber.
5. Brick masonry shall be rendered with 20 mm thick plaster in cement mortar 1:1 or as specified in the schedule of work inside and outside surfaces in two courses and inside surface finished smooth with neat cement punning.

3.12.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.12.5. THE RATE INCLUDES FOR :

1. Concreting in foundation, forming the channels, constructing brick masonry and plastering over the brick work, and finishing smooth in side surfaces.
2. Cutting existing stoneware/RCC Hume pipe line to facilitate construction the Inspection chamber.
3. Dewatering the pit if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

3.12.6. MODE OF MEASUREMENT : The measurement shall be for an Inspection chamber of specified finished internal size and initial depth measured vertically from top of the frame and cover to the invert of chamber. Extra for additional depth or rebate for lesser depth shall be measured in R.M.

3.12.7. MODE OF PAYMENT : The contract rate shall be for unit Inspection chamber of specified internal size and initial depth., Extra/Rebate for additional/lesser depth respectively shall be paid in RM.

3.13. CIRCULAR MANHOLE :

3.13.1. GENERAL : The item includes provision of brick masonry Circular manhole of internal size as specified in the schedule.

3.13.2. MATERIAL : Concreting, Brick work, plastering etc. shall be as per specification as given in general specification under section II.

3.13.3. CONSTRUCTION :

1. Internal dimensions and initial depth shall be as specified in the schedule of work or as shown in the drawing.

2. Foundation of 1:2:4 concrete shall be 300 mm thick and shall have 300 mm offset.

3. The concrete 1:2:4 shall be laid to necessary shapes to form the channel for the pipe being received in the channel. It shall be of appropriate diameter and shall be half round. The sides shall be kept sloping towards the channel.

4. Brick masonry shall be in cement mortar 1:2 or as specified in the schedule of work. One meter height from top shall be conical in shape and shall be constructed in 230 mm thick brick masonry and remaining height shall be 345mm thick in cylindrical shape.

5. Brick masonry shall be rendered with 20 mm thick plaster in cement mortar 1:1 or as specified in the schedule of work inside and outside surfaces in two courses and inside surface finished smooth with neat cement punning.

3.13.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.13.5. THE RATE INCLUDES FOR :

1. Concreting in foundation, forming the channels, constructing brick masonry and plastering over the brick work and finishing smooth inside surfaces.

2. Cutting existing stoneware/RCC hume pipe line to facilitate construction of new manhole.

3. Dewatering the pit if found necessary till completion of work.

4. All necessary labour, materials and use of tools.

3.13.6. MODE OF MEASUREMENT : The measurement shall be for one circular manhole of specified finished internal size and initial depth measured vertically from top of the frame and cover to the invert of manhole. Extra over for additional depth or rebate for lesser depth shall be measured in R.M

3.13.7. **MODE OF PAYMENT** : The contract rate shall be for unit circular manhole of specified internal size and initial depth, Extra/Rebate for additional/lesser depth respectively shall be paid in RM.

3.14. **EXTRA DEPTH FOR INSPECTION CHAMBER AND MANHOLE** :

3.14.1. **GENERAL** : The item includes provision for extra depth of Inspection Chamber and manholes of brick masonry.

3.14.2. **MATERIAL** : Concreting, Brick work, plastering etc. shall be as per specification as given in general specification under section II.

3.14.3. **CONSTRUCTION** : Extra depth for inspection chamber and manhole shall be constructed under the clause 5.12.00 & 5.13.00 of the Section -5.

3.14.4. **DEWATERING** : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.14.5. **THE RATE INCLUDES FOR** :

1. Constructing brick masonry and plastering over the brick work.
2. Dewatering the pit if found necessary till completion of work.
3. All necessary labour, materials and use of tools.

3.14.6. **MODE OF MEASUREMENT** : The measurement shall be for unit meter depth or part thereof for inspection chamber / circular manhole constructed. Depth of manhole or chamber shall be measured from top of the frame and cover to the invert level of manhole deducting the initial depth of at manhole/ chamber. Extra for additional depth or rebate for lessor depth shall be measured in R.M.

3.14.7. **MODE OF PAYMENT** : The contract rate shall be for unit meter depth of inspection chamber / circular manhole constructed.

3.15. **DROP CONNECTION** :

3.15.1. **GENERAL** : The item includes provision of drop connection of salt glazed of nominal diameters as specified in schedule of quantities including 1:2:4 cement concrete encased to pipe all round.

3.15.2. **MATERIAL** : Concreting, mortar for jointing the pipes, hemp yarn, salt glazed stoneware pipes and specials like bends, tees, crosses (double tees), plugs caps etc. of specified diameter shall be of grade 'A' or 'AA' conforming to IS 651. All the pipes and fitting shall be free from pin Helen, cracks and other imperfections and should have be free from pin holes, cracks and other imperfections and should have the glossy finish in salt glazing, necessary form work for encasing the pipe.

3.15.3. **DAMAGED MATERIAL** : Any material found damaged or cracked shall not be used in the work and contractor has to replace the same from the site at his own cost and charges.

3.15.4. **LAYING, FIXING, JOINTING, CLEANING, TESTING** : Above shall be done as specified in clause 5.18.00 i.e. salt glazed stone ware piping work.

3.15.5. **ENCASING THE PIPE LINE** : After the joints and pipes have been proved to be water tight then pipe line shall be embedded in cement concrete as specified in the schedule of quantities and as shown in drawings including necessary form work.

3.15.6. DEWATERING : The contractor rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.15.7. THE RATE INCLUDES FOR :

1. Stone ware pipe with specials viz. bends, tees, crosses (double tees), plugs, caps etc. cement mortar 1:1 and spun yarn
2. Laying, jointing and testing the pipe line including cutting & wastage
3. Concreting and formwork for encasing
4. Dewatering if found necessary till completion of work.
5. All necessary labour, materials and use of tools.

3.15.8. MODE OF MEASUREMENT : The measurement shall be for one drop connections of specified nominal dia. of pipe & depth of drop connection shall be measured vertically from the bed level of drop pipe cleaning chamber (i.e. finished top of bed concrete) to the invert level of manhole or chamber. Extra/Rebate for additional/lesser than the initial depth respectively shall be measured in RM.

3.15.9. MODE OF PAYMENT : The Contract rate shall be for one drop connection of specified nominal diameter & depth as specified in the schedule & drawings.

3.16. EXTRA OVER DEPTH FOR DROP CONNECTION :

3.16.1. GENERAL : The item includes provision of extra depth for drop connection including providing and laying salt glazed stone ware pipe & specials, 1:2:4 (or as specified in schedule) cement concrete for on casing the pipe al round square in shape all as specified in drawings & schedule.

3.16.2. MATERIAL : Concreting, mortar for jointing the pipes, hemp yarn, salt glazed stoneware pipes and specials of specified diameter shall be of grade 'A' or 'AA' class and conforming to IS 651-1971. All the pipes and fittings shall be free from pin holes. Cracks & other imperfection and should have the glossy finish of salt glazing, necessary form work encasing the pipes.

3.16.3. DAMAGE / MATERIALS : This clause shall be as per clause 5.21 salt glazed stone ware piping work.

3.16.4. LAYING, FIXING JOINTING, CLEANING AND FIXING : This clause shall be as per clause 5.21 i.e. salt glazed stone ware piping work.

3.16.5. ENCASING THE PIPE LINE : This clause shall be as per clause 5.15.05 as i.e. Drop connection.

3.16.6. DEWATERING : This clause shall be as per clause 5.15.06 i.e. drop connection.

3.16.7. THE RATE INCLUDES FOR :

1. S.W. pipe with specials, cement mortar 1:1 and spun yarn.
2. Laying, jointing and testing the pipe line including cutting and wastage.
3. Concreting and form work for encasing
4. Dewatering if found necessary till completion of work.

3.16.8. MODE OF MEASUREMENT : The depth of drop connection shall be measured vertically from the bed level of drop pipe cleaning chamber (i.e. finished top of bed concrete) to the invert level of manhole or chamber and initial depth shall be deducted.

3.16.9. MODE OF PAYMENT : Contract rate shall be for unit meter depth or part thereof for drop connection

3.17. DROP PIPE CLEANING CHAMBER :

3.17.1. GENERAL : The item includes construction of brick masonry valve chamber of size as specified in this schedule including providing M.S./G.I. frame and cover over R.C.C pre-cast cover with or without surface box.

3.17.2. MATERIAL : Brick work, plastering, concreting etc. shall be as per general specification under section II. Precast RCC cover slab, surface box, C.I./M.S frame and cover etc. shall be size and weight as specified in the schedule.

3.17.3. CONSTRUCTION :

a) Foundation concrete of mix 1:2:4 shall be of 150 mm thick with 150 mm offset around or as specified in the schedule.

b) Brick masonry in cement mortar 1:2 as specified.

c) Plastering inside and outside surfaces of walls in two courses using cement mortar 1:1 of thickness as specified mixed with water proofing compound of specified Quality including inner surfaces finished smooth with neat cement punning.

3.17.4. RCC PRECAST/CAST IRON COVERS

3.17.4.1. RCC PRECAST COVER (for chambers of size upto 600 x 600 mm) : Chamber cover shall be casted as shown in the drawing having minimum 75 mm thick in cement concrete 1:2:4 or as specified in the schedule by using nominal reinforcement @ 100 kg/ Cum. of concrete including shuttering, finishing, curing, placing the cover in position as directed by Engineer-In-Charge.

3.17.4.2. CAST IRON/ M.S COVER: Cast iron/ M.S cover of specified size and weight shall be supplied and placed over the chamber as directed. The cover shall be painted with 3 coats of black bitumastic paint.

3.17.5. DEWATERING: The water accumulated in the pit due to rain, seepage, springs or any other cause during the progress of work shall be pumped / bailed out till the completion of work.

3.17.6. THE RATE INCLUDES FOR :

1. Bed concrete, Brick masonry, cement plaster, RCC pre-cast cover / MS cover etc.
2. Dewatering the trench or pit if necessary.
3. All necessary labour, materials and use of tools.

3.17.7. MODE OF MEASUREMENT: The measurement shall be for each unit of chamber of specified internal size and depth constructed.

3.17.8. MODE OF PAYMENT: The contract rate shall be for each unit of chamber of specified internal size and depth constructed.

3.18. C.I. FRAME AND COVER FOR MANHOLES:

3.18.1. GENERAL: The item includes supply LD/MD/HD/EHD/C.I. frame and cover as specified in schedule including fixing and painting.

3.18.2. MATERIAL: C.I. Frame and cover shall conform to IS 1720 and shall have IS certification mark with grade LD/MD/HD/EHD and the weight of frame and cover shall not be less than as specified in the schedule.

3.18.3. FIXING: Frame shall be fixed in the cement concrete 1:2:4 for bearing course and capping on the brick masonry wall of the chamber of manhole and finishing shall be done in 1:2 cement plaster finished smooth with neat cement.

3.18.4. PAINTING: The frame and cover shall be painted with two coats of approved black bitumastic anticorrosive paint over a coat of primer.

3.18.5. THE RATE INCLUDES FOR:

1. C.I. frame and cover, cement concrete, cement plaster, painting etc.
2. All necessary labour, material and use of tools.

3.18.6. MODE OF MEASUREMENT: The measurement shall be for C.I. Frame & cover on actual unit weight basis.

3.18.7. MODE OF PAYMENT: The contract rate shall be for C.I. Frame and cover on actual unit weight basis.

3.19. PRECAST CONCRETE FRAME AND COVER FOR MANHOLES :

3.19.1. GENERAL: The item includes supply LD/ MD/ HD/ EHD factory made precast steel fiber reinforced concrete (SFRC) frame and cover as specified in schedule including fixing and placing.

3.19.2. MATERIAL: The precast frame and cover shall be of steel fiber reinforced concrete (SFRC) conforming to IS 12592 and shall be of approved make. The frame and cover shall be of LD/ MD/ HD/ EHD grade, size and thickness as mentioned in the description of the item. The defective Frame and cover shall be replaced by the contractor at his own cost and charges.

3.19.3. FIXING: Frame shall be fixed in cement concrete 1:2:4 for bearing course & capping on the top of masonry wall of chamber or manhole and finishing shall be done in 1:2 cement plaster finished smooth with neat cement.

3.19.4. THE RATE INCLUDES FOR :

1. Precast S.F.R.C. Frame and cover, cement concrete, cement plaster etc.
2. All necessary labour, material and use of tools.

3.19.5. MODE OF MEASUREMENT: The measurement shall be for unit set of Precast S.F.R.C. Frame and cover fixed.

3.19.6. MODE OF PAYMENT: The contract rate shall be for unit set of Precast S.F.R.C. Frame and cover fixed.

3.20. CAST IRON STEPS / RUNGS :

3.20.1. GENERAL: The item includes supplying of cast iron steps including fixing and painting.

3.20.2. MATERIAL: The steps shall be of cast iron and minimum 150 mm wide. The minimum weight of each step shall not be less than 5 kg or as specified in the schedule.

3.20.3. FIXING: The steps shall be fixed in brick masonry wall with 1:2:4 cement concrete with 75 mm cement concrete cover at all around the step. The first step shall be 450 mm below from top surface of structure and next shall be fixed 300 mm centre to centre in two rows at 300 mm distance or as shown in the drawing.

3.20.4. PAINTING: The projected portion of the cast iron step shall be painted with two coats of approved black bitumastic anti corrosive paint over a coat of primer.

3.20.5. DEWATERING: The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.20.6. THE RATE INCLUDES FOR :

1. C.I. Steps cement concrete and painting etc.
2. Dewatering if found necessary till completion of work.
3. All necessary labour, material and use of tools.

3.20.7. MODE OF MEASUREMENT: The measurement for C.I. steps shall be on actual unit weight basis or unit C.I. step fixed as specified in the schedule.

3.20.8. MODE OF PAYMENT: The contract rate for C.I. steps shall be on actual unit weight basis or unit C.I. step fixed.

3.21. SALT GLAZED STONE WARE PIPING WORK :

3.21.1. GENERAL: The item includes supplying, laying and fixing the salt glazed Stone ware pipes with necessary fittings of specified diameter including laying, jointing etc.

3.21.2. MATERIAL: Salt glazed stoneware pipes and specials of specified diameter shall be of grade "A" or "AA" conforming to IS 651. All the pipes and fitting shall be free from pin holes, cracks and other imperfections and should have the glossy finish of salt glazing.

3.21.3. DAMAGED MATERIAL: Any material found damaged or cracked shall not be used in the work contractor has to replace the same from the site at his own cost and charge.

3.21.4. TRENCHES: The trench shall be so dug that the pipe can be laid to the required alignment and at the required depth. When the pipe line is under road way, a minimum cover of 900 mm is recommended for adoption, but it may be modified to suit local conditions.

Unless otherwise specified by the Engineer-In-Charge, the width at bottom of trenches for different diameters of pipe laid at different depths shall be as given below:

- a) For all diameters, up to an average depth of 1200 mm , width of trench in mm shall be equal to diameter of pipe plus 300 mm.
- b) For all diameters for depths above of 1200 mm , width of trench in mm shall be equal to the diameter of pipe plus 400 mm.

c) Notwithstanding (a) & (b) above, the total width of trench shall not be less than 750 mm for depths exceeding 900 mm.

The width of trench in the upper reaches shall be increased as described in sub head under “Earth Work.”

3.21.5. LAYING AND FIXING : Pipes shall be laid carefully to the correct alignment, levels and gradient and care shall be taken to prevent for entering the sand, earth or other foreign material into the pipes during laying. The pipes between manhole shall be laid truly in straight line, without vertical or horizontal undulations.

All inverts shall be laid from sight rails fixed at the true levels, with proper boning rods, The pipes shall be laid sockets facing up the gradient, alignment at the lower end and with the socket resting in the concrete bed if specified. Each pipes shall be laid singly and no pipe shall be laid until the trench has been excavated up to the required depth for a distance of 5meter in front of the pipes to be laid.

3.21.6. JOINTING : Spun yarn soaked in cement wash shall be passed round the spigot and spigot inserted in the socket, The spun yarn shall then be caulked with 1:1 cement mortar with a little water, pressed into the joint with hand and finished at 45 degree The mortar shall be cured for seven days.

The following table shows the details of materials used for jointing the S.W. pipe.

3.21.7. CLEANING: Interior surface of the pipes and fittings shall be cleaned off from all dirt, cement mortar and superfluous materials.

3.21.8. TESTING : The joints of S.W. Pipe line shall be tested for a minimum 2.50 metre water head over the crown of the highest pipe between the two manholes. The lower end shall be plugged water tight. Water shall then be filled in the inspection chamber or manhole at the upper end of the line with 2.50 metre depth of water over the crown. If it is found the certain pipe joints are leaking, the water shall be drained off and joints shall be re-caulked. The hydraulic test shall be carried out in accordance with IS 4127.

3.21.9. ENCASING THE PIPE LINE : After the joints and pipes have been proved to be water tight then pipe line shall be embedded in cement concrete if specified to the extent of one half of external diameter of the pipes as directed, the concrete being made to slope away towards the sides of the foundations bed. Refilling shall be done with fine selected materials and shall be done in layers not exceeding 150mm thick, watered, consolidated and rammed properly, as specified.

3.21.10. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.21.11. THE RATE INCLUDES FOR :

1. S.W. Pipes with specials, cement mortar 1:1 and spun yarn.
2. Laying, jointing and testing the pipe line including cutting and wastage.
3. Dewatering if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

3.21.12. MODE OF MEASUREMENT : The measurement shall be for unit meter length of pipe line laid. The pipe shall be measured along the Centre line over all fittings. The measurement does not include for encasement of the pipe, which will be paid the relevant item.

3.21.13. MODE OF PAYMENT : The contract rate shall be for unit meter S.W. pipe line laid.

3.22. SEWER TRAP :

3.22.1. GENERAL : The item includes supplying, laying and fixing the Stone ware sewer trap of specified diameter including fixing, jointing and embedding.

3.22.2. MATERIAL : Sewer trap shall be salt glazed of stoneware of specified diameter and shall be of grade "A" or "AA" conforming to IS 651. Sewer trap should be free from pin holes, cracks and other imperfections and should have the glossy finish of salt glazing.

3.22.3. DAMAGED MATERIAL : Any material found damaged or cracked shall not be used in the work and contractor has to replace the same from the site at his own cost and charge.

3.22.4. FIXING : Sewer trap shall be laid carefully to the correct alignment, levels and gradient and care shall be taken to prevent for entering the sand, earth or other free material into the trap during laying. The trap shall be on bedded in CC 1:2:4 including necessary form work.

3.22.5. TESTING : The testing shall be done along the testing of sewer line with the same specification.

3.22.6. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.22.7. THE RATE INCLUDES FOR :

1. S.W. sewer trap, cement mortar 1:1 and spun yarn.
2. Laying, jointing on bedding in CC 1:2:4
3. Dewatering if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

3.22.8. MODE OF MEASUREMENT : The measurement shall be for each unit of sewer trap fixed..

3.22.9. MODE OF PAYMENT : The contract rate shall be for each unit of sewer trap fixed.

3.23. CONNECTION WITH DOMESTIC SEWER :

3.23.1. GENERAL: The item includes the provisions of connecting sewer line with existing sewer line chamber or manhole including cutting, breaking of masonry, road surface and making good to the original condition of the damages.

3.23.2. MATERIAL: Concreting, Brick work, plastering etc. shall be as per specification as given in general specification of section II.

3.23.3. MAKING CONNECTION :

1. Breaking or cutting the road surface for sewer connection.
2. Restoring all the excavated items in proper manner as directed by the Engineer-In-Charge.
3. Cutting the brick masonry wall to required size of existing manhole or inspection chamber.
4. Connecting the sewer line to the chamber or manhole.

5. Making good to the original condition all the damages after completion of sewer connection.
6. Disposing off all the superfluous material as directed.

3.23.4. DEWATERING: The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.23.5. THE RATE INCLUDES FOR :

1. Cutting the road surface as required and making good.
2. Restoring all the excavated materials and disposal of superfluous materials.
3. Cutting the manhole masonry, making good masonry and other damages to the original condition according to the bye-laws
4. Dewatering if found necessary till completion of work.
5. All the necessary labour, materials and use of tools.

3.23.6. MODE OF MEASUREMENT: The measurement shall be for one job.

3.23.7. MODE OF PAYMENT: The contract rate shall be for one job.

3.24. CONNECTION WITH MUNICIPAL SEWER LINE :

3.24.1. GENERAL : The item includes the provisions of connecting sewer line with existing municipal sewer line chamber or manhole including cutting, breaking of masonry, road surface and making good to the original condition of the damages.

3.24.2. MATERIAL : Concreting, brick work, plastering etc. shall be as per specification as given in general specification under section II.

3.24.3. MAKING CONNECTION :

1. Breaking or cutting the road surface for sewer connection.
2. Restoring all the excavated items in proper manner as directed by the Engineer-In-Charge.
3. Cutting the brick masonry wall to required size of municipal manhole or inspection chamber.
4. Connecting the sewer line to the chamber or manhole of Municipal sewer line.
5. Making good to the original condition all the damages after completion of sewer connection.
6. Disposing off all the superfluous materials as directed.
7. All necessary labour, materials and use of tools.

3.24.4. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

3.24.5. MUNICIPAL CHARGES : The contractor shall obtain the necessary permission for connecting the sewer line to the municipal sewer from the concerned authorities. He shall pay all necessary charges towards the connection given by the municipality.

3.24.6. THE RATE INCLUDES FOR :

1. Cutting the road surface as required and making good.
2. Restoring all the excavated materials and disposal of superfluous materials.
3. Cutting the manhole masonry, making good masonry and other damages to the original condition according to the bye-laws.
4. All the municipal charges towards connection.
5. Dewatering if found necessary till completion of work.
6. All necessary labour, material and use of tools.

3.24.7. MODE OF MEASUREMENT: The measurement shall be for one job.

3.24.8. MODE OF PAYMENT: The contract rate shall be for one job.

4.0. WATER TANK, SEPTIC TANK, UPFLOW FILTER & SOAK PIT

4.1. FRAME AND COVER :

4.1.1. GENERAL: The item includes supplying of M.S. or C.I. frame with cover of size as specified in the schedule including fixing and painting. The frame and cover shall be of mosquito proof condition and approved by the Municipality.

4.1.2. MATERIAL : The frame and cover shall be of mild steel or cast iron as specified in the schedule. The weight of frame and cover shall not be less than 50 kilogram's. They should have locking arrangement.

4.1.3. FIXING : The frame shall be fixed in the roof slab of tank or built with hold fast to R.C.C. slab by chasing or cutting slab and grouting with 1:2 cement mortar.

4.1.4. PAINTING : The frame and cover shall be painted with two coats of approved anti corrosive black bitumastic paint over a coat of approved quality primer.

4.1.5. THE RATE INCLUDES FOR :

1. Supplying and fixing frame and cover with locking arrangement.
2. All necessary materials, labour, painting and use of tools.

4.1.6. MODE OF MEASUREMENT : The measurement shall be on actual unit weight basis.

4.1.7. MODE OF PAYMENT : The contract rate shall be for unit weight basis.

4.2. SPOOL PIECE :

4.2-A. MILD STEEL / CAST IRON :

4.2-A.1. GENERAL : The item includes supplying of M.S. Spool piece with end coupling or C.I. Spool piece with end flanges of size as specified in the schedule including fixing and painting.

4.2-A.2. MATERIAL : Spool piece shall be in length 400 mm of G.I. pipe with end coupling or to 600 mm of C.I. spun pipe with end flanges, as specified in the schedule, A mild steel plate of size 3D x 3D or 200 mm x 200 mm whichever is more (where 'D' is the outer diameter of pipe) and shall be welded on the pipe such a way that it can be placed in the Centre of the RCC wall/ floor. The plate shall not be less than 4 mm thick.

4.2-A.3. FIXING: The Spool piece shall be fixed in position as shown in the drawing or as directed by the Engineering in charge. The spool piece in RCC wall / floor of water tank / septic tank shall be fixed by making hole in the shuttering and tying it with reinforcement with M.S. wire, all as directed by the Engineer-In-Charge.

4.2-A.4. PAINTING : Projected length of Spool piece shall be painted with two coats of oil paint or anticorrosive black bitumastic paint as specified.

4.2-A.5. THE RATE INCLUDES FOR :

1. Supplying and fixing of spool piece.
2. All necessary materials, labour, painting and use of tools.

4.2-A.6. MODE OF MEASUREMENT : The measurement shall be taken for each spool piece of specified diameter fixed.

4.2-A.7. MODE OF PAYMENT : The contract rate shall be for each spool piece of specified diameter fixed.

4.2-B. STAINLESS STEEL :

4.2-B.1. GENERAL : The item includes supplying of stainless steel Spool piece with end flanges with required number of bolt holes of size as specified in the schedule & drawings including fixing.

4.2-B.2. MATERIAL : Spool piece shall be of approximate 600 mm long or standard available length of stainless steel pipe conforming to ASTM A312, TP304/TP304L with end flanges as specified in the schedule. A stainless steel plate of size 3D x 3D or 200 mm x 200 mm, whichever is more (where 'D' is the outer diameter of pipe) and shall be welded on the pipe such a way that it can be placed in the Centre of the RCC wall/ floor. The plate shall not be less than 4 mm thick. The stainless steel pipe shall be seamless and scheduled / classified / graded as per actual system requirement and as per ANSI B36.19

4.2-B.3. FIXING : The spool piece shall be fixed in position as shown in the drawing or as directed by the Engineer-In-Charge. The spool piece in RCC wall and floor of water tank shall be fixed by making hole in the shuttering and tying it with reinforcement using M.S. wire, all as directed by the Engineer-In-Charge.

4.2-B.4. THE RATE INCLUDES FOR :

1. Supplying and fixing of spool piece.
2. All necessary materials, labour and use of tools.

4.2-B.5. MODE OF MEASUREMENT : The measurement shall be on total weight / mass basis of pipe pieces, flanges and puddle plate fixed as one unit.

4.2-B.6. MODE OF PAYMENT : The contract rate shall be for unit weight of each spool piece fixed.

4.3. OVER FLOW COUPLING :

4.3.1. GENERAL : The item includes supplying of C.P. Brass over flow coupling with mosquito proof jalli of size as specified in the schedule including fixing and painting.

4.3.2. MATERIAL : The overflow coupling shall be of heavy quality. Over flow coupling and Mosquito proof Jalli shall be of C.P. brass.

4.3.3. FIXING : The over flow coupling & jalli shall be fixed in position as shown in the drawing with leak proof joints.

4.3.4. THE RATE INCLUDES FOR :

1. 1.Supplying & fixing Overflow coupling with mosquito proof jalli.
2. 2.All necessary materials, labour, painting and use of tools.

4.3.5. MODE OF MEASUREMENT : The measurement shall be for each Over flow coupling fixed with mosquito proof jalli.

4.3.6. MODE OF PAYMENT : The contract rate shall be for each over flow coupling fixed.

4.4. BALL VALVE :

4.4.1. GENERAL : The item includes providing horizontal type ball valve with PVC or copper float of size as mentioned in the schedule including fixing.

4.4.2. MATERIAL : Horizontal plunger type ball valve with PVC or copper float shall be conforming to IS 1703. The lever shall be of brass and may be made in one piece and the diameter of the lever rod shall not be less than the diameter of the thread for boss of ball. Float shall be watertight and non-absorbent and shall not contaminate water. Adhesives for joining the part shall not be used. The minimum thickness for copper sheet of copper float shall be 0.45 mm up to 115 mm diameter and 0.55 mm for ball over 115 mm diameter. Valve shall be tested in closed position to the hydraulic pressure of 2 MPa for a minimum period of 2 minutes without leakage and sweating.

4.4.3. MINIMUM MASS : The minimum mass of finished ball valve and float of different size and class shall be as per Table No. 8 of IS 1703.

4.4.4. FIXING : Valve shall be fixed in position as indicated in the drawing with necessary socket, union nuts etc. as per site requirements. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tight joint. Leaking joint if any shall be rectified to make it leak proof.

4.4.5. TESTING : Testing shall be done along with the testing of pipe line, Separate testing if required shall be done as per ISI norms.

4.4.6. THE RATE INCLUDES FOR :

1. Supply of specified diameter ball valve with copper or PVC float & brass lever arm, hemp yarn, linseed oil, zinc etc.
2. All necessary materials, labour and use of tools.

4.4.7. MODE OF MEASUREMENT : The measurement shall be for each ball valve fixed.

4.4.8. MODE OF PAYMENT : The contract rate shall be for each ball valve fixed.

4.5. RUNGS

4.5.1. GENERAL : The item includes supplying of copolymer polypropylene, steel reinforced plastic foot rests/ Rungs of size as specified in the schedule including fixing and painting.

4.5.2. MATERIAL : The Steps shall be of 20 mm size, round or square of copolymer poly propylene, steel reinforced plastic foot rests conforming to ASTM-D-4101 or as specified in the schedule of work.

4.5.3. FIXING : The Rungs shall be fixed in position as shown in the drawing or as directed by the Engineer-In-Charge. It shall be fixed with cement concrete 1:2:4 in position in stone / brick masonry wall or direct cast to concrete wall. The first step shall be fixed 450 mm below from the top surface of structure and other rungs shall be fixed 300 mm Centre to Centre (staggered) as shown in the drawing.

4.5.4. THE RATE INCLUDES FOR :

1. Copolymer steel reinforced rungs, cement concrete etc.
2. All necessary materials, labour and use of tools.

4.5.5. MODE OF MEASUREMENT : The measurement shall be on the basis of unit rung fixed.

4.5.6. MODE OF PAYMENT : The contract rate shall be for unit rung fixed.

4.6. POLYETHYLENE WATER TANK :

4.6.1. GENERAL : The item includes providing polyethylene plastic water tank with cover of capacity as mentioned in the schedule including fixing and making connections such as inlet, outlet, scour, overflow etc.

4.6.2. MATERIAL : The water tank shall be made out of best moulded Polyethylene plastic. It shall be vertical or horizontal type as specified, watertight and non-absorbent and shall not contaminate water. Adhesives shall not be used in joints. The cover shall be of polyethylene / M.S. / C.I. as approved.

4.6.3. FIXING : The plastic water tank with cover shall be installed and fixed as per the manufacturer's specification. The connections such as inlet, outlets, over flow, scour etc. of specified diameter shall be made as mentioned in the schedule including the cost of fittings, fixtures and pipe of approximate 400 mm long.

4.6.4. THE RATE INCLUDES FOR :

1. Supply of polyethylene plastic tank, cover, G.I. pipe, fittings etc.
2. Installation of tank and making connections.
3. All necessary materials, labour and use of tools.

4.6.5. MODE OF MEASUREMENT : The measurement shall be for each polyethylene water tank of specified capacity installed or per litre capacity of water tank.

4.6.6. MODE OF PAYMENT : The contract rate shall be for each polyethylene water tank of specified capacity installed. The support for the tank shall be paid under relevant item.

4.7. MEDIA FOR UP-FLOW FILTER :

4.7.1. GENERAL : The item pertains to the provision of Stone aggregate as filter media of specified size for upflow filter as mentioned in the schedule including laying and filling.

4.7.2. MATERIAL : The media of stone aggregate shall be irregular or cubical in shape. They shall be free from thin, elongated and flat pieces. They should have high specific surface area, high percentage void, space, resistance to abrasion or disintegration during placement, insolubility in sewage or other waste water and resistance to spelling and flaking.

4.7.3. LAYING : The filter media made up of stone aggregate ranging from 40 mm to 75 mm in sizes as shown in the drawing and the same shall be placed in different layers starting from bigger sizes to smaller sizes from bottom.

4.7.4. DEWATERING : The contract rate includes bailing or pumping out all the water if accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.

4.7.5. THE RATE INCLUDES FOR :

1. Supplying and laying stone aggregate.
2. Dewatering, if necessary till completion of work.
3. All necessary materials, labour and use of tools.

4.7.6. MODE OF MEASUREMENT : The measurement shall be for unit cubic meter aggregate filled.

4.7.7. MODE OF PAYMENT : The contract rate shall be for unit cubic meter aggregate filled.

4.8. GENERAL SPECIFICATIONS FOR WATER TANK AND SEPTIC TANK :

4.8.1. GENERAL : Construction of water tank, septic tank and up flow filter is required to be done very carefully with good quality materials. Dense, well compacted concrete of required strength has to be achieved in order to make water tight compartment. The slope in the bed of tank, invert levels of insert, and also the levels of partition and baffle walls should be properly maintained for proper flow of liquid.

4.8.2. TESTING OF WATER TANK AND SEPTIC TANK : After construction of tank, it shall be tested for leak proof ness. The tank shall be first filled with water up to the top of wall. The water level should not drop more than 50 mm within 48 hours. If the drop of water level is found more than 50 mm the defective and leakage point shall be rectified to the full satisfaction of the Engineer-In-Charge.

4.8.3. COMMISSIONING OF SEPTIC TANK : Before commissioning the septic tank, a little quantity of digested sludge, horse or cow dung may be added as a seed sludge to start functioning of bacterial activity in sewage.

4.8.4. BACK FILLING : The back filling shall be done as per specification after satisfactory testing of the tanks. Back filling shall be done in layers all around the tank and above the roof slab of the tank up to the height / depth as directed by the Engineer-In-Charge.

4.8.5. CLEANING OF WATER TANK: The cleaning of the tank shall be done by manually or by Hydro dynamic mechanism with low or high pressure as directed. Potable water, approved disinfectant etc. shall be used for cleaning of water tank before use.

4.8.6. DEWATERING: The contract rate shall include bailing or pumping out all the water if any accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.

4.8.7. MODE OF MEASUREMENT: The work shall be measured under relevant item in the schedule of quantities and paid for. Quoted rates are deemed to include for dewatering, back filling testing and commissioning of water tank, septic tank and up-flow filter.

4.8.8. MODE OF PAYMENT: No additional payments shall be made towards dewatering back filling & commissioning.

4.9. HUME PIPE SEPTIC TANK :

4.9.1. GENERAL : The item pertains to providing Hume pipe septic tank of specified diameter with vent pipe and cap including laying, fixing and making connections.

4.9.2. MATERIAL : The Hume pipe septic tank of specified diameter and capacity with vent pipe and cap. The Hume-pipe septic tank shall be in good condition without any damage and cracks.

4.9.3. LAYING AND FIXING: Hume pipe septic tank shall be fixed in position and level as indicated in the drawing as per the manufacturer's specifications. The pipe joints for connection shall be made in cement mortar 1:1 The vent pipe with cap shall be fixed to the septic tank. Septic tank shall be completely filled with water just before putting into use.

4.9.4. DEWATERING : The contract rate includes bailing or pumping out all the water if accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.

4.9.5. THE RATE INCLUDES FOR :

1. Hume pipe septic tank, vent pipe with cap, cement mortar etc.
2. Laying Hume pipe septic tank, fixing vent pipe, making inlet pipe connection and filling the tank with water.
3. Dewatering the pit, if necessary till completion of work.
4. All necessary labour, material and use of tools.

4.9.6. MODE OF MEASUREMENT : The measurement shall be for each unit of Hume pipe septic tank for specified capacity provided.

4.9.7. MODE OF PAYMENT : The contract rate shall be for each unit of Hume pipe septic tank for specified capacity provided.

4.10. SOAK PIT :

4.10.1. GENERAL : The item pertains to providing Soak pit of specified size as mentioned in the schedule of quantities including filling with brick bats and coarse sand filling around the honey comb brick wall.

4.10.2. MATERIAL : The brick bats shall be from properly burnt bricks and not from over burnt bricks, Coarse sand filling. Brick work and plastering shall be as per general specifications under section II.

4.10.3. CONSTRUCTION : Brick masonry shall be in cement mortar and its size and type shall be as specified in the schedule. The pit shall be filled with loosely packed brick bats. The coarse sand shall be filled around the honey comb brick wall of specified thickness.

4.10.4. DEWATERING : The contract rate includes bailing or pumping out all the water. If accumulated during the progress of work either from rain, seepage, springs or any other cause till completion of the work.

4.10.5. THE RATE INCLUDES FOR :

1. Providing all materials required for the construction of soak pit.
2. Dewatering the pit, if necessary till completion of work.

3. All necessary labour, materials and use of tools.

4.10.6. MODE OF MEASUREMENT : All the items shall be measured separately under the relevant items or as specified in the schedule of work.

4.10.7. MODE OF PAYMENT : All the items shall be paid separately under the relevant item or as specified in the schedule of work.

4.11. RCC SPUN PIPE FOR DRAIN WORK :

4.11.1. GENERAL : The item includes supplying. Laying and fixing the RCC spun pipe of specified diameter and class including all necessary fittings, laying, jointing etc.

4.11.2. MATERIAL : NP3 / NP2 class pipe and collar shall comply with IS 458.

4.11.3. LAYING : The pipe shall be laid to lines, level and slope as indicated in the drawing. The pipe drain shall rest on the bed throughout its length. To ensure this the space between under side of the pipe and the invert of the cradle shall be carefully grouted with cement slurry consisting of one part of cement to three parts of clean washed sand in a manner to avoid the voids during grouting. The contractor shall take precautions to see that dirt, earth or other foreign matter is not allowed on the surface of the cradle or of the pipe resting there on.

No pipe shall be laid / placed / jointed till the alignment of the pipe drain and its levels and gradient have been carefully checked and found correct.

4.11.4. CONCRETE CRADLE : The cradle of concrete shall be allowed to set at least for three days before any pipe is placed on it and the contractor shall take due care in setting the pipe on the cradle so that no damage to the cradle shall occur. If any damage to the cradle occur, it shall be remade or rectified. In case the damage to the cradle is beyond repair, contractor shall cut out the damaged section of the cradle and replace the same at his own cost to the complete satisfaction of the E-in-Ch.

4.11.5. JOINTING : The joints of pipe shall be made by loose collars and the connecting space shall be as minimum as possible. The collars shall be specially roughened inside to provide a better grip. The two adjacent pipe ends will be so designed and manufactured that when butted together concentrically, a dowel shall be left between the two ends. In this dowel, Cement mortar of 1:1 proportion or as specified in the schedule shall be filled. The remaining space between the pipe ends and the collar shall then be caulked with cement mortar 1:1 all-round the external diameter of the pipes. Every joint shall be finished off smooth at an angle of 45 degree with the longitudinal axis of the pipe of the collars.

4.11.6. CLEANING : The interior of the pipe drains shall be cleaned off from all dirt, cement mortar & superfluous materials.

4.11.7. TESTING : The joints of R.C.C. spun pipe line shall be tested for 1.80 meter water head over the crown of the highest pipe between the two manholes. The lower end shall be plugged water tight. Water shall than be filled in the manhole at the upper end of the line with 1800 mm depth of water over the crown.

The test shall be for an hour or longer as directed by the Engineer-In-Charge. If the water level does not fall more than 12 mm in a length of 92 mtr. The test may be considered satisfactory. If it is found that certain pipe joints are leaking, the water shall be drained off and joints shall be remade/recalked.

4.11.8. ENCASING THE PIPE LINE : After the joints and pipes have been proved to be water tight then pipe line shall be embedded in cement concrete if specified to the extent of one half of external diameter of the pipes as directed, the concrete being made to slope away towards the sides of the

foundation bed, Refilling shall be done with fine selected materials in layers not exceeding 150mm thick, watered, consolidated and rammed properly, as specified.

4.11.9. DEWATERING : The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage or any other cause till completion of the work.

4.11.10. THE RATE INCLUDES FOR :

1. RCC Spun pipe with collar, cement mortar 1:2 and spun yarn.
2. Laying, jointing and testing the pipe line including cutting and wastage.
3. Dewatering if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

4.11.11. MODE OF MEASUREMENT : The measurement shall be for length in running meter of pipe line laid and shall be measured along the Centre line.

4.11.12. MODE OF PAYMENT : The contract rate shall be for unit running meter of pipe line laid. Making the cradles and encasing the pipe line shall be paid under the relevant item.

4.12. GREASE TRAP CHAMBER :

4.12.1. GENERAL: The item includes provision of brick masonry Grease Trap Chamber of internal size as specified in schedule of work.

4.12.2. MATERIAL: Concreting, Brick work, plastering etc. shall be as per specifications given in general specification under section-II.

4.12.3. CONSTRUCTION :

1. Internal dimensions and depth shall be as specified in the schedule of work.
2. 150 mm thick foundation shall be in 1:4:8 cement concrete and shall have 150 mm offset from outer surface of brick wall.
3. Brick masonry shall be in cement mortar 1:
4. Brick masonry shall be plastered with 20 mm thick cement mortar 1:3 inside and outside surfaces in two courses, inside surface finished smooth with neat cement punning.

4.12.4. DEWATERING: The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

4.12.5. THE RATE INCLUDES FOR :

1. Concreting in foundation, constructing brick masonry and plastering over the brick work.
3. Dewatering the trench or pit if found necessary till completion of work.
4. All necessary labour, materials and use of tools.

4.12.6. MODE OF MEASUREMENT: The measurement shall be for each unit of grease trap chamber of specified internal size and depth constructed.

4.12.7. MODE OF PAYMENT: The contract rate shall be for each unit of grease trap chamber of specified internal size.

4. LIST OF APPROVED MATERIALS:

Note:

1. The Contractor shall obtain prior approval from the Principal, Hindu College ,before placing order for any specific material or engaging any of the specialized agencies. The Contractor shall make a detailed submittal with catalogues and highlighted proposed specifications, as well as full details of the works proposed to be executed by the specialized agency, as specified.
2. Wherever applicable, the Principal, Hindu College ,may approve any material equivalent to that specified in the tender subject to proof being offered by the Contractor for equivalence to his satisfaction.
3. Unless otherwise specified, the brand / make of the material as specified in the item nomenclature, in the particular specifications and in the list of approved materials attached in the tender, shall be used in the work.
4. Reinforcement steel shall be procured from any vendors who have the license for at least 5 years for manufacture of BIS subject to prior written approval of Principal, Hindu College , Steel sample of all the lots procured shall be subjected to testing through recognised laboratories and shall be at Contractors' cost. Sampling shall be as per the Specifications (referred to Schedule F).

A. CIVIL WORKS

Sr No	Description For Work	Manufacturers
I	STRUCTURAL & ARCHITECTURAL	
1	CEMENT- ONLY OPC (ORDINARY PORTLAND CEMENT) CAN BE USED FOR ANY ACTIVITY IN THIS PROJECT	ACC, ULTRA TECH, VIKRAM, SHREE CEMENT, BIRLA JUTE, CEMENT CORPORATION OF INDIA, AMBUJA CEMENT
2	WHITE CEMENT/ PUTTY	J.K., BIRLA
3	READY MIX CONCRETE	A.C.C., ULTRA TECH,NUEVOCO, RDC RMC,
4	WATERPROOFING COMPOUND	PIDILITE, BASF, CICO, FOSROC, ROFF, KERACOL, SIKA
5	REINFORCEMENT STEEL	SAIL, TATA STEEL, RINL, JINDAL STEEL & POWER LTD., JSW STEEL LTD., MAKES CONFORMING TO CRITERIA MENTIONED IN TENDER DOCUMENT, PRIMARY MANUFACTURERS APPROVED BY MINISTRY OF STEEL/ SECONDARY MANUFACTURERS HAVING VALID BIS LICENSE (to be as per latest BIS provisions)
6	MECHANICAL SPLICING SYSTEM WITH COUPLER	SPLICETEK INDIA PVT. LTD. DEXTRA INDIA PVT. LTD. ISHITA ENTERPRISES
7	STRUCTURAL STEEL	TATA STEEL, SAIL, RINL, VIZAG, JINDAL, PRIMARY MANUFACTURERS

		APPROVED BY MINISTRY OF STEEL/ SECONDARY MANUFACTURERS HAVING VALID BIS LICENSE (to be as per latest BIS provisions)

Sr No	Description For Work	Manufacturers
8	CONCRETE BLOCKS	CONWOOD, GURJARI, HINDUSTAN, LOKGROUP, SAI BLOCK, VED PMC LTD.
9	AAC BLOCKS	AEROCON, SIPOREX, ULTRA TECH, ECOLITE, GODREJ
9A	FLY ASH BRICKS	AEROCON, POROTHERM, KANSAL, ECOLITE, MAPICRETE
10	WOODEN FLUSH DOORS	KENWOOD, ANCHOR, KUTTY, GREENPLY, SHREEJI, KITPLY, NAVAIR
10A	FRP DOOR SHUTTERS	MERINO, GREENLAM
11	HIGH PRESSURE LAMINATES	FORMICA, MERINO, GREENLAM, CENTURY
11A	VENEERS	CENTURY, ARCHID, EURO, GREEN
12	FRD WOODEN FRAME & SHUTTERS	SUKRI, PROMAT, KUTTY, SIGNUM, KENWOOD, SHREEJI, TUFWOOD, NAVAIR
13	FRD METAL FRAME & SHUTTERS	SUKRI, SHAKTI MATE HORMAN, KUTTY, SIGNUM, NAVAIR, ICLEAN
14	FIRE RATED GLASS	PILKINGTON, SCHOTT, SAINT GOBAIN, ASAHI, GUARDIAN
15	HARDWARE FOR FIRE RATED DOORS	DORMA, GEZE, HAFELE, ASABOLY, SHALIMAR, OZONE
16	INTUMESCENT STRIPS	PROMAT, PEMKO, INTUMEX, ASTROFLAME
17	SS DOOR HARDWARE	DORMA, GEZE, HAFELE, ASABOLY, OZONE, SHALIMAR
18	MODULAR FURNITURE HARDWARE / SS WIRE BASKETS	HETTICH/ HAFELE/ ASABOLY
19	PVC EDGE BANDING TAPE	REHAU/ DOLKIN
20	HOT MELT GLUE FOR EDGE BANDINGTAPE	KLEIBERIT 773.3 / HENKEL
21	WOOD WORK	SAL WOOD
22	PLYWOOD	GREENPLY, KITPLY, ANCHOR, ARCHID, CENTURY.
23	BLOCK BOARD	GREEN PLY / CENTURY/ANCHOR / ARCHID/KITPLY
24	STAINLESS STEEL	JINDAL, SAIL, TATA STEEL OR EQUIVALENT

Sr No	Description For Work	Manufacturers
25	VITRIFIED TILES/ CEREMIC TILES	FIRST QUALITY KAJARIA ONLY
26	POLYMER MODIFIED CEMENTITIOUS GROUT / CEMENT ADHESIVE / EPOXY GROUT	PIDILITE, KERACOL, ARDEX ENDURA, LATICRETE, BAL ENDURA, FERROUSCRETE
27	POLYMER MODIFIED ADHESIVE MORTAR FOR FLY ASH BLOCKS / bricks	WALPLAST, ULTRA TECH, SOUND BUILD CARE LTD., ECOLITE, FERROUSCRETE, KERACOL, PIDILITE
28	READY MIXED CEMENT PLASTER	WALPLAST, ULTRA TECH, MADRAS CEMENT LTD, SOUND BUILD CARE LTD., FERROUSCRETE, PRECISE CONCHEM PVT LTD.
29	METAL FALSE CEILING	ARMSTRONG, GYPROC, HUNTERDOUGLES, USG BORAL, TECHNO
29A	GYPSUM FALSE CEILING	ARMSTRONG, GYPROC, TECHNO, KNAUF
29B	ACOUSTIC FALSE CEILING	GYPROC, TECHNO,
30	GYPSUM LIGHT WEIGHT PLASTER	J.K. ONE COAT , BIRLA ONE COAT ,
33	ACRYLIC TEXTURE PLASTER	ASIAN PAINTS, SPECTRUM PAINTS, HERITAGE
34	VINYL FLOORING	RESPONSIVE, TARKETT, POLYFLOR, GRABO
34A	READY MADE TOILET CUBICLE	CITADEL, GREENLAM, MARINO
34B	ACOUSTICAL WALL PANEL	GYPROC, TECHNO, ECOPHON
II	PLUMBING	
35	SANITARY WARES	JAQUAR ONLY
36	C. P. FITTINGS	JAQUAR ONLY
37	S. S. SINK	NIRALI, DEEPALI, FUTURA,
38	C. I. PIPES & FITTINGS	NECO, KAPILANSH, SKF, HEPSCO

Sr No	Description For Work	Manufacturers
39	G.I. PIPES	TATA, JINDAL, PRAKASH SURYA,
40	G. I. FITTINGS	UNIK, R-BRAND, ZOLOTO
41	NP2 CLASS, R.C.C. PIPES	JAIN SPUN PIPE, K. K. SPUN PIPE, THE INDIANHUME PIPE CO. LTD., PATEL HUME PIPES
41A	P.V.C RAINWATER PIPE	SUPREME, ASTRAL, ASHIRVAD, FINOLEX, PRINCE
41B	UPVC PIPES AND FITTINGS	ASTRAL, FINOLEX, SUPREME, KISAN
41C	CPVC PIPES AND FITTINGS	ASTRAL, SUPREME, FINOLEX, PRINCE
III	FAÇADE & WINDOW	
42	ALUMINIUM EXTRUSION SECTIONS	JINDAL, HINDALCO, NALCO, INDIANALUMINIUM CO.
43	SYSTEM	JINDAL, GUJRAT ALUM, SAPA, GLOBAL OR AS APPROVED
44	EXTRUDER	JINDAL, GUJRAT ALUM, SAPA, GLOBAL
45	FLOAT CLEAR GLASS	SAINT GOBAIN, ASAHI GLASS, MODI GUARD, GUARDIAN, PILKINGTON, AIS, GUARDIAN, SESICAM
46	COATED GLASS	SAINT GOBAIN, ASAHI GLASS, GUARDIAN
47	CALCIUM SILICATE BOARD	HILUX, STARPAN, AEROLITE, PROMAT, VISAKA
48	FLOOR SPRINGS /DOOR CLOSERS/ PANICBAR/ PATCH FITTINGS	DORMA, GEZE, HAFELE, HORMAN
49	S. S. GRATINGS	CHILLY, CAMRY,
50	FLOAT GLASS MIRROR	MODIGUARD, SAINT GOBAIN, ASAHI NP2 RCC Pipe
51	STAINLESS STEEL ANCHOR FASTENERS	HILTI, FISCHER, INDEX
52	EPDM	AMEE RUBBER INDUSTRIES PVT. LTD. , BOHRA RUBBER
53	ALL TYPES OF SILICONE	DOW CORNING, GE
54	SPACER TAPE / BACKER ROD	NORTON, BOW, TREMCO
55	FRICTION HINGES AND LOCKS	COTSWOLD, GIESSE, ALUALPHA, SECURISTYLE, SOTRALU

Sr No	Description For Work	Manufacturers
56	ALUMINIUM COMPOSITE PANEL	ALUDECOR, EUROBOND, ALSTRONG, ALUCOBOND
57	FROSTED GLASS FILM	GARWARE, LLUMAR, 3M
58	POWDER COATING	JOTUN, PPG, AKZONOBEL
59	GLASS WOOL	UP TWIGA
60	ROCK WOOL	ROCKWOOL INDIA
61	SMOKE SEAL INTUMUSCENT	HILTI / DC/ GE/ TREMCO
62	HANDLES	GIESSE /ALUALPHA/SIEGENIA
63	SS SCREWS	GKW, HILTI, POWER, WURTH, PHILLIPS
64	UPVC WINDOWS	FENESTA ONLY
IV	LANDSCAPING	
65	PAVER BLOCKS/ GRASS PAVERS/ KERBSTONE	KK/ PAVER INDIA/ HINDUSTAN TILES/ SWASTIK/ DALAL
66	LIMESTONE/ KOTA STONE FLOORING	SIDDHIVINAYAK, WORLD OF STONES, STONESTUDIO
67	SOFTSCAPE MAINTAINANCE MATERIAL	7PETALS, GREENLAND
V	ADDITIONAL ITEMS	
1	BRICKS	COMMERCIALLY AVAILABLE OF REQUIREDSTRENGTH
2	BRICKS FOR EXPOSED BRICK WORK	AS PER ITEM SPECIFICATION
3	LAMINATES	GREENLAM/ DURO/ ARCHID/ MERINO/CENTURY
4	STAINLESS STEEL NUTS/ BOLTS/ SCREWS	KUNDAN/ PUJA/ ATUL/ GKW
5	PAINT/ PRIMER/ OIL BOUND DISTEMPER/ ACRYLICPAINT/ PLASTIC PAINT	1ST QUALITY PAINTS OF ASIAN/ BERGER/NEROLAC/ SHALIMAR /DULUX
6	WATER PROOF CEMENT PAINT/ EXTERIOR PAINT	1ST QUALITY PAINTS OF ASIAN PAINTS/BERGER/ NEROLAC/ SHALIMAR /DULUX
7	FLOOR SPRING	DORMA/ GODREJ/ HAFELE/ GEZE/ OZONE
8	DOOR CLOSER	SANDHU/ HARDWIN/DORMA/ GODREJ/ HAFELE/GEZE/ OZONE
9	MIRROR	ATUL/ MOIGUARD / SAINT GOBAIN/ AASHI
10	PARTICLE BOARD	NOVA PAN/ BHUTAN BOARD/ ECO BOARD
11	PVC WATER STORAGE TANK (ISI MARKED)	SINTEX/ UNI PLAST/ POLYWELL
12	PVC INSULATED WATER STORAGE TANK HEAVYDUTY 4/5 LAYER	SINTEX/ UNIPLAST/ POLYWELL/ EURO
13	SANDWICH ROOF PANEL (PUFF PANEL)	KAKTUS/ ZEP/ E- PACK/ LLOYED
14	GALVALUME ROOFING CITY	TATA . JINDAL
15	WPC BOARD AND MPC BOARD	FLORESTA, ECOSTE, RAJ SHREE
16	WPC DOOR FRAME	FLORESTA, ECOSTE, RAJ SHREE
17	SELF- CLOSING HINGES	HETTICH, KITCH, PLUM
18	POLY CARBONATE SHEET	GE LEXAN/ POLYGAL/TUFLITE

19	ACP PANEL	ALSTRONG /ALUCOBOND / EUROBOND/ALUDECOR
20	ACOUSTIC WOODEN/FABRIC PANELING	ARMSTRONG / ANUTONE/ CREDENCE /TOPAKUSTIC
21	GLOW STUD, SOLAR POWER STUD	ROAD STAR/ 3M/ DARK EYE/ EVERY DENNISON
22	LAMINATE WOODEN FLOORING	VISTA/ ACTION TESA/ ARMSTRONG/ PERGO
23	SUN CONTROL FILM	3M/ GARWARE/ SAINT GOBAIN
24	INSULATION (MINERAL / ROCK WOOL)	UP TIWAGA LTD / ROCKWOOL IND./ F.G.P.
25	FIRE DOOR	NAVAIR/ SHAKTI/ RADIANT/SIGNUM/PROMAT
26	FLUSH DOOR SHUTTERS OF VARIOUS THICKNESS	MERINO/ DURO/ GREEN/ CENTURY/ KIT(SWASTIK)
27	OPEN CELL FALSE CEILING	ARMSTRONG /CREDENCE /HUNTER DOUGLAS
28	CALCIUM SILICATE FALSE CEILING	AEROLITE, RAMCO, HILUX, USG BORAL
29	GYPSUM BOARD	GYPROC BY SAINT GOBAIN, USG BORAL,ARMSTRONG
30	FIBER CEMENT BOARD	EVEREST/ USG BORAL / VISAKA
31	CPVC PIPE FITTING & SOLVENT	SUPREME/ ASTRAL/ ASHIRWAD / PRINCE /PRAKASH
32	UPVC WINDOW	FENESTA
33	FRICTION STAY HINGES	EARL- BIHARI/ EBCO/HETTICH
33	M.S PIPES	JINDAL/ APPOLO/ SWASTIK / TATA / SURYA
34	GYPSUM PLASTER	FERROUS CRETE (FERRO-500)/ GYPROC (ELITE-100)/ KERAKOL (K-100)
35	GRC WALL TILE / JALI	UNISTONE/ DALAL/ SWASTIK ALWAR / ULTRA
36	HDMR BOARD	CENTURY/ GREEN/ ACTION TESSA
37	ANCHOR FASTENER(MECHANICAL/ CHEMICAL)	HILTI/ FISCHER/ WUERTH
38	CUPBOARD LOCK	PLAZA/ GODREJ/ HETTICH/ HAFLEY
39	RUST REMOVER / RUST CONVERTING PRIMER /PAINT	FOSROC/SIKA/BASF/PIDILITE
40	POLYMER BASED ZINC RICH PRIMER	FOSROC/SIKA/BASF/PIDILITE
41	ANTICORROSIVE PAINT	FOSROC/SIKA/BASF/PIDILITE
42	CONCRETE PENETRATING HI-TECH CORROSIONINHIBITOR	FOSROC/SIKA/BASF/PIDILITE
43	THIXOTROPIC EPOXY REPAIR MORTAR	FOSROC/SIKA/BASF/PIDILITE
44	LATEX / SBR POLYMER COMPOUND	FOSROC/SIKA/BASF/PIDILITE
45	LOW VISCOUS EPOXY RESIN GROUT	FOSROC/SIKA/BASF/PIDILITE
46	EPOXY RESIN FOR CONCRETE BOND COAT	FOSROC/SIKA/BASF/PIDILITE
47	PRE-BATCHED NON-SHRINK POLYMER MODIFIEDMORTAR	FOSROC/SIKA/BASF/PIDILITE
48	PRE-BATCHED PRE MIXED NON- SHRINK MICRO	FOSROC/SIKA/BASF/PIDILITE

	CONCRETE	
49	PRE-BATCHED PRE MIXED NON-METALLIC COMPOSITE FIBER WRAPPING SYSTEM	FOSROC/SIKA/BASF/PIDILITE
50	EPOXY FOR REBAR/SHEAR ANCHOR	FOSROC/SIKA/BASF/HILTI
51	MANHOLE COVER /GRATING	KK MANHOLE / DALAL / SWASTIK / HINDUSTAN
52	ENGINEERED WOOD FLOORING	PERGO / JUNKERS / BOEN / SQUARFOOT
53	SS PIPE (304 GRADE) FOR WATER SUPPLY	JINDAL / TATA / ALFA PRESS / VIEGA
54	EPOXY FLOORING	FOSROC / SIKA / BASF
55	UTILITY GAS PIPING VALVES AND FITTINGS (FOR CLEAN ROOM)	SHAVO TECHNOLOGIES / EXCEL GAS / GDS STARLING / BROEN / RATNAMANI
56	UTILITY GAS PIPE SS 304 SEAMLESS (FOR CLEANROOM)	EXCEL GAS / SCODA / VENUS / DOCKWELLER
57	INSULATION FOR PIPE AND VALVES	ARMAFLEX/ K FLEX/ A FLEX/ SUPREME
58	AUTO AIR VENT, Y STRAINER	ANERGY / ZOLOTO / LEHRY
59	EXHAUST BLOWER	COLASIT / PLASTIFIER/ SEAT
60	ACID STORAGE	KEWAUNEE/ JUSTRITE/ASECOS

B. PLUMBING WORKS:

Sr.No.	Description for Work	Manufacturers
1	Vitreous chinaware	
a.	European Water Closet	Jaquar-Model No.-CNS-WHT-WS04
b	European Water Closet for Physically Handicap	;Jaquar-Model No.-CNS-WHT-WS04
c	Indian Water Closet	Jaquar-Model No.-CNS-WHT-OP02
d	Wash hand basin	Jaquar-CNS-WHT-WB03
e	white vitreous china large flat back / half stall urinal	;Jaquar-URS-WHT-0706) (Make For Push Tap for Urinal : Jaquar, Model No : Pressmatic PRS077 G Urinal Valve with Auto Closing system with 65 mm Extension Body;
2	Health Faucet	Jaquar, Model No : ALD - CHR - 565 GC Chrome, 1.0 mtr long Tube in Chrome Finish & Wall Hook
3	Toilet paper Roll Holder	Jaquar, Model No : Toilet paper Roll Holder with Flap - ACN - 1153N
4	coat hook	Jaquar, Model No : ACN - 1191N
5	Bib tap	Jaquar, Model No : CON - 041KN
6	waste coupling	Jaquar, Model No : ALD - 709 - 32mm Size, 60 mm Height 510x420
7	Pillar Cock	Jaquar, Model No : Pressmatic - PRS - 031L65 GC with Auto Closing System with 65mm Extension Body

Sr.No.	Description for Work	Manufacturers
8	Bottle Trap	Jaquar, Model No : ALD - 769L - 300 x 190;
9	flexible water pipe	Jaquar, Model No : Angular Stop Cock with Wall Flange, Continental : 059KN
10	Sink taps	as per CAT no. SOL-6357 GE.
11	C.P brass waste coupling	Jaquar, Model No : ALD - 709 - 32mm Size, 60 mm Height
12	flexible water pipe	Jaquar, Model No : Angular Stop Cock with Wall Flange, Continental : 059KN
13	Concealed bath shower	Jaquar, Model No : OHS 1779 GC - 120 mm dia with Shower Arm SHA - 477 - 190 mm Long Wall Mounted & Wall Mixer - Jaquar make, Model No : CON - 273 KNUPR GC
14	liquid soap dispenser	Jaquar, Model No : ACN 1137N
15	towel rail	Jaquar, Model No : Continental - ACN 1111BNM - 450 mm Long;
16	Hand Dryer	Jaquar, Model No : M99ACS - Optima
17	Paper Towel Dispenser	Jaquar, Model No : DT0106CZ
18	Soap Holder	Jaquar, Model No : AHS - 1531
19	Angular Stop cock	Jaquar, Model No : Angular Stop Cock with Wall Flange, CQT-CHR-23059
20	Floor trap	Chilly-CCTL-SMHC-150
21	Flushing Cistern	Commander, Dual flush Egret;Hindware-Sleek essential dual flush 3/6 litreSD
22	Push tap for Urinal	Jaquar, Model No : Pressmatic PRS077 G Urinal Valve with Auto Closing system with 65 mm Extension Body
23	Health Faucet	Jaquar-ALD-CHR-565GC
24	Two way Bib tap	Jaquar, Model No : CQT - CHR - 23041 GB;
25	Pair of Towel Hook	Jaquar: CAN 1191N
26	Glass, Mirror	Modi Guard, Saint Gobin,

Sr.No.	Description for Work	Manufacturers
27	Stainless steel Sink	a) Silent square - Omni Small - Overall size 460 mm x 460 mm and Bowl size 410 x 410 x 165 mm b) Silent square - Omni Big - Overall size 510 mm x 510 mm and Bowl size 460 x 460 x 165 mm
28	Urinal Sensors	Jaquar
29	Floor Drain Fixture, Rain Water Outlets	ACO / GMGR / Geberit / Viega
30	G.I / M.S Pipes	ITC, TATA, Zenith, Ambika, Surya, Khandelwal, Jindal, Hissar / AST Pipes / Hitech / Swastik or approved eq.
31	G.I Malleable fittings	PEC, MJM, Unik, Zoloto, 'R' / Jain Sons / Kirti or approved eq.
32	C.P. Grating for Floor Trap	Chilly / GMGR / Neer
33	GM or copper alloy Gate / Peet / Globe / Check valve	Neta, Sant, Kingston, NEW, Leader, Zoloto, GG
34	Ball Valve	MBM, Sant, Techno, A.I (JS), Zoloto or approved eq.
35	GM / Forged Brass Ball Valves	CIM / Danfoss / Jayhiwa / Kitz / RB / Sant / Tiemme / TSB
36	Air Valve / Kinetic Air Valve	Durga, BSJShau, VKE, Sant, Hawa, IVC, Mayur, BJC
37	Water meter	Capston, Keycee, Paramount or approved eq.
38	Sluice valve / Foot valve (swing & lift type)	BSJ-Shau, Mayur, Upadhyay, Minoti, Effco, Kartar, KPM, IVC, Leader, Durga, Kirloskar.
39	C.I Water quality pipes	Electrosteel, KDUL, Kesoram or approved eq.
40	C.I Soil quality pipes	A-1, Neco, Rifco, SRIF or approved eq.
41	C.I Frame & Cover	A-1, Neco, Rifco, SRIF, Kajeco or approved eq.
42	S.W Pipe & Gully Trap	Kashmira, Rajura, Girco, Perfect, C.I.or approved eq.
43	RCC Hume pipe	JSP/ LAKSHMI/ SOOD & SOOD/ JAIN &Co./ DIWANSPUN PIPES
44	SFRC frame & cover / gratings	Bharat, Shreeji, SS, KK or approved eq.
45	HDPE Pipe	Prince, Goutam, Duraline , Kimplas,/ Reliance or approved eq.

Sr.No.	Description for Work	Manufacturers
46	SS Pipes	Remi / Viega
47	SWR-UPVC pipe & fittings	Prince, Premium, Supreme, Finolex, Kissan, Perfect Potteries, JABALPUR
48	Water supply – PVC pipes & fittings	Prince, Premium or approved eq.
49	Pig Lead	Hindustan Zinc
50	PVC flushing Cistern	Commander, Hindustan, Duralite or approved eq.
51	Pressure Gauge	Pie-big, Guru or approved eq.
52	Foot Valve (Ball type)	Normex
53	SBR / EPDM Gaskets	Prabhat, Orient, Paul, Durable or approved
54	C.I fittings / Specials	Kejriwal, Upadhyay, Orient, Durga or approved eq.
55	Flush Valves	Jaguar, Parko, Orient or approved eq.
56	Electronic flush Valve for Urinal	Cera, Parryware, Jaguar, Utech, Robo, Angus, Askon Engineers / Euronics / Toshi
57	Check Valve – WaferType	Advance / Danfoss / Kirloskar / Jayhiwa
58	Check Valve – Dual Plate	Advance / SKS
59	Check Valve Forged Screwed	CIM / Leader / RB / Sant / TBS / Zoloto
60	Check Valves (slim type)	Zoloto, Intervall or approved eq.
61	Butterfly Valve	Audco, C&R, Intervall, Keystone, IVC, Durga, Danfoss / Honeywell / Jayhiwa or
62	Ball Valve (15 to 40 mm)	CIM, Sant or approved eq.
63	Pressure Reducing Valve	Fouress / Honeywell / RB / SKS / OR / Zoloto
64	Cockroach trap	Chilly
65	CI double flanged non-return valve	Kirloskar, IVC, Leader, or approved eq.
66	Cast Iron Pipes & Fittings Manhole covers and frames	
	As per IS:3989 (Pipes & Fittings)	Kapilash
	As per IS:1729 (Manhole covers and frames)	Raj Iron Foundry Agra
	As per IS:1536 (CIClass LA Pipes)	IISCO / NECO
67	D.I. Manhole Covers & Frames	Kartar valves & fittings
68	CILA fittings	Kartar valves & fittings

Sr.No.	Description for Work	Manufacturers
69	Suspended Manhole and Gully Trap	Patel Pattern
70	Drip Seal	ACQUA Bond / Vinod Cement Co. Chandigarh
71	GI pipe sealant	Henkel - LOCTITE 55
72	Pipe clamp & supports	Chilly / Euroclamp / Easyflex / Gripple
73	D. I. Pipes	Electro Steel / Jindal / Lanco Kalahasthi
74	Copper Pipes & Fitting	Flowflex – Rajco / Viega – Max flow
75	UPVC Pipe	Astral / Finolex / Supreme
76	CPVC pipes	Ajay / Ashirwad / Astral
77	PB Pipe	Flexalen – Thermaflex / George Fisher
78	Solenoid Valve	Avcon / Danfoss
79	Thermostatic valve	Oventrop
80	Air Release Valve	Arco / CIM / Fouress OR / SKS
81	Ball Float Valve	Esseti / HBD / Zoloto
82	NRV – Ball type – Sewage application	Danfoss / Silverspark
83	Y Strainer CI	Emerald / Sant / SKS / Zoloto
84	Self-Priming Pumps	Johnson / Kirloskar
85	Drinking Water Cooler	Blue Star / Usha / Voltas
86	Anti Vibration Mounting & Flexible Connections	Cori / Dunlop / Flexionics / Kanwal Industrial Corporation / Resistoflex / VIMPA
87	Pressure Gauge	Emerald / Fiebig / H Guru / Wika
88	Water Meter (Mechanical Type)	Actaris / Kranti / Kent
89	Electronic Flow Meter	Krohne (Forbes Marshall) / Rockwin
90	Level Controller & Indicator (Water)	Auto Pump / Cirrus Engineering / Elegent Controls / Technika / Techtrol
92	MH / Water Tank Plastic Steps	KGM / Patel / Pranali Industries
93	Fastner	Fisher / Hilti

Sr.No.	Description for Work	Manufacturers
94	Fire Sealant	Birla 3 M / Hilti / Promat / STI (USA)/ Fire master
95	Manhole (Prefabricated)	OK Play / Supreme
96	Temperature Sensor/ Gauge	Forbes Marshall / Danfoss / Wika
97	Kitchen Hot Zone Suppression System	Ansul (Tyco) / Amerex India

C. SPECIALISED AGENCIES:

Sr No	Description For Work	Manufacturers
1	WATERPROOFING WORK	PIDILITE, A. NAYAK Constructions Pvt. Ltd., LIKPROOF INDIA PVT. LTD., MODERN WATERPROOFING CO, INDIA WATERPROOFING CO., OVERSEAS WATERPROOFING CORP. KERACOL, NINA WATERPROOFING, NATIONAL WATER PROOFING
2	CURTAIN GLAZING	GLAZE TECNO INDIA, AJIT INDIA PVT. LTD., INNOVATORS FACADE SYSTEMS PVT. LTD., ALUMAYER INDIA PVT. LTD. OR ANY OTHER AGENCIES APPROVED BY ENGINEER IN CHARGE WHO HAS EXECUTED WORK OF SIMILAR NATURE AND QUANTUM
3	GLASS PROCESSER	ASAHI GLASS, SAINT GOBAIN
4	PVDF COATING	AURA ARCHITECTURAL COATINGS, M. J. COATERS PVT. LTD., S P ARCHITECTURAL COATINGS PVT LTD., AMECO, RADIANT ANODISERS PVT. LTD.

5. LIST OF APPROVED LABORATORIES

APPROVED LIST OF LABORATORIES

The following Government & non-Government Laboratories for testing of samples.

A. Government Laboratories.

- I. NTH, Ghaziabad**
- II. CRRI, Delhi**
- III. IIT, Delhi**
- IV. C.P.W.D. Lab, I.P. Estate, New Delhi.**
- V. R.T.C., Okhla**
- VI. C.B.R.I., Roorkee**
- VII. FRI, Dehradun**
- VIII. NCCBM, Ballabgarh.**

B. Non Government Laboratories.

- I. Sri Ram Test House, Delhi**
- II. Sun Beam Auto Lab, Gurgaon**
- III. Spectro Analytical Lab, Ballabgarch/Okhla.**
- IV. Delhi Test House, G. T. Karnal Road, Azadpur, Delhi.**

75% tests shall be carried out from Government labs and 25% from the private laboratories.

PARTC:

**MINOR COMPONENTS- ELECTRICAL, MECHANICAL AND FIRE
FIGHTING (E&M) WORKS**

ADDITIONAL/PARTICULAR SPECIFICATIONS FOR MECHANICAL AND ELECTRICAL WORKS

2.1 ELECTRICAL WORKS

2.1.1 SPECIAL CONDITIONS

2.1.1.1 GENERAL

These special conditions are intended to amplify the General Conditions of Contract and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply.

2.1.1.2 PREAMBLE

- a. This is an item rate contract. Some of the items may not be operated. The Vendor cannot raise any objection for non-operation/deletion of any items, also the rate will be remains same for any quantities variations
- b. BOQ to be read in conjunction with the Drawings.
- c. All material delivered on-site shall be inspected properly and Manufacturing Test Certificate (MTC) shall be submitted to PMC / Client for verification of the material.
- d. The rate quoted by the Contractor shall be inclusive of the following:
- e. All labour, materials, wastage, transportation, handling, use of tools, equipment, scaffolding, cheery picker etc and other items incidental to the satisfactory completion of item work at all depths, heights and at any levels.
- f. Internal / external scaffolding as required for single or double heights. Contractor to erect scaffolding which will be stable, strong and safe. Contractor to take all precautionary measures to protect the workers/labours while working on scaffolding.
- g. Inspection of fabricated material for FAT to be arranged by contractor wherever required.
- h. Samples of any material, Mock-up (Preferably a working mock up) at place as desired by the Design Architect, Consultants or PMC
- i. Making shop drawings as & when required & asked by the PMC/Design Architect with 4sets.
- j. The scope is also inclusive of name plate & tagging of switch boards/DBs/ Cables etc, pasting of warnings, ferruling, O&M trainings, handing over documents with O&M manuals, As-built layouts, in proper readable format in 4 set & Soft Copies
- k. All necessary miscellaneous items to complete the item to the satisfaction of PMC, Design Consultant & Client
- l. In Case of discrepancy in item description / specification in BOQ, technical Bid & Drawings, most stringent specs to be followed.
- m. This project is IGBC compliance & vendor should comply the same wherever applicable for procurement & installations

2.1.1.3 SCOPE OF WORK

The general character and the scope of work to be carried out under this contract is illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labour, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete electrical system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract, the rates will

be applicable for any height as per the proposed building , scaffolding , cheery picker etc to be considered by contractor in their cost/ without any additional cost . The electrical system shall comprise of (but not limited to) the following:

- a. All conduit work including junction boxes, outlet boxes and wiring for lighting and power circuit in all areas as per the drawings
- b. Switches, plug sockets, cover plates and other wiring accessories.
- c. LT Cables, Mains and Sub-Mains.
- d. Supply & Installation of Main/sub Distribution Panels / board.
- e. Cables on cable trays, Floor Raceways, cable trays, hangers, supports, cable terminations and all fixing accessories.
- f. Earthing (Grounding) System.
- g. Supply and installation of Lighting Fixtures.
- h. Supply and installation of Data/CCTV , ACCESS CONTROL System
- i. Supply & Installation of Lightening Protection System.
- m. Supply & Installation of External Lighting

2.1.1.4 ASSOCIATED CIVIL WORKS

Note that all civil works associated with electrical works are included in Contractor's scope of work, like wall chasing by wall chaser, making holes, filling etc. for installation of conduits/cables and making good. These shall be executed in accordance with approved shop drawings.

Cable supports for laying of cables, Repair of all disturbed surfaces/openings made by Electrical Contractor shall be included in the scope of work and accounted for in the relevant Electrical work item. No extra payment / claim shall be made on this account.

2.1.1.5 PROJECT EXECUTION AND MANAGEMENT

The Contractor shall ensure that senior planning and erection personnel from his organization are assigned exclusively for this project. The Contractor shall appoint one Project Manager holding senior management position in the organization. He shall be assisted on full time basis by a minimum of one electrical engineer & senior supervisors. The entire staff shall be posted at site on full time basis as per work line up.

2.1.1.6 PERFORMANCE GUARANTEE/WARRANTEE

The contractor shall carry out the work in accordance with the Drawings, Specifications, Schedule of Quantities and other documents forming part of the Contract.

The contractor shall be fully responsible for the performance of the selected equipment (installed by him) at the specified parameters and for the efficiency of the installation to deliver the required end result..

The contractor shall guarantee that the Electrical system as installed shall perform to complete satisfaction of the owner.

Complete set of architectural drawings is available in the Architect/Consultant's office and reference may be made to same for any details or information. The contractor shall also guarantee that the performance of various equipment individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.

At the close of the work and before issue of final certificate of virtual completion, the contractor shall furnish written performance guarantee against defective materials and workman-ship for a period of One years from date of testing, commissioning and handing over. The guarantee shall be submitted letter head of company. The Contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to Owner the following:

- a. Any defective work or material supplied by the Contractor.
- b. Any material or equipment damaged or destroyed as a result of defective workmanship by the Contractor.

2.1.1.7 BYE-LAWS AND REGULATIONS

The work shall be carried out to the satisfaction of the Owner's site representative and in accordance with the Specifications, Regulations of the Electric Supply Authority, Indian Electricity Rules and Regulations, latest Indian Standards and as per the requirements of the Chief Fire Officer.

2.1.1.8 FEES AND PERMITS

The Contractor shall obtain permits required for the installation of this work, actual fees will be borne by client in form of cheque / DD only. On completion of the work, the contractor shall obtain and deliver to the Owner, certificate of final inspection and approval by the local electricity authority (CFO/ Municipal, State/Central govt. whichever is applicable)

2.1.1.9 DRAWINGS

The Electrical Drawings, which may be issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of equipment, electrical points & fixtures.

The contractor shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.

Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the Architect/Consultant/Owner's site representative before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and contractor shall rectify the same at his own cost.

The contractor shall examine all architectural, structural, plumbing, HVAC and other services drawings and check the as-built works before starting the work and report to the Owner's site representative any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/Owner's site representative without additional cost to the Owner.

2.1.1.10 SPECIFICATIONS

The Specifications shall be considered as part of this contract. The Drawings indicate the extent and general arrangement of power distribution, location of lighting fixtures, controlling switches, wiring system, cabling and earthing. These drawings are essentially diagrammatic. The Drawings indicate the point of termination of conduit runs and broadly suggest the routes to be followed. The work shall be installed as indicated on the Drawings. However, any change found essential to coordinate the installation of this work with other trades shall be made without any additional cost to the Owner. The data given herein and on the Drawings is as exact as could be secured, but its complete accuracy is not guaranteed. The drawings are for the guidance of the contractor, exact locations, distances and levels shall be governed by the site conditions and the Architectural & Interior layouts.

2.1.1.11 SHOP DRAWINGS

- All the shop drawings shall be prepared on computer through AutoCAD System based on Architectural Drawings, site measurements and Interior Designer's Drawings. Contractor shall furnish, for the approval of the Architect/Consultant, Four sets of detailed shop drawings of all equipment and materials including layouts for all conduit layouts, distribution panels, switch boards, cabinets, special pull boxes, cable trays and any other requirement to be fabricated or purchased by the contractor.
- These shop drawings shall contain all information required to complete the Project as per specifications and as required by the Architect/Consultant/Owner's site representative. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment/materials/ works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings.
- Each item of equipment/material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers list given in the tender document.
- When the Architect/Consultant makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated along with check print, for approval. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment/installation.
- Shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material 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 programme.
- Manufacturers drawings, catalogues, pamphlets 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.
- Samples of all materials like conduits, accessories, switches, wires, control cables etc shall be submitted to the Owner's site representative prior to procurement. These shall be submitted in two sets for approval and retention by Owner's site representative and shall be kept in their site office for reference and verification till the completion of the Project.
- 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 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, foundation, wiring or any other part of the mechanical, electrical or architectural layouts; all such redesign, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the Architect/Consultant/ Owner's site representative.
- 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 Owner to initiate action for procurement of spare parts and tools at the completion of project.
- Contractor has to submit all the shop drawings as per the tender completion schedule.

2.1.1.12 ACCESSIBILITY

The Contractor shall verify the sufficiency of the size of the Hume pipes (under road crossings), excavation in trenches. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all trenches, Hume pipes, required for each crossing, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense.

2.1.1.13 MATERIALS AND EQUIPMENT

All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. Makes shall be strictly in conformity with list of approved makes given in tender document.

The Contractor shall ensure & maintain the sufficient stock at his cost at Manufacturer service Centre to make the delivery of items problem free during any phase of project. The Contractor shall be responsible for the safe custody of all materials and shall insure them against theft or damage in handling or storage etc. A list of items of materials and equipment, together with a sample of each shall be submitted to the Owner's site representative within 15 days of the award of the contract. Any item which is proposed as a substitute, the contractor shall state the credit, if any, due to the Owner in the event the substitution is approved. All changes and substitutions shall be requested in writing and approvals obtained in writing from the Owner's site representative.

2.1.1.14 MANUFACTURERS INSTRUCTIONS

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, manufacturer's instructions shall be followed in that case.

2.1.1.15 COMPLETION CERTIFICATE

On completion of the electrical installation a certificate shall be furnished by the Contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local, state/central govt./municipal / fire authorities concerned.

2.1.1.16 INSPECTION AND TESTING

The Owner may carry out inspection and testing at manufacturer's works for this contract. No equipment shall be delivered without prior written confirmation from the Owner's site Engineer. In case factory inspection is carried out then all travelling and lodging expenses for two persons one from owner and one from consultants shall be borne by the Contractor, also all expenses related to testing shall be to Contractor account. Tests on site of completed works shall demonstrate the following:

That the equipment installed complies with specification in all respect and is of the correct rating for the duty and site conditions.

That all items operate efficiently and quietly to meet the specified requirements.

That all circuits are fully protected and that protective devices are properly co-ordinated.

That all non-current carrying metal parts are properly and safely grounded in accordance with the specification and appropriate Codes of Practice.

The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Owner and shall provide test certificate signed by a authorized person. Such test shall be conducted on all materials and equipment and tests on completed work as called for by the Owner at contractor's expenses unless otherwise called for.

If it is proved that the installation or part thereof is not satisfactorily carried out then the contractor shall be liable for the rectification of the same. Owner Site Engineer's decision as to what constitutes a satisfactory installation shall be final.

All tests shall be carried out by a test house approved by the Owner / Consultants.

2.1.1.17 COMPLETION DRAWINGS

Upon completion of the work and before issuance of certificate of virtual completion the contractor shall submit to the Owner's site representative four sets of layout drawings in progressive manner for individual systems drawn at approved scale indicating the complete wiring system as installed. Drawings shall be in DWG format. Along with the hard copies, the contractor shall submit copies of all drawings on Pen Drive with handing over documents containing all As built layouts, General arrangements, test certificates, product data sheets, warranty certificates, testing reports, DB charts etc as relevant applicable documents.

2.1.1.18 OPERATING INSTRUCTION & MAINTENANCE MANUAL

Upon completion and commissioning of part Electrical system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Owner's site representative and two for Owners Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4-year period of maintenance of each equipment.

2.1.1.19 ON SITE TRAINING

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labour and helpers for operating the entire installation for a period of thirty (30) working days of ten (10) hours each, to enable the Owner's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Owner's personnel in the operation, adjustment and maintenance of all equipment installed.

2.1.1.20 MAINTENANCE DURING DEFECTS LIABILITY PERIOD

- Complaints

The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 2 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist. Corrective actions to problem experienced, if takes longer time, shall be complied 100% by during next business hours.

- Repairs

All equipment that require repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defects liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Owner.

2.1.1.21 UPTIME GUARANTEE

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all temperatures, pressures, humidity, power consumption, starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Owner's site representatives/Consultant's review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.

2.1.1.22 OPERATION AND MAINTENANCE

Contractor may be required to carry out the operation of the Electrical installation for the defect's liability period.

2.1.1.23 METHOD OF MEASUREMENT

The works shall be measured in accordance with relevant IS codes. Notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract.

2.1.1.24 DEMONSTRATION TO OWNER

At completion, devices subject to manual operation shall be operated at least five times in presence of Owner's site representative to demonstrate satisfactory operation.

2.1.1.25 TOOLS AND TACKLES

The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, all transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Owner's site representative.

2.1.1.26 PARTIAL ORDERING

Owner through the Architect/Consultant/ Owner's site representative reserves the right to order equipment and material from any and all alternates, and /or to order high side and /or low side equipment and materials or parts thereof from one or more tenderers.

2.1.1.27 SITE ACCEPTANCE TEST (SAT)

The SAT will include the following tests: -

- Finishing Visual check.
- Main component Visual check.
- Utility functionality and setting check.
- Material checklist.
- Finishing packing list check.
- Check for any damage upon receiving.
- Check for any missing item/ part.
- Complete documents/ manual check.

Item that not fulfill the above conditions is a failure and needs to be replaced.

2.1.1.28 HANDING OVER PROCEDURE

The contractor shall prepare a checklist of the work done by him before handing over. The checklist shall be verified in the presence of owner's site representative / PMC/ Stage-I contractor. The work done shall be inspected, tested & commissioned in the presence of above representatives. Further, the contractor shall also furnish all the technical documents/ manuals of all equipment to PMC/ owner's site representatives.

2.1.2 Additional Specification

LIST OF INDIAN STANDARDS:

Following are the various pertinent Indian Standards, relevant to buildings work :

(All Latest Versions of I.S. codes shall be referred)

I. S. CODE NO.	SUBJECT
IS : 374	Ceiling fans and regulators (3rd revision)
IS : 694	PVC insulated Electric cable for working voltage upto and including 1100 volts.

I. S. CODE NO.	SUBJECT
IS : 732	Code of practice for electrical wiring and installation
IS : 1255	Code of Practice for installation and maintenance of Power Cables up to and including 33 KV rating (Second Revision)
IS : 1258	Bayonet lamp holders(Third revision)
IS : 1293	Three pin plugs and sockets outlets rated voltage up to and including 250 volts and rated current up to and including 160 amps.
IS : 1554 (Part - IS)	PVC insulated (Heavy Duty) electric cables for working voltages up to and including 1100 volts.
IS : 1646	Electrical installation fire safety of buildings (general) Code of practice.
IS : 1885	Glossary of items for electrical cables and conductors
IS : 1913	General and safety requirements for fluorescent lamps luminaries Tubular.
IS : 2026 - Part (I to IV)	Power Transformers/ Dry Type Transformers
IS : 2071	Methods of high voltage testing
IS : 2309	Protection of building and allied structures against lightning
IS : 2551-	Danger notice plate.
IS : 3043	Code of practice for earthing.
IS : 3427	AC Metal enclosed switch gear and control gear for rated voltages above 1 KV and upto and including 52 KV.
IS : 3480	Flexible steel conduits for electrical wiring.
IS : 3837	Accessories for rigid steel conduit for electrical wiring.
IS : 4146	Application guide for voltage transformers
IS : 4615	Switch socket outlets.
IS : 5133 (Part -I)	Boxes for the enclosure of electrical accessories.
IS : 5216 (Part-I)	Guide for safety procedures and practices in electrical work.
IS : 5424	Rubber mats for electrical purposes.
IS : 5578 & 11353	Marking and arrangement of bus bars
IS : 7098 - (Part - II)	Cross linked polyethylene insulated PVC sheathed cables. For working voltages from 3.3 KV upto and including 33 KV
IS : 8130	Conductors for insulated electric cables and flexible cords
IS : 8623 - (Part -I)	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V D C.
IS : 8623 - (Part -II)	Bus Bar trunking system

I. S. CODE NO.	SUBJECT
IS : 8828	Miniature Circuit Breakers
IS : 9537	Rigid Steel Conduits for electrical wiring (Second Revisions)
IS : 10810	Methods of test for cables.
IS : 12640	Earth Leakage Circuit Breakers
IS : 13947 (Part-II)	Air Circuit Breakers
IS : 13947	Moulded Case Circuit Breakers
IS : 13947	Degree of protection provided by enclosures for LV switchgear and control gear.
IS : 13947	General requirement for switchgear and control gear for voltage not exceeding 1000 Volts.
IS : 15652	Insulating materials for electrical purposes.
IS : 1651 & 1652	Stationary cells and batteries lead acid type.

2.1.2.1 INTERNAL WIRING

2.1.2.1.1 System of Wiring

The system of wiring shall consist of PVC insulated copper stranded conductor flexible FRLS wires in metallic / non metallic (Rigid heavy Duty ISI -marked fire retarded FRST PVC Conduits of minimum 2mm Wall thickness and Sizes starting from 20 mm diameter) conduits and shall be concealed or surface mounted above false ceiling as called for

2.1.2.1.2 General

Prior to laying and fixing of conduits, the contractor shall mark the conduit route, carefully examine the working drawings prepared by him and approved by the Consultant indicating the layout, satisfy himself about the non interference in the route, sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found shall be brought to the notice of the Owner's site representative. Any modifications suggested by the contractor should get written approval before the actual laying of conduits is commenced.

In laying of conduits it is important that not more than two right angle bends are provided for each circuit without a pull box. No junction box shall be provided in the entire length of conduit run for drawing of wires. Only switch outlets, lighting fixture outlets, equipment power outlets and socket outlets shall be considered for drawing of wires.

2.1.2.1.3 Metal Conduits & Accessories

2.1.2.1.3.1 Conduits

Conduits and Accessories shall conform to latest edition of Indian Standards IS-9537 part 1 & 2. 16/14 (16 gauge up to 32mm diameter & 14 gauge above 32 mm diameter) gauge screwed GI or MS painted conduits as specified on schedule of quantities shall be used. Joints between conduits and accessories shall be securely made by standard accessories, as per IS-2667, IS-3837 and IS-5133 to ensure earth continuity. All conduit accessories shall be threaded type only.

Only approved make of conduits and accessories shall be used.

Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

Note. : Whatever materials required to be billed by the Contractor should come on site with proper Challan Numbers and quantity mentioned in each such Challan.

2.1.2.1.3.2 Joints

All jointing shall be subject to the approval of the Owner's site representative. The threads and sockets shall be free from grease and oil. End termination of conduit on GI boxes shall be by means of hexagon check nuts & spring washer on both sides of the conduit. The joints in conduits shall be free of burrs to avoid damage to insulation of conductors while pulling them through the conduits. Rubberised bushes shall be used in the conduit entry and exit from DBs, switch boxes etc ,so that wires are protected from damage to insulation of the incoming and outgoing wires

2.1.2.1.3.3 Recessed or Exposed Conduits

All conduits shall be as per Schedule of Quantities.

2.1.2.1.3.4 Flexible Conduits

Flexible conduits shall be made of heavy gauge MS strip galvanized after making the spiral. Both edges of the strip to have interlocking to avoid opening up. Flexible conduit shall be heat resistant, lead coated steel, water leak, fire and rust proof. The flexible conduit shall be heat resistant on continuous temperature upto 150 deg. C and intermittent temperature upto 200 deg. C. The flexible conduit shall be corrosion resistant as per IS-3480 & BS-731.

2.1.2.1.4 PVC Conduit and Accessories

PVC Conduit

Conduits and accessories shall conform to latest edition of IS-9537 part 3 and shall be heavy duty with minimum wall thickness of 2.0 mm rigid tubes which are unscrewed without coupling and with plain ends. All conduits used shall be ISI-marked and shall not be less than 20 mm diameter.

PVC conduit shall be used for all concealed / embedded installation.

PVC Conduit Accessories

Accessories used for conduit shall be of an approved brand and type complying to relevant IS code.

All accessories used shall be of standard white or black colour, identical to conduit used.

Plain conduits shall be jointed by slip type of couplers with manufacturer's standard sealing cement.

All conduit entries to outlet boxes, trunking and switchgear are to be made with adaptors female thread and screwed male bushes.

PVC-switch and socket boxes with round knockouts are to be used. The colours of these boxes and the conduits shall be the same.

Standard PVC circular junction boxes are to be used with conduits for intersection, Tee-junction, angle-junction and terminal. For the drawing-in of cables, standard circular through boxes shall be used.

Samples of accessories shall be submitted for approval prior to installation.

All jointing of PVC conduits shall be by means of adhesive jointing. Adequate expansion joints shall be allowed to take up the expansion of PVC conduits.

2.1.2.1.5 Bends in Conduit

Where necessary, bends or diversions may be achieved by means of bends and / or circular cast iron boxes with inspection cover and 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 flush with the finished wall surface. No bends shall have radius less than 7.5 cms or three times

the outside diameter of the conduits. For metallic conduits, bends of defined radius shall be made by compactly filling fine sand inside the conduit length, to avoid non-uniform shape, once the bend is done. Proper jigs shall be used to ensure that the Enamelling /Galvanising of the Conduit is not damaged.

2.1.2.1.6 Fixing of Conduits

All conduits, shall be installed so as to avoid exposure to steam, hot water or any other process pipes. After the conduits, junction boxes, outlet boxes and switch boxes are installed in position, their outlets shall be properly plugged or covered so that water, mortar, rodents and insects, insects or any other foreign matter does not enter into the conduit system. Surface conduits shall be fixed by means of heavy gauge GI saddles secured on 5mm thick GI spacers at intervals not more than 1000 mm, and on either side of couplers or bends or similar fitting saddles shall be fixed at a distance of 300 mm from centre of each fitting. For conduit fixing suitable PVC/Nylon fasteners shall be used.

Recessed conduiting shall be done by making chase in the masonry by chase cutter, the conduit shall be fixed in the chase by means of GI hooks not more than 600 mm apart. After fixing of conduit the chase shall be filled with cement mortar after fixing of chicken mesh and brought to the original finish level of the surface to the entire satisfaction of Owner.

2.1.2.1.7 Switch outlets and Junction Boxes

All outlet boxes for switches, sockets and other receptacles shall be rust proof and shall be of 1.6 mm thick mild steel sheets with HOT dipped galvanizing (or as specified in SOQ), having smooth external and internal surfaces to true finish. All outlet boxes for receiving plug sockets and switches shall be fabricated to approved sizes. All boxes shall have adequate number of knock out holes of required diameter and earthing terminal screws. Outlet boxes shall generally be of 50mm depth subject to maximum depth of 65 mm.

2.1.2.1.8 Inspection Boxes

50 mm dia inspection boxes and pull boxes shall have smooth external and internal finish to facilitate removal and replacement of wires, where required.

2.1.2.1.9 Fish Wire

To facilitate subsequent drawing of wires in the conduit, GI fish wires of 2.0 mm (14 SWG) shall be provided along with the laying of recessed conduit.

2.1.2.1.10 Conductors

All PVC insulated copper conductor flexible FRLS, as specified in SOQ, wires shall conform in all respects to Standards as listed under sub-head Indian Standards and shall be IS approved and ISI marked.

2.1.2.1.11 Bunching of Wires

Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not run in the same conduit. All wires shall have ferrules for identification. Lighting and power circuits shall be separate. Each Power/ Light Circuit's Neutral shall be individual per Circuit and shall not be looped from any other Circuit.

2.1.2.1.12 Drawing Conductors

The drawing and jointing of PVC insulated copper conductor wires shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends. Wire reel stands to be used for pulling of wires to avoid kinks. Care shall be exercised while drawing

the wires from reels, by taking appropriate measures to ensure that wires are not spread on ground, causing dust and dirt accumulation on the new wires.

Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into metallic Conduits are given below:

Size of wires Nominal Cross section Area (Sq. mm.)	Maximum number of wires within conduit size(mm)				
	20	25	32	40	50
1.5	5	10	14	--	--
2.5	5	8	12	--	--
4	3	7	10	--	--
6	2	5	8	--	--
10	--	3	5	6	--
16	--	2	3	6	6
25	--	--	2	4	6
35	--	--	--	3	5

Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or PVC Conduits are given below:

Size of wires Nominal Cross section Area (Sq. mm.)	Maximum number of wires within conduit size(mm)				
	20	25	32	40	50
1.5	7	12	16	--	--
2.5	5	10	14	--	--
4	4	8	12	--	--
6	3	6	8	--	--
10	--	4	5	6	--
16	--	3	3	6	6
25	--	--	2	4	6
35	--	--	--	3	5

Insulation shall be removed by insulation stripper only. Few Strands of wires shall not be cut/reduced for convenience in connecting into terminals. The terminals shall have sufficient cross sectional area to take all strands and it's connecting brass screws shall have flats ends. All looped joints shall be connected through terminal block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. All light points shall be terminated through a connector.

Conduits having nominal cross sectional areas exceeding 10 sq.mm shall always be provided with cable sockets. At all bolted terminals brass flat washer of large area and approved steel spring washer shall be used. Brass nuts and bolts with brass washers shall be used for all connections.

Only licensed wiremen (Before doing the work or before appointing him on site contractor has to submit his wiring licence to Owner) and cable jointers shall be employed to do jointing work. Before entrusting cable jointing work to any technician, or before appointing Cable Jointers or Wiremen on Site, Contractor has to submit such Technicians' / Wireman's / Cable Jointer's licence to Owner.

All wires and cables shall be embossed with the manufacturer's label with ISI mark and shall be brought to site in original packing. For all internal wiring. PVC insulated wires of 1100 volts grade (FRLS) shall be used.

The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors. No wire shall be drawn into any conduit until all defective work of conduit installation of any nature that may cause injury to wire is completed. Care shall be taken while pulling out the wires so that no damage occurs to conduits/wire itself, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction. The minimum size of PVC insulated copper conductor wires for all sub-circuit wiring for light points shall be minimum 2.5 sq.mm copper. Separate neutral to be pulled for each circuit.

2.1.2.1.13 Joints

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switches boxes only. No joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to inlet.

2.1.2.1.14 Mains and Sub-Mains

Mains and sub-mains cable or wires where called for shall be of the rated capacity and approved make. Every main and sub main wires shall be drawn into an independent adequate size of conduit. Earthing shall be in conformity with relevant IS codes and calculations shall be submitted for verification. An independent earth wire of the proper rating shall be provided for every single phase sub-main. For every 3-phase sub-main, 2 Nos. earth wires of proper rating shall be provided alongwith the sub-main. The earth wires shall be drawn along with circuit wires through conduit. Where mains and sub-mains cables are connected to switchgear, sufficient extra lengths of cable shall be provided to facilitate easy connections and maintenance. Where ever necessary, powder-coated 1.6 mm thick sheet steel covering (also called trunking) shall be provided to cover the group of conduits and cables entering and exiting the Wall mounted/Floor mounted SubDBs, DBs, and FDBs, so that the Installation looks neat. The colour of such sheet steel covering (trunking) shall be matching with the colour of the SDBs, DBs and FDBs

2.1.2.1.15 Load Balancing

Balancing of circuits in three phase installation shall be as planned by the Consultants in the tender drawings and shall be checked by the contractor before the commencement of wiring and shall be strictly adhered to.

2.1.2.1.16 Colour Code of Conductors

Colour code shall be maintained as indicated by the Consultant for the entire wiring installations. Red, yellow, blue shall be for three phases, black for neutral and green with yellow band shall be for earthing.

2 (A) SWITCHES, RECEPTACLES (MODULAR), LIGHTING FIXTURES & LIGHTING CONTROL EQUIPMENT

2.1.2.2.1 Switches

All switches shall be enclosed type flush mounted suitable for 240 volts AC. All switches shall be fixed inside the switch boxes on adjustable flat M S strips/plates with tapped holes and brass machine screws, leaving ample space at the back and sides for accommodating wires. Switch controlling the light point shall be connected to the phase wire of the circuit and load on each switch shall be restricted to maximum 800 watts & maximum 1500 watts per circuit. All wiring accessories shall be BIS approved. Perfect alignment shall be maintained while fixing of the back boxes.

2.1.2.2.2 Socket Outlet

Socket outlets shall be of the three pin. The switch controlling the socket outlet shall be on the phase wire of the circuit and not more than two socket outlets of 16 amps shall be connected on one circuit. An earth wire shall be provided along with the circuit wires and shall be connected to earthing screw inside the box.. All sockets shall be shuttered type.

- a. Every socket outlet shall be controlled by an individual switch unless mentioned otherwise.
- b. The switch controlling the socket outlet shall be on the 'Live' side of the line.
- c. 6 amps and 16 amps socket outlet shall normally be fixed at any convenient height above the floor level as desired by the Architect. The switch for 6 and 16 amps, socket outlet shall be kept alongwith the socket outlet. However, in special case, if desired by the Architect the 6 amp. socket outlet can be placed at the normal switch level.

In a room containing a fixed bath or shower, there shall be no socket outlet and there shall be no provision for connecting a portable appliance. Any stationary appliance connected permanently in the bathroom shall be controlled by an isolator switch or circuit breaker having outlets at such location where water / moisture does not effect. Generally, switches and outlets shall be planned at a minimum distance of 1.5 Metre away from any water supply outlet, so that splashed water may not affect the live installation.

d. Where socket outlets are placed at lower level, they shall be enclosed in a suitable metallic box with the system of wiring adopted or shutter type sockets shall be provided as specified.

e. In an earthed system of supply, a socket outlet and plug shall be of three pin type, the third terminal shall be connected to earth.

f. Conductors connecting electrical appliance with socket outlet shall be flexible twin cord with an earthing cord which shall be secured by connecting between the earth terminal of plug and the metallic body of the electrical appliance.

g. Where use of shutter type of interlocking type of socket is required for any special installation, the items should be separately and specifically listed in the Schedule of Quantities of that particular work.

2.1.2.2.3 Lighting Fixtures & Accessories

The light fixtures and fittings shall be assembled and installed in position complete and ready for service, in accordance with details, drawings, manufacturer's instructions and to the satisfaction of the Project Manager.

2.1.2.2.3.1 Scope :

Scope of work under this section shall include inspection at suppliers/manufacturer's premises at site, receiving at site, safe storage, transportation from point of storage to point of erection, erection and commissioning of light fittings, fixtures and accessories including all necessary supports, brackets, down rods and painting etc as required.

2.1.2.2.3.2 Standards :

The lighting and their associated accessories such as lamps, reflectors, housings, ballastetc., shall comply with the latest applicable standards, more specifically the following:

General and safety requirements for Luminaires :

Part-1 Tubular flourescent lamps	-	IS – 1913 (Part-1)
Industrial lighting fittings with metal reflectors	-	IS - 1777
Decorative lighting outfits	-	IS - 5077
Bayonet lamp holders	-	IS - 1258
Bi-pin lamp holders for tubular fluorescent lamps	-	IS - 3323
Electronic Ballasts for fluorescent lamps – General & Safety requirement	-	IS – 13021 (Part-1)
Electronic Ballasts for fluorescent lamps – Performance requirement	-	IS – 13021 (Part-2)
Ballast for HP MV lamps	-	IS - 6616
Tubular Fluorescent lamps	-	IS - 2418 (Part-1 to 4)

Luminaries – General requirement	-	IS – 10322 (Part-1)
Luminaries – Constructional requirement	-	IS – 10322 (Part-2)
Luminaries – Screw and Screwless termination	-	IS – 10322 (Part-3)
Luminaries – Methods of Tests	-	IS – 10322
(Part-4)		
Particular requirement – General purpose Luminaries		IS – 10322 (Part-5/Sec-1)
Particular requirement – Recessed Luminaries	-	IS – 10322 (Part-5/Sec-2)
Particular requirement – Luminaries for Road and Street lighting	-	IS – 10322 (Part-5/Sec-3)
Particular requirement – Portable General purpose Luminaries	-	IS – 10322 (Part-5/Sec-4)
Particular requirement – Flood Lighting	-	IS – 10322 (Part-5/Sec-5)
High pressure mercury vapour lamps	-	IS – 9900 (Part-1)
Tungsten filament general electric lamps	-	IS - 418

2.1.2.2.3.3 Light Fittings-General Requirements :

- a) .Fittings shall be designed for continuous trouble free operation under atmospheric conditions without reduction in lamp life or without deterioration of materials and internal wiring. Degree of protection of enclosure shall be IP-65 for outdoor fittings except bulkhead fitting. Bulkhead fitting shall be provided with IP-54 protection.
- b) Fittings shall be so designed as to facilitate easy maintenance including cleaning, replacement of lamps/ ballasts.
- c) All hardwares used in the fitting shall be suitably plated or anodized and passivated.
- d) Earthing : Each lighting fitting shall be provided with an earthing terminal. All metal or metal enclosed parts of the housing shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity throughout the fixture.
- e) Painting/Finish : All surfaces of the fittings shall be thoroughly cleaned and degreased and the fittings shall be free from scale, rust, sharp-edges, and burns.
- f) The housing shall be powder coated/stove-enamelled or anodised as required. The surface shall be scratch resistant and shall show no sign of cracking or flaking when bent through 90 deg. over 12 mm dia mandrel.
- g) All Light Fitting in Dining Area, Kitchen Area shall be Suspended type as per the drawings & site requirement, suspension kit should be part of the fixtures & all light fixtures should be complete in all respect.
- h) Civil work related to external lights will be part of light fixture installation scope & vendor to quote accordingly .

2.1.2.2.3.4. LED Light Fittings

LED Fixtures

The driver shall be CCCV isolated driver (Constant current constant voltage driver). All light fixtures should be with Opex lighting fixture. Type of PCB is MCPCB for External & FRPCB for external light.

General requirements for LED lighting:

S.N.	Types of Test/Specifications		Test Method
1	High bright white power LEDs shall be used in the luminaires and the wattage of these LEDs shall be >1W and <3W. *LED Technical datasheet for the LED source intended for supply of the project including packaging details to be submitted.		Specify Make
2	Manufacturer should submit proof of procurement of LEDs and LM-80 Test Reports of specific LED used in the proposed. (No other chip details to be offered).		
3	Life span of the LEDs used in the Luminaire shall be more than 50,000 hours at 70% light output. (Manufacturer shall submit the proof – L70 & TM 21 Test Report.		
4	Color Rendering Index of the LEDs used in the luminaire shall be greater than 80.		
5	LED chip efficiency shall be more than 100 Lumens/Watt at Tj 25 C (Manufacturer shall submit the proof – LED Technical Data Sheet to be submitted).		
6	Power Factor	>0.95	
7	System Efficacy (Lumens/Watt)	System Lumen output supported by LM79 report shall be submitted.	
8	CRI of Luminaires	>70 (LM 79 report to be submitted)	
9	The luminaire light output shall be constant. The voltage variations/ fluctuations in the specified voltage range shall not impinge upon the lumen it produces. Maximum +/- 2% is allowed throughout in the input operating voltage range.		Test Report from NABL Accredited Lab
10	Operating Voltage	140 V to 270 V universal electronic driver with internal surge protection of 2.5 KV (Applicability IS 15885, Driver Safety 16104-1/2).	
11	Total harmonic Distortion	<10% THD – Test Method IEC:610003-2	

S.N.	Types of Test/Specifications		Test Method
12	LED Driver Efficiency	>85%	
13	The outdoor luminaire housing shall be made up of corrosion free High Pressure Aluminum die casting thus conforming the luminaire to minimum IP-65 for luminaire at 60 W or below/ IP-66 for wattage above 60 W-protection and safety as per IEC 60598/IS 10322. (NABL accredited Lab Report supporting the same shall be furnished at the time of supply). Necessary Guarantee & Warranty certificate must be submitted at the time of bid submission. (Only single housing fixtures allowed). Embossing of supplier logo on housing.		
14	The luminaire shall be equipped with distortion free, clear, heat resistant, toughened, UV stabilized glass cover or Polycarbonate cover in the front fixed to the die cast Aluminum frame which shall be fixed to the housing by means of stainless steel screws.		
15	Frequency	50 Hz +/- 3%	
16	Protections	IP65 up to 60 W and IP-66 for wattage above 60 W, IP-20 for Indoor areas and IP-65 for kitchen area. Surge protection 2.5 KV, IEC61000-4-5	To be confirmed by the vendor
17	Conformation Standards of luminaire (Test Reports of Luminaire)	The luminaire should conform to IEC 60598/ IS: 10322 The luminaire should be tested as per IEC 60598-2-3: 2002/ IS: 10322 Part 5 Sec-3 standards and following test reports should be submitted: Heat Resistance Test, Thermal Test, Ingress Protection Test, Drop Test, Electrical/ Insulation Resistance Test, Photometry Test (LM 79 report), Vibration Test	From NABL Certified lab Report TEST REPORT as per IS: 10322 part 5 Sec-3/ IEC: 60598-2-3.
18	Conformation Standards of luminaire	LM80 (IS16105) NABL Acc. Lab certificate for LED And LM79 (IS16106), IEC60598/ IS: 10322 for LED Luminaire	To be confirmed by the vendor
19	Conformation Standards of luminaire	IS 16101/2/3/8 and 7	To be confirmed by the vendor
20	Surge Protection	Surge protection of 10 KV to be separately installed housed inside fixture for all wattages >= 35 W.	
21	Replacement Warrantee	05 YEARS	
22	Working Temperature	-5 to +50 degree C	
23	Heat Sink	Good thermal management System should be provided & LED Must be mentioned on heat sink Conductive Al. bars with Suitable large Surface area by means Of fins to dissipate the heat to ambient temperature.	

Contractor shall submit all following test reports for LED lighting fixtures before dispatching of material at site. All tests shall be carried as per IES approved methods defined (LM-82). The replacement warranty for LED shall be 5 years.

2.1.2.3 MEDIUM VOLTAGE 1.1 KV GRADE XLPE / PVC CABLES

2.1.2.3.1 General

The MV cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, Specifications, relevant Standard Specifications and cable manufacturer's instruction.

2.1.2.3.2 Material

The MV cables shall be cross linked polyethylene (XLPE)\ PVC core insulated, extruded PVC inner sheathed and extruded HR PVC / FRLS PVC outer sheath of 1100 volts grade as asked for in the schedule of quantities. Cables shall be of copper and or aluminium conductor as mentioned BOQ.

2.1.2.3.3 Technical Requirements:

2.1.2.3.3.1 All XLPE Aluminium/Copper Power cables shall be 1100 Volts grade, multi core constructed as per IS : 7098 Part-I of 1988 as follows :

- a) Stranded Aluminium /Copper conductor as specified in BOQ.
- b) Cores laid up
- c) The inner sheath should be bonded over with thermo-plastic material for protection against mechanical and electrical damage.
- d) Armoring should be provided over the inner sheath to guard against mechanical damage. Armoring should be Galvanised steel wires or galvanised steel strips. (In single core cables used in A.C. system armoring should be non-magnetic hard aluminium Wires/Strips. Round steel wires should be used where diameter over the inner sheath does not exceed 13 mm; above 13 mm flat steel armour should be used. Round wire of different sizes should be provided against specific request.)
- e) The outer sheath should be specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS : 5831-1984 extruded to form the outer sheath.

2.1.2.3.3.2 Conductor shall be of electrolytic Aluminium/Copper conforming to IS : 8130 and are compact circular or compact shaped.

2.1.2.3.3.3 Insulation shall be of XLPE type as per latest IS general purpose insulation for maximum rated conductor temperature 70 degree centigrade.

2.1.2.3.3.4 In Inner sheath laid up cores shall be bonded over with thermoplastic material for protection against mechanical and electrical damage. Inner sheath shall be extruded type only.

2.1.2.3.3.5 Insulation, inner sheath and outer sheath shall be applied by extrusion process only.

2.1.2.3.3.6 Armoring shall be of galvanised steel wire/flat.

2.1.2.3.3.7 Repaired cables shall not be used.

2.1.2.3.3.8 Current ratings of the cables shall be as per IS : 3961.

2.1.2.3.3.9. The XLPE insulated cables shall conform to latest revision of IS and shall be read along with this specifications. The Conductor shall be stranded Aluminium/Copper circular/

sector shaped and compacted. In multi core cables the core shall be identified by red, yellow, blue and black coloring of insulation.

2.1.2.3.3.10 The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.

2.1.2.3.3.11 Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables.

2.1.2.3.3.12 Cables shall be supplied in non returnable wooden drums as per IS : 10418.

Both ends of the cables shall be properly sealed with PVC/Rubber caps so as eliminate ingress of water during transportation, storage and erection.

2.1.2.3.3.13 The product should be coded as per IS :- 7098 Part-I as follows :-

Aluminium Conductor	A	
XLPE Insulation		2X
Steel round wire armour	W	
Steel strip armour		F
Steel Double round wire armour		WW
Steel Double strip armour	FF	
Non-magnetic (Al.) round wire armour		Wa
Non-magnetic (Al.) strip armour	Fa	
PVC outer sheath		Y

2.1.2.3.4 Inspection

All cables shall be inspected by the contractor upon receipt at site and checked for any damage during transit.

2.1.2.3.5 Joints in Cables

The Contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoid cable jointing. This apportioning shall be got approved by the Owner's site representative before the cables are cut to lengths. Where joints are unavoidable heat shrinkable type joints shall be made. The location of such joints shall be got approved from the Owner's site representative and shall be identified through a marker.

2.1.2.3.6 Jointing Boxes for Cables

Cable joint boxes shall be installed with heat shrinkable sleeve and of appropriate size, suitable for XLPE armoured cables of particular voltage rating.

2.1.2.3.7 Jointing of Cables

All cable joints shall be made in suitable, approved cable joint boxes and the filling in of compound shall be done in accordance with manufactures' instructions and in an approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resin.

All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commence. The seals of cables must not be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. The conductors shall be efficiently insulated with high voltage insulating tape and by using of spreaders of approved size and pattern. The joints shall be completely topped up with epoxy compound so as to ensure that the box is properly filled.

2.1.2.3.8 Cable End Terminations

Cable end termination shall be done in cable terminal box using crimping sockets and proper size of glands of double compression type

2.1.2.3.9 Bonding of Cables

Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armour clamp and gland. The clamps must grip the armouring firmly to the gland or casing, so that no undue stress is passed on to the cable conductors.

2.1.2.3.10 Cable Installation

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks.

2.1.2.3.10.1 Laying of Cables on Cable Trays

The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturer's. All cables shall be laid with minimum one diameter gap and shall be clamped at every metre to the cable tray. Cables shall be tagged for identification with aluminum tag and clamped properly at every 20M. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings. All cable shall be identified by embossing on the tag the size of the cable, place of origin and termination.

All cables passing through holes in floor or walls shall be sealed with fire retardant Sealant and shall be painted with fire retardant paint up to one meter on all joints, terminations and both sides of the wall crossings by "VIPER CABLE RETARD".

2.1.2.3.10.2 Laying of Cables in Ground

The width of trench for laying single cable shall be minimum 350 mm. Where more than one cable is to be laid in horizontal formation, the width of the trench shall be worked out by providing 200 mm gap between the cables, except where otherwise specified. There shall be clearance of 150 mm between the end cable and the side wall of the trench. The minimum depth of the cable trench shall not be less than 750 mm for single layer of cables. When the cables are laid in more than one tier the depth of the trench shall be increased by 300 mm for each additional tier.

Excavation of trenches : The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided. Where gradients and changes in depth are unavoidable, these shall be gradual. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. The bottom of the trench shall be levelled and shall be made free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 100 mm in depth. Prior to laying of cables, the cores shall be tested for continuity and insulation resistance. The cable drum shall be properly mounted on jacks, at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum and the spindle is horizontal. Cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire drum length shall be laid in one stretch. However, where this is not possible the remainder of the cable shall be removed by 'Flaking' i.e. by making one long loop in the reverse direction. After the cable has been uncoiled and laid into the trench over the rollers, the cable shall be lifted off the rollers beginning from one end by helpers standing about 10 meters apart and laid in a reasonably straight line. Cable laid in trenches in a single tier formation shall have a cover of clean, dry sand of not less than 150 mm. above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. Finally the cables shall be protected by second class bricks before back filling the trench. The buried depth of uppermost layer of cable shall not be less than 750 mm.

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

300 mm. 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.

2.1.2.3.11 Cables inside Building

Cables inside buildings shall be laid on the cable trays. All cables passing through walls shall run through GI Pipes sleeves of adequate diameter 50 mm apart maintaining the relative position over the entire length.

2.1.2.3.12 Route Marker

Route marker shall be provided along straight runs of the cables not exceeding 30 meters also for change in the direction of the cable route and underground joints.

Route marker shall be of cast iron painted with aluminum paint. The size of marker shall be 100 mm dia with "Cable" and voltage grade inscribed on it.

2.1.2.3.13 Cable Trays

Ladder and perforated type Cable Trays shall be of Hot dip Galvanized bolted type and factory fabricated out of CRCA sheet with standard accessories like tee, bends, couplers etc. for different loads and number and size of cables as given below :

Cable trays shall be galvanized as per Specification given under 3.14.

- a. 1500 mm wide
Runners 25 x 100 x 25 x 3 mm
Rungs 2# 20 x 40 x 20 x 3 mm 250 mm C/C
Suspenders 2 Nos. 40 x 40 x 5 mm GI angle 1500 mm C/C with base support of 40x 40 x 5mm GI angle.
- b. 1200 mm wide
Runners 25 x 100 x 25 x 3 mm
Rungs 2# 20 x 40 x 20 x 3 mm 250 mm C/C
Suspenders 2 Nos. 40 x 40 x 5 mm GI angle 1500 mm C/C with base support of 40x 40 x 5mm GI angle.
- c. 1000 mm wide
Runners 25 x 100 x 25 x 3 mm
Rungs 2# 20 x 40 x 20 x 3 mm 250 mm C/C
Suspenders 2 Nos. 40 x 40 x 5 mm GI angle 1500 mm C/C with base support of 40x 40 x 5mm GI angle.
- d. 750 mm wide
Runners 20 x 75 x 20 x 2.5 mm
Rungs 20 x 30 x 20 x 2.5 mm 250 mm C/C
Suspenders 2 Nos. 32 x 32 x 5 mm GI angle 1800 mm C/C with base support of 40x 40 x 5mm GI angle.
- e. 600 mm wide
Runners 20 x 75 x 20 x 2.5 mm
Rungs 20 x 30 x 20 x 2.5 mm 250 mm C/C
Suspenders 2 Nos. 32 x 32 x 5 mm GI angle 1800 mm C/C with base support of 40x 40 x 5mm GI angle.
- f. 450 mm wide
Runners 20 x 75 x 20 x 2.5 mm

Rungs 20 x 30 x 20 x 2.5 mm 250 mm C/C

Suspenders 2 Nos. 25 x 25 x 4 mm GI angle 1800 mm C/C with base support of 40x 40 x 5mm GI angle.

- g. Supply and fixing of perforated type cable trays of the following sizes of pre-galvanized iron.
- i. 600 x 40 x 40 x 2 mm thick
 - i. 450 x 40 x 40 x 2 mm thick
 - i. 300 x 40 x 40 x 2 mm thick
 - ii. 150 x 40 x 40 x 2 mm thick

Note : Suitable length of 10 mm dia GI rod suspenders at 1800 mm interval shall be included in the item for perforated type cable tray.

2.1.2.3.14 Specification for Hot Dip Galvanizing Process (for Mild Steel Used For Earthing, Cable Trays Or Junction Boxes For Electrical Installation.

General Requirements

I. Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.

II. Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square metre shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing.

2.1.2.3.15 Fire retardant Cable Paint & Fire Barrier

The fire retardant paint / barrier shall be listed by independent test agencies such as UL, FM or OPL and be tested to, and pass the criteria of ASTM E 814 (UL1479) standard test method for fire test through- penetration fire stops and ASTM E 1996 (UL 2079) standard test method for fire resistive joint system/

2.1.2.3.15.1 Fire retardant cable Paint

The Fire-resistant cable coating / painting shall be intumescent / ablative, water-based compound, The coating shall expand up to 10 times, supplied in a manufacturer seal container indicating manufacturing and expiry dates. The coating material shall be non-toxic, asbestos free, & halogen free and shall have good mechanical strength. The colour of paint shall be white and density of coating shall be 1.3 kg/ltr , coating shall have a snap time of 30 minutes, the expansion shall begin at 230 deg.C and it shall have a oxygen index of 41%.

Coating shall be applied by ordinary paint brush after cleaning the cables of dust and oil deposition. A minimum textured finish of 3 mm wet film thickness shall be achieved by applying the material in 2-3 layers leaving intervals of 2 to 8 hours depending upon the moisture and thickness, moisture and temperature hours between each coat.

2.1.2.3.15.2 Fire Barrier sheet for floor and wall sealing

The framing & fixing part of fire barrier sheet shall be very simple & directly fixed around walls & floors by help of anchored bolts & washer. For 2 hour fire rating the fire barrier sheet shall be minimum 7.62 mm thick and shall be cut as per the profile of penetration and opening. The small gap left around the

penetration shall be closed with fire rated soft & mouldable putty. Fire barrier must be design on the intumescent technology to seal larger penetration through the fire rated walls & floors. Fire barrier must be a composite construction with the quality incorporated with organic/ inorganic fire resistive elastomeric sheet with specific gravity of 1.6 gm/ cubic centimetre.

2.1.2.3.16 Testing of Cables

Cables shall be tested at works for all routine tests as per IS including the following tests before being dispatched to site by the project team.

- a) Insulation Resistance Test.
- b) Continuity resistance test.
- c) Earth test.(in armoured cables)
- d) Hi Pot Test.

Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner's site representative.

- a) Insulation Resistance Test(Sectional and overall)
- b) Continuity resistance test.
- c) Earth test.

All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Owner's site representative, results will be noted and signed by all present and record be maintained.

2.1.2.4(A) DISTRIBUTION PANELS/BOARDS

Main Distribution Panels, Sub-Distribution Panels and Final Distribution shall be covered under this section. Panels/Boards shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All Distribution panels shall be CPRI tested design and manufactured by a approved manufacturer. CPRI certificate shall be made available.

Distribution panels shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

2.1.2.4.1 Construction Features

Distribution panels shall be 2 mm thick sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be form 3b construction. The Distribution panels shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors and folded covers, Neoprene gasket, padlocking arrangement and bolted back. All removable/ hinged doors and covers shall be grounded by flexible standard connectors. Distribution panel shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of Distribution panels shall be 2 mm thick and 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 shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC.

All panels and covers shall be properly fitted and 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 wing nuts. Self threading screws shall not be used in the construction of Distribution panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum operating clearance of 275 mm shall be provided between the floor of Distribution panels and the lowest operating height.

Distribution panels shall be of adequate size with a provision of spare switchgear as indicated on the Single Line Diagram. Feeders shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Distribution panels in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal name plates. All panels shall be provided with circuit diagram engraved on PVC sheet. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

2.1.2.4.2 Bus Bar Connections

Bus bar and interconnections shall be of high conductivity electrolytic grade tinned copper as indicated in the bill of quantities complying with requirement of IS : 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area to be added to the bus bar to compensate for the holes. All connections between bus bars and breakers shall be through solid Tinned copper strips of proper size to carry full rated current and insulated with insulating sleeves. Maximum current density for the busbars shall be 0.8 A/sq.mm for aluminium and 1.4 A/sq.mm for copper busbars.

Maximum allowable temperature for the Bus bar to be restricted to 85 deg C

2.1.2.4.2.1 Temperature – Rise Limit

Unless otherwise specified, in the case of external surface of enclosures of bus bar compartment which shall be accessible but do not need to be touched during normal operation, maximum temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces.

All main distribution panels and sub distribution panels shall be provided with MCCB of appropriate capacity as per Single Line Diagram. All final Distribution boards shall be provided with Miniature Circuit Breakers. Final Single Phase Distribution boards shall be connected to the incoming supply through double pole MCB units & earth leakage circuit breakers. All wiring for final distribution boards shall be concealed behind 5 mm thick bakelite sheet or M S sheet cover. All Distribution boards shall be completely factory wired, ready for connection. All the terminals shall be of proper current rating and sized to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

2.1.2.4.3 Cable Compartments

Cable compartment of adequate size shall be provided in the Distribution panels for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables.

2.1.2.4.4 Air Circuit Breakers (ACB)

2.1.2.4.4.1 The ACB shall conform to the requirements of IEC 60947-2 / IS 13947-2 and shall be type tested & certified for compliance to standards from CPRI, ERDA/ any accredited international lab. The circuit breaker shall be suitable for 415 V + 10%, 50 Hz supply system. Air Circuit Breakers

shall be with moulded housing flush front, draw out type and shall be provided with a trip free manual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" "TRIP" indications.

The ACB shall be 3/ 4 pole with modular construction, draw out, manually or electrically operated version as specified. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (Ics) shall be as specified on the single line diagram and should be equal to the Ultimate breaking capacity(Icu) and short circuit withstand values(Icw) for 1 sec.

Circuit breakers shall be designed to 'close' and 'trip' without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Inspection of main contacts should be possible without using any tools. The ACB shall be provided with a door interlock. i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts. All electrical closing breaker shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/OFF status of the ACB.

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall close before the main contacts have closed. All other contacts shall close simultaneously with the main contacts. The auxiliary contacts in the trip circuits shall open after the main contacts open. Minimum 4 NO and 4 NC auxiliary contacts shall be provided on each breaker.

Rated insulation voltage shall be 1000 volts AC.

2.1.2.4.4.2 Cradle

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on steel balls/rollers and not on flat surfaces.

There shall be 4 distinct and separate position of the circuit breaker on the cradle.

Racking Interlock in Connected/Test/Disconnected Position.

Service Position : Main Isolating contacts and control contacts of the breaker are engaged.

Test Position : Main Isolating contacts are isolated but control contacts are still engaged.

Isolated Position : Both main isolating and control contacts are isolated.

There shall be provision for locking the breaker in any or all of the first three positions.

The following safety features shall be incorporated :

- a. Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.
- b. Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.
- c. All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.
- d. All Switchgear module front covers shall have provision for locking.
- e. Switchgear operating handles shall be provided with arrangement for locking in 'OFF' position.

2.1.2.4.4.3 Protections

The breaker should be equipped with micro-controller based , communicable type release with RS 485 port for communication to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following four zones :

- Long time protection.
- Short time protection with intentional delay.
- Instantaneous protection.
- Ground fault protection.

The protection release shall generally have following features and settings however for exact requirement of protection releases, reference shall be made to SOQ:

a. True RMS Sensing

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current. It shall take into account the effect of harmonics also.

b. Thermal Memory

When the breaker shall reclose after tripping on overload, then the thermal stresses caused by the overload if not dissipated completely, shall get stored in the memory of the release and this thermal memory shall ensure reduced tripping time in case of subsequent overloads. Realistic Hot/Cold curves shall take into account the integrated heating effects to offer closer protection to the system.

c. Defined time-current characteristics :

A variety of pick-up and time delay settings shall be available to define the current thresholds and the delays to be set independently for different protection zones thereby achieving a close-to-ideal protection curve.

d. Trip Indication

Individual fault indication for each type of fault should be provided by LEDs for faster fault diagnosis.

e. Self powered

The release shall draw its power from the main breaker CTs and shall require no external power supply for its operation.

f. Zone Selective Interlocking

The release shall be suitable for communication between breakers to enable zone selective interlocking. This feature shall be provided for both short circuit and ground fault protection zones to offer intelligent discrimination between breakers. This feature enables faster clearance of fault conditions, thereby reducing the thermal and dynamic stresses produced during fault conditions and thus minimises the damage to the system. To implement ZSI manufacturer should supply all related equipment like power supply, wiring etc.

On-Line change of settings should be possible. It should be possible to carry out testing of release without tripping the breaker.

g. The release shall meet the EMI / EMC requirements.

h. The setting range of release shall be generally as follows :

	SETTING RANGE OF RELEASE	
Type of Protection	PICK-UP CURRENT	TIME DELAY

Long Time	0.4 to 1.0 times I_n (I_r) Steps : 0.4, 0.5, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.00. Operating Limit : 1.05 to 1.2 times I_r	0.5 to 30 sec at 6 I_r Steps 0.5, 1, 2, 4, 6, 8, 12, 18, 24 and 30 secs Tolerance : Corresponding to $\pm 10\%$ of current.
Short Time	2 to 10 times I_r Steps : 2, 3, 4, 5, 6, 7, 8, 9 & 10 Tolerance : $\pm 10\%$	20 ms to 600 ms Steps 20, 60, 100, 160, 200, 260, 300, 400, 500 and 600 ms Tolerance : $\pm 10\%$ or 20ms whichever is higher
Instantaneous	2 to 12 times I_n Steps : 2, 3, 4, 6, 8, 10, 12 Tolerance : $\pm 10\%$	
Ground Fault	0.2 to 0.6 time I_n Steps : 0.2, 0.3, 0.4, 0.5, 0.6 Tolerance : $\pm 10\%$	100 ms to 400 ms Steps : 100, 200, 300, 400ms Tolerance : $+10\%$ or 20 ms whichever is higher.

All incomer ACBs shall have following additional protections other than mentioned above.

- Under and over voltage
- Under and over frequency
- Restricted Earth Fault protection
- Trip Circuit supervision with PS class CT's.
- Undercurrent, (for DG set only)
- Reverse power (for DG set only)
- Phase sequence reversal (for DG set only)
- Load shedding and reconnection thru programmable contacts.
- Release should display the Contact wear indication.

The release should provide local indication of actual %age loading at any instant. The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port and shall be integral part of supply with trip unit. Parameters of the Protection Release should be changeable from Release as well as thru communication network. Release should have graphical LCD for display of power parameters. The release of incoming breakers should provide comprehensive metering with the following parameters

- Phase currents (running, avg & max) – All parameters in single window.
- Release should be able to capture short circuit current on which ACB has tripped. The last ten trips and alarms shall be stored in memory with the date & time stamping along with type of fault and alarm. The sensing CT Should be Rogowsky type with measurement precision of 1%.
- Release should be self powered .
- Release should have facility to select different type of IDMTL protection(DT,SIT,VIT,EIT,HVF) for better co-ordination with HT Breaker/Fuse.
- Phase voltages (running, avg & max)

- Energy & power parameters (active, reactive and apparent)
- PF
- Frequency
- Maximum Demand (KVA & KW)
- Total Harmonics distortion

All O/G ACBs shall have following functions.

Protection

- ☐ The ACB control unit shall offer the following protection functions as standard:
 - Long-time (LT) protection with an adjustable current setting and time delay;
- ☐ Short-time (ST) protection with an adjustable pick-up and time delay;
- ☐ instantaneous (INST) protection with an adjustable pick-up and an OFF Position.
- ☐ Current and time delay setting shall be indicated in amperes and seconds respectively On a digital display.
- ☐ Earth-fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

Measurements

- ☐ An ammeter with a digital display shall indicate the true rms values of the currents for each phase. Release shall acknowledge the current & time delay settings done by user on the LCD display.
- ☐ A LED bargraph shall simultaneously display the load level on the three phases.
- ☐ A maxi meter shall store in memory and display the maximum current value observed since the last reset. The data shall continue to be stored and displayed even after opening of the circuit breaker.

2.1.2.4.4.4 Safety Features

- I. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
- II. It shall not be possible to interchange two circuit breakers of two different thermal ratings. For Draw-out breakers, an arrangement shall be provided to prevent rating mismatch between breaker and cradle.
- III. There shall be provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of fixed ACB.
- IV. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.
- V. It shall 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.
- VI. Draw out breakers should not close unless in distinct Service/Test/Isolated positions.
- VII. The insulation material used shall conform to Glow wire test as per IEC60695.
- VIII. The ACB shall provide in built electrical and mechanical anti-pumping.

- IX. All EDO ACB's Shall have Ready to Close Contact to ensure that the ACB gets a command only when it is ready to close for applications of Remote Control, AMF, Synchronization and Auto Source Change Over Systems.

2.1.2.4.5 Moulded Case Circuit Breaker (MCCB)

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab. MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses

The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-2. The breaker as supplied with ROM should meet IP54 degree of protection.

2.1.2.4.5.1 Current Limiting & Coordination

- The MCCB shall employ maintenance free minimum 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 and let-through energy curves for all.

Protection Functions

- MCCBs with Thermal-magnetic shall have adjustable thermal for overload and fixed magnetic for short-circuit protection.
- Microprocessor MCCBs shall be equipped with microprocessor based trip units having complete LSIG protections.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorised access to the settings
- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.)
- Protection settings shall apply to all poles of circuit breaker.
- All Microprocessor components shall withstand temperatures up to 125 °C

2.1.2.4.5.2 Testing

- a) Original test certificate of the MCCB as per IEC 60947-1 &2 or IS13947 shall be furnished.
- b) Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

2.1.2.4.5.3 Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

- a) Handle interlock to prevent unnecessary manipulations of the breaker.
- b) Door interlock to prevent the door being opened when the breaker is in ON position.
- c) 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 over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.

- All MCCB with microprocessor based release unit shall have LSI protection. Also wherever specified in BOQ ground fault protection shall be integral part of the microprocessor based release and neutral CT shall be provided in case of Triple pole breaker. Adjustable Overload, Short circuit and earth fault protection with time delay shall be provided.
- The trip command shall override all other commands.

2.1.2.4.6 Motor Protection Circuit Breaker (MPCB)

Motor circuit breakers shall conform to the general recommendations of standard IEC 947 -1,2 and 4 (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752) and to standards UL 508 and CSA C22-2 N°14. The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 947-4. MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard IEC 60947-2 and shall have a rated impulse withstand voltage (Uimp) of 6 kV. The motor circuit breakers shall be designed to be mounted vertically or horizontally without derating. Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc, by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and trip simultaneously. The motor circuit breakers shall accept a padlocking device in the “isolated” position.

The motor circuit breakers shall be equipped with a “PUSH TO TRIP” device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or NC. All the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly co-ordinated motor-starter. This combination shall enable type 1 or type 2 co-ordination of the protective devices conforming to IEC 60947-4-1. Type 2 co-ordination shall be guaranteed by tables tested and certified by an official laboratory: LOVAG (or other official laboratory). The motor circuit breakers, depending on the type, could be equipped with a door-mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set to an average value of 12 Ir.

All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 60°C without derating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available. Temperature compensation (-20°C to +60°C)

2.1.2.4.7 Miniature Circuit Breaker (MCB)

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) 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. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

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, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

Coordination Study in LV Network

LV Switchgear Manufacturer shall submit coordinated & Discriminated solution for LV Network protection devices i.e. ACB, MCCB, MPCB & MCB for all Incoming and outgoing devices for all Panels/ DB's as per BOQ with the help of published discrimination tables. Total discrimination shall be provided up to the short circuit breaking capacity of most down stream circuit Breakers .

2.1.2.4.8 Residual Current Circuit Breaker Current Operated Type (RCCB)

I. System of Operation

Residual Current Circuit Breaker shall conform to IEC 61008. RCCB shall work on the principle of core balance transformer. The incoming shall pass through the toroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 30 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

II. Mechanical Operation

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing /opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

III. Neutral Advance Feature

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact First before the phases; and at the time of opening, the neutral shall breaks last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

IV. Testing Provision

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 / RCCB and the operating handle shall move to the "OFF" position.

2.1.2.4.9 Earthing

Earthing shall be provided as per IS: 3043-1987.

2.1.2.4.10 Painting

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside / outside shall be as per BOQ confirming to IS Code No.5.

2.1.2.4.11 Labels

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

2.1.2.4.12 Meters

- i. All voltmeters and indicating lamps shall be through MCB's.
- ii. Meters and indicating instruments shall be flush type.
- iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
- iv. CT ratio and burdens shall be as specified on the Single line diagram.

2.1.2.4.13 Current Transformers

Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast/ Flame Retardent resin filled Nylon type robust to withstand thermal and dynamic stresses during short circuits. Metering CTs, shall have inbuilt busbar mounting arrangement. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The secondary terminal should be covered with insulation cap/cover so that there should not be any possibility of touching the live terminal. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

2.1.2.4.14 Potential Free Contacts

Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

2.1.2.4.15 Indicating Panel

All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/MPCB as per relevant fault level and toggle switch.

4(B) FINAL DISTRIBUTION BOARDS (FDB's)

Final Distribution Boards (FDBs) shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum dielectric strength of 2.5 KV / Sec. All Distribution Boards shall be manufactured by a manufacturer listed in Appendix-I.

FDB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

2.1.2.4.16 Construction Features

FDB's shall be made out of 1.6 mm thick (for residential project FDB shall be of minimum 1.2 mm thick) high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of FDB shall be folded and braced as necessary to provide a rigid support for all component. FDB shall be suitable for indoor / outdoor installation, wall mounting free standing type, in double door construction. The Final Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sqm tinned stranded copper connectors. Final Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall conform to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC.

All panels and covers shall be properly fitted and 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 wing nuts. Self threading screws shall not be used in the construction of FDBs.

Knockout holes of appropriate size and number shall be provided in the FDB's in conformity with the location of cable/conduit connections. Detachable sheet steel gland plates shall be provided at the top / bottom to make holes for additional cable entry at site if required.

Final Distribution Boards shall comprises of the following:

2.1.2.4.17 A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.

2.1.2.4.18 Installation accessories shall be part of the DB for fixing conductor and rails for mounting MCB's and RCCB's etc.. neutral bus bars & earthing bus bars required in the circuit. All busbars in the FDB shall be insulated type.

2.1.2.4.19 Service cable / enterconnection shall be part of the Distribution Boards.

2.1.2.4.20 The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.

2.1.2.4.21 Degree of protection shall be IP-42 for indoor application, IP-65 for kitchen & laundry and IP-65 for outdoor application.

2.1.2.4.22 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.

2.1.2.4.23 Phase segregation to be maintained in all three phase distribution boards.

2.1.2.4.24 Earthing shall be provided in each FDB's.

2.1.2.4.25 Miniature Circuit Breaker (MCB)

For specifications refer Section 4A, clause 4.7

2.1.2.4.26 Residual Current Circuit Breaker Current Operated Type (RCCB)

For specifications refer Section 4A, clause 4.8

2.1.2.4.27 Earthing

Earthing shall be provided as per IS:3043-1987.

2.1.2.4.28 Painting

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be of Siemens gray paint shade no. RAL-7032 of IS Code No.5.

2.1.2.4.29 Labels

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

2.1.2.4.30 Testing

Testing of panels shall be as per following codes:

I. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages up to and including 1000 VAC.

II. IS: 13947 : 1993 Degree of protection

2.1.2.4.31 Wiring

In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

2.1.2.5 RISING MAINS

2.1.2.5.1 Sandwiched Construction

2.1.2.5.1.1 Scope:

The specification covers design, manufacturing, supply, installation, testing and commissioning of Sandwich type busbar trunking for use as feeder busbars for interconnection between separate electrical equipment / load centers, and for use as plug in busbar risers.

2.1.2.5.1.2 System details:

The busduct shall be suitable for operation in a 600/1000V system, with frequency of 50 Hz having 100% neutral and internal earth. The bus duct shall be designed for an ambient of 40 deg C (35 deg C average over a period of 24 hours) as per IS 8623.

2.1.2.5.1.3 Standards:

The busbar shall be designed and manufactured in accordance with the following international standards for busbar trunking:

- BS 5486 Part 2 : Particular requirements of busbar trunking systems
- IEC 60439 –2 : Particular requirements of busbar trunking systems
- IEC 60529 : Degree of protection

The bus duct shall conform to IEE/NEMA/BUI/JIS for seismic protection certification.

2.1.2.5.1.4 Testing:

The busbars shall be type tested at a reputed international test laboratory (ASTA or CPRI) for short circuit withstand. The test shall be for a minimum duration of 1 second. Tests shall be performed over a range of current ratings, covering the different frame sizes of the manufacturer.

Degree of ingress protection (IP rating) shall also be tested at any reputed independent laboratory. This test shall be for IP54 for indoor application and IP65 for outdoor application for sandwiched busbars.

2.1.2.5.1.5 Manufacturer:

The manufacturer must have an established track record in design and manufacture of sandwich and cast resin busbar trunking, and must have supplied busbar systems for at least 5-10 years.

The manufacturer must have ISO 9001 certification for design, manufacture and testing of busbar systems.

2.1.2.5.1.6 Design & Construction requirements – Sandwich busbars

General: The busbars shall be of sandwich construction, non-ventilated design. It shall be possible to mount the busbar system in any orientation, without affecting the current rating.

The bus duct shall consist of three phases and neutral bus bar permanently positioned dust and vermin proof and the degree of enclosure protection shall be IP 54 for indoor installation and shall be IP-65 for outdoor installation as per schedule of quantities.

Busbars: The busbars shall of high conductivity Copper, or Aluminum, as specified in the tender. Unless otherwise specified, in the external surface of enclosures of bus bar compartment which shall be accessible but do not need to be touched during normal operation, maximum temperature rise limits of 40° C above ambient temperature shall be permissible for metal surface and of 50° C above ambient temperature for insulating surfaces as per IS 8623(Part-1) 1993

Where an earth conductor is required, it shall be a separate, integral earth conductor, of the same high conductivity material as per clause 7.4.3.1.7 of IS 8623 or IEC 60439. In addition to this, enclosure shall have fixing arrangement to install 2 nos. of external earth strip along the run of the bus duct.

It shall be possible to provide a 200% Neutral where specified.

Insulation:

The busbars shall be insulated throughout their length by epoxy coating / Mylar. The insulation material used shall be of minimum Class F (155 deg. C). The insulation must comply to UL 94 V-O. It shall be Halogen Free.

Housing:

The housing shall be made of electro-galvanized sheet steel, with an epoxy powder coated paint finish. The housing shall be profiled, to provide higher strength and efficient heat dissipation. The width of the housing shall preferably be the same for all ratings of busbars, in order to provide interchangeability of tap off boxes.

Joints:

The joints between sections shall be made so as to provide flexibility during installation and expansion / contraction of busbar during operation. The joints shall be of the single bolt type

The joint construction must have the following features.

- Heat expansion of at least 3mm per joint.
- The joint insulation must be of one piece molded design and not have any cut edges which can absorb moisture.
- The joint construction must allow a +/- 14mm adjustment at the time of installation, for ease of adjusting to site measurement variations.
- The joint bolt must be insulated with a bolt insulator. The bolt insulator must be of molded one piece.
- The joint system must be designed in a way that the installer cannot insert the busduct length too far and damage the bolt insulator.
- The busbar ends shall not have holes or slots at the joints – the electrical continuity shall be through pressure plates, achieving a high area of joint cross section and expansion capability.
- It shall be possible to install and remove the joints without disturbing the busbar run.

2.1.2.5.1.7 Tap off units:

Where specified, tap off locations shall be provided for insertion of plug in tap off units. The tap off locations shall be covered by hinged plates.

Tap off units safety features:

- ☐ When the door cover is open, it should not be possible to turn the MCCB on. This should be by means of mechanical safety locking system and not by the rotary handle of the MCCB.
- ☐ The door shall be provided with a lock and keys.
- ☐ When the lever is in 'on' position, even with the key unlocked, the operator should not be able to remove the box or open the tap off location cover.
- ☐ During insertion, the earth conductor shall make contact first before the phase conductors. This should follow the sequence of first in last out concept.
- ☐ The tap off unit handle shall be flexible in the sense that the 'on/off' handle can be attached to the left or right side of the box or in front, depending on the site situation.

- When the box is open the live conductors shall be safe guarded by a transparent insulator plate which allows for visible inspection but does not allow touching of the live conductors.
- In the event of a MCCB requiring maintenance or changing, the mechanical interlocking must allow easy access by removing only the front plate and not interrupting the adjacent linkages.
- For IP65 bus-trunking, the tap off unit arrangement also must achieve IP65 and for indoor installation IP-52, without requiring any additional sealing at site. The complete arrangement with the tap off unit shall be tested for IP rating by an independent test authority.
- The tap off boxes will be suitable for accommodating MCCBs or other accessories, as required. The tap off units should allow the flexibility of accommodating different, reputed MCCB makes, to be mutually agreed depending on the tender requirements.
- Accessories: A full range of accessories like bends, end flanges, end feed units, and support brackets etc. shall be available Installation

Bus ducts running along the wall shall be supported at intervals not exceeding 1.5 m. In case of branching, there shall be support on all branches at a distance of 300 mm from the point of branching, Support shall not be less than 40 x 40 x 6 mm MS angle secured in an approved manner. Supports may also be provided in the form of brackets fixed to walls where the duct runs along the wall. In case of ceiling suspended bus ducts, supports made out of 40x40x6 mm MS angle iron shall be provided. The horizontal distance between two such supports shall not be more than 1200 mm. The ducts supports shall be suspended from suitable approved suspension devices provided in the ceiling. Fire barrier shall be provided at each floor/wall crossing as per relevant IS code
Test at Site

The following tests shall be carried out at site and test results to be recorded:

- a. Insulation resistance shall be tested with 1000 V megger and shall be not less than 100 mega ohms..
- b. Earth continuity test

2.1.2.5.1.8 Data sheet:

TECHNICAL DATA FOR RISING MAINS :-

TENDERER MUST FILL IN THE FOLLOWING TECHNICAL DATA

- a. Busduct material & thickness :
- b. Busbar material and size :
- c. Class of insulation :
- d; Material of insulation :
- e. Maximum bus bar temperature at full load under steady state condition :
- f. Resistance in ohm per meter, R20 :
- g. Reactance in ohms per meter, X20 :
- h. Degree of protection for busduct including all joints :
- i. Degree of protection for tap off boxes :

2.1.2.6.1 Earthing

The system shall be TNS with four wire supply system (R,Y,B,N and 2 Nos. E) brought from the main L T Panel. All the non-current carrying metal parts of electrical installation and all metal conduits trunking, cable sheaths, switchgear, distribution panels, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All metal work such as pipe lines, ducts, cable trays, stair case railing etc shall be bonded to earth.

All earthing shall be in conformity with IS:3043 1987, and the basic system of earthing shall be TNS.

2.1.2.6.2 Earthing Conductors

Earthing conductors shall be of copper / GI as mentioned in schedule of quantities and shall be protected against mechanical injury and corrosion.

2.1.2.6.3 Sizing of Earthing Conductors

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits upto 15 amps shall be earthed with PVC insulated copper wire.

2.1.2.6.4 Connection of Earthing Conductors

Main earthing conductors shall be taken from the earth connections at the main L T panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI, wires shall be connected with crimping lugs, all bolts shall have spring washers. Sub- mains earthing conductors shall run from the main distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel.

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 panel. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to distribution panel 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 the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed. The installation shall be complete in all respects for efficient and trouble free service. All work shall be carried out in a first class quality and neat workmanship. Grounding conductors shall be handled carefully to avoid kinking and cutting of the conductors during their installation. All exposed ground conductors run shall be taken in a neat manner horizontal, vertical and parallel to the building walls or columns and shall not be laid haphazardly. All connections to the grounding grid shall be made with earthing strip welded to grid and bolted at equipment ends.

2.1.2.6.5 Prohibited Connections

Neutral conductor, sprinkler pipes, or pipes conveying gas, water or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lightning protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system. The electrical resistance measured between earth connection at the main L T panel and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate or circuit breakers, and shall not exceed 1 ohm. All switches carrying medium voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in G I pipe of adequate size. The overlapping in strips at joints where required shall be minimum 75 mm. The joints shall be riveted and brazed in case of copper and by welding / bolting in case of GI in an approved manner. Sweated lugs of adequate capacity and size shall be used for termination of all conductor wires above 6 sq.mm size. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned. Equipotential bonding of all metallic structures shall be done.

2.1.2.6.6. Earthing

The following must always be ensured in earthing system.

- All earths must be interconnected at the earth pits. This includes generator neutrals, transformer neutrals, transformer body, lightning protection system earths, UPS earths etc.
- Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure.

2.1.2.6.7 The Contractor shall get the soil resistivity test done at his own cost of the area where earthing pits are to be located before starting the installation.

2.1.2.6.8 Resistance to Earth
The resistance of earthing system shall not exceed 1 ohm.

2.1.2.6.9 Specification for Hot Dip Galvanizing Process
General Requirements

- I. Quality of Zinc
Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.
- II. Coating Requirement
Minimum weight of zinc coating for mild steel flats with thickness up to 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square metre shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing. Jointing of earthing tape shall be by welding. All joints and cut ends shall be properly painted with aluminium paint.

(Note : Please specify only one type as per project requirement)

2.1.2.6.10 Earthing Electrode

Conventional Plate electrode
Copper Earth Electrode

Earthing electrode shall be 600 x 600 x 3.15 mm thick tinned copper plate electrode, with 2 Nos 50 x 6 mm copper strips from earth plate electrode to inspection chamber, 50 mm dia medium class GI pipe, CI funnel with 20 gauge GI wire mesh, masonry chamber 1000 x 500 mm with concrete base as per IS3043 with C I heavy duty / chequered plate manhole cover with frame painted with bitumastic paint and packing with mixture of charcoal and common salt around plate electrode including digging of pit upto permanent moisture level and as per soil condition but not less than 3 meters and back filling as required.

GI Earth Electrode

Earthing electrode shall be 600 x 600 x 6.3 mm thick GI plate electrode, with 2 nos. 50 X 6 mm GI strips from earth plate electrode to inspection chamber, 50 mm dia medium class GI pipe, CI funnel with 20 gauge GI wire mesh, masonry chamber 1000 X 500 mm with concrete base as per IS3043 with CI manhole cover with frame painted with bitumastic paint and packing with mixture of charcoal and common salt around plate electrode including digging of pit up to permanent moisture level but not less than 3 meters and back filling as required.

7. EXTERNAL LIGHTNING PROTECTION SYSTEM AND STRUCTURAL EARTHING AS
PER INTERNATIONAL & NATIONAL STANDARDS- IS IEC 62305-3 & NBC 2016 CODES

2.1.2.7.1 General

Lightning Protection System shall be in accordance with IS IEC 62305-3 and corresponding Earthing shall comply with the relevant sections of IS IEC 62305 and IS3043 and UL 467 with the necessary certification.

2.1.2.7.2 Protection Zone

The zone of protection of a lightning conductor defines the space within which Air Terminal provides protection against a direct lightning strike with probability of protection as per LPL.

2.1.2.7.3 LPL (Lightning Protection Level)

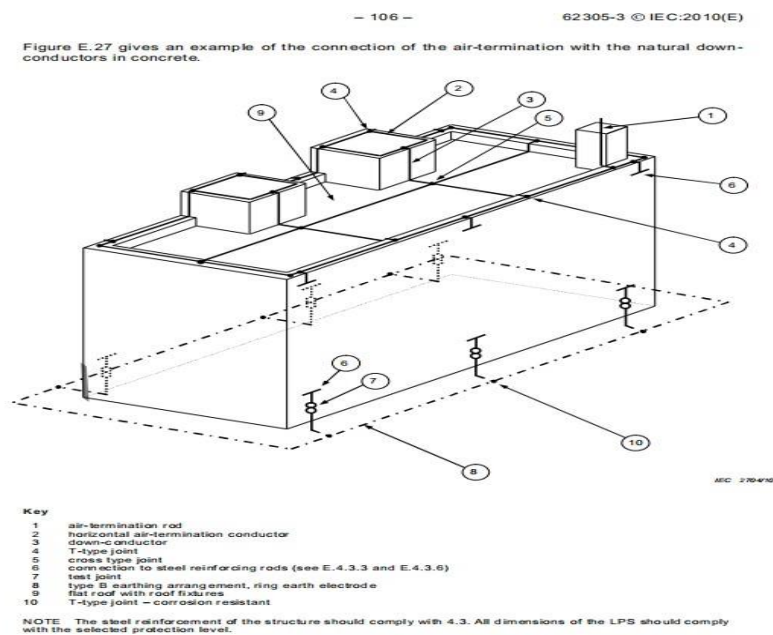
LPL is a number associated with a set of lightning current parameters relevant to the probability that the associated minimum & maximum values do not exceed the normally occurring lightning. LPL can be determined by Risk analysis as explained in IS IEC 62305-2. Risk analysis report from the specified manufacturer based on the inputs provided shall be generated from software and submitted for approval.

2.1.2.7.4 Components of External LPS and Structural Earthing

- 1.) Air terminal (as per rolling sphere or mesh or protective angle method or any combination thereof.)
- 2.) Down conductor along with the reinforcement within the designated columns
- 3.) Earthing – Vertical rod and Ring

Air termination system (With Vertical Air Terminal) :

No drilling is allowed in the terrace for fixing the air terminal, if the roof is made of concrete. Parapet wall is exception to this. Angle of protection shall be used only for protecting the exposed components on the building roof. Horizontal grid or mesh is preferred over the vertical AT in general in line with IS IEC 62305. Design drawings validated by the ExLPS manufacturer shall be submitted for approval.



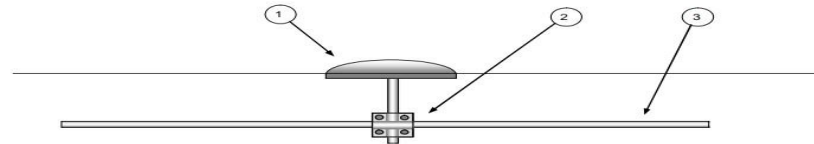
Air termination system (With Strike Pad) :

62305-3 © IEC:2010(E)

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E.5.2.4.2.1 Lightning protection for multi-storey car park roofs

For the protection of this type of structure, air-termination studs may be used. These studs can be connected to the reinforcement steel of a concrete roof (see Figure E.28). In the case of roofs where a connection to the reinforcement cannot be made, the roof conductors can be laid in the seams of the carriageway slabs and air-termination studs can be located at the mesh joints. The mesh width shall not exceed the value corresponding to the protection class given in Table 2. In this case, the persons and vehicles on this parking area are not protected against lightning.



IEC 2705/10

Key

- 1 air-termination stud
- 2 steel conductor connecting to several bars of the reinforcement steel
- 3 steel reinforcement to concrete

Figure E.28 – Example of an air-termination stud used on car park roofs

Values of Rolling sphere radius, Mesh size and protection angle as per Class of LPL/LPS.

Class of LPL/LPS	Rolling radius(m)	sphere	Mesh size (m)	Protection angle
1	20		5*5	Refer figure 1
2	30		10*10	Refer figure 1
3	45		15*15	Refer figure 1
4	60		20*20	Refer figure 1

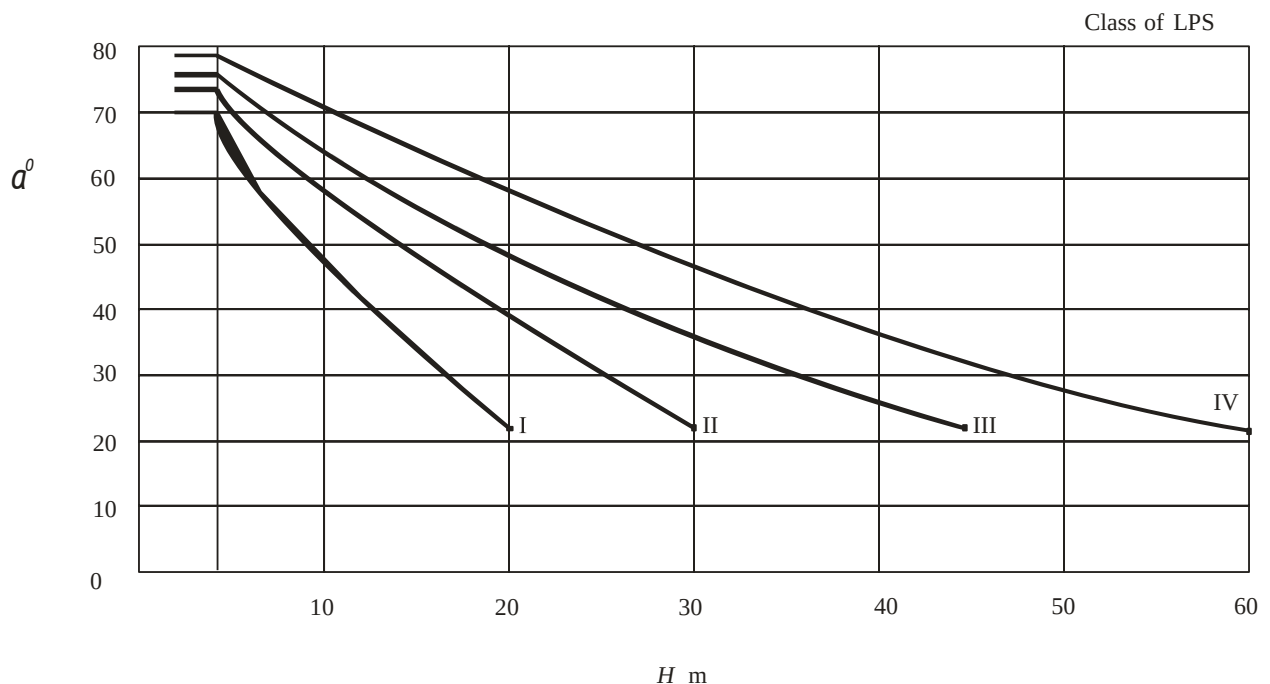


Fig 1. Class of LPS Vs Angle of protection.

If the structure height is more than 60 meters, top 20% of the height of the structure shall be protected with a lateral air termination system. This is needed because; the probability of flashes to the side is generally more for structures more than 60 meters in height. For structures of height more than 120 meters, ring has to be formed for every 20 meters height of the building above 60 meters height.

Material and Dimensions

Material of air terminal, down conductor of structural Earthing, earth termination etc. shall be as below:

Material	Components
8 mm – 100 Microns Copper bonded steel round conductor	Structural Earthing down conductor
8 mm Round EC grade Half hard Aluminum Alsimg3 – Aluminum alloy conductor	Roof mesh conductor
Stainless steel SS 304 Grade	Roof conductor holder and components
Brass, Stainless steel 304 or Gun Metaltal Alloys	Structural Earthing down conductor holder and components
Copper Bars with insulators	Equipotential Bonding Bars
254 Microns copper bonded bars + Earthth Enhancement Compound + HDPE Chamber Cover + SS Rod to tape clamps	Vertical Earthing
10 mm dia 100 Mic Copper bondingng conductor	Ring Earthing

Dissimilar metals (Ex: Copper with Aluminium) must be connected only by using bimetal or Stainless steel connectors.

Material, Configuration and Minimum cross sectional area of air terminal & down conductors

Material	Type	Minimum cross s section area	Remarks
Copper plated	Solid round	50 sq mm	8mm dia
Aluminium	Solid round	50 sq mm	8 mm dia
GI	Solid tape	70 sq mm	25 x 3 mm min thickness

Mesh or Grid conductor holder:

Concrete Roof structure: Conductors shall be securely fixed on the terrace by means of Stainless steel air terminal holder with plastic base and disc which is fixed on the roof by adhesive of good quality two part epoxy glue taking care of varying weather conditions. Conductor holder is an insulator & should be of minimum 30 mm height so that small amount of water logging on terrace is below the level of conductor holder.

Parapet Roof structure: Conductors shall be securely fixed on the Parapet by means of Stainless steel conductor holder which is screwed on the parapet using counter sunk screws and wood plugs of suitable size.

Metal Roof structure: Conductors shall be securely fixed on the seaming roof sheets by means folding clamps secured to the seaming roof pattern using nut bolts of good quality which is tested for lightning current as per IS IEC standard. As metal roof structures are normally tapered at an angle, there is no min. height criterion for metal conductor holder. Plastic pyramid shaped conductor holders also can be used with two part epoxy glue as an option with possibility of filling the holder with cement mixture which shall act as dead weight.

2.1.2.7.5 Recommended distance between air terminal holders:

Arrangement	Recommended distance for ROUND conductors
Horizontal conductor on horizontal surface	1000 mm
Horizontal conductor on vertical surface	1000 mm
Vertical conductor from Ground to 20m height	1000 mm
Vertical conductor above 20m height	1000 mm

If antenna, air cooler, ventilation pressurization fans or any other electrical equipment is present above terrace level, the same shall have to be protected by using vertical air terminal after calculating the safety or separation distance. The vertical air terminal has to have suitable supports to hold it. Wind speed need to be taken into account. Vertical air terminal must be connected to horizontal air terminal by using suitable stainless steel connectors. The Air terminals shall be secured vertically using stainless steel base holders with anchoring and or gluing provisions and the holders shall be supported with the round concrete blocks acting as dead weight to support the air terminal. Air terminals beyond two meter heights shall be additionally supported with a tripod stand in addition to the SS base and concrete block.

At the crossings of the horizontal air terminals, suitable Cross connector with separation plates will have to be used for secure connection which is tested for lightning current as per IS IEC 62305 standard.

Expansion piece

In order to take care the expansion of the metal in summer and contraction of the metal in winter, expansion piece with suitable connectors have to be used at every 20m distance of horizontal air terminal.

Joints and Bonds

The lightning protective system shall have few joints as far as possible & air terminal & down conductor have to be straight. Under no circumstances, it should be bent at 90 degree (right angles) & should have a curved path always.

2.1.2.7.6 Down conductor system

In order to reduce the probability of damage to electronic/electrical equipment, the down conductors shall be arranged in equi distance in such a way that from the point of strike to earth, several parallel current paths should exist & length of the current path should be kept minimum. Down conductors can be installed separately or more wisely it can be part of natural components of the building. Examples are steel reinforcement in RCC columns, metal facades, profile rails, metal doors & windows. Down conductors should be installed at each exposed corner of the structure as a minimum. The numbers of down conductors need to be worked out on the basis of Risk analysis and the level of protection designed and required for the structure.

2.1.2.8 Structural lightning protection system

Structural bonding system consists of an additional conductor installed inside an RCC column along with structural steel. The conductor shall be of continuous length from basement to the top of the building. The conductor shall have minimum joints and all joints shall be either connected with suitable connection clamps or exothermically welded for application in columns, 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.

Exothermic welding if used shall confirm the requirements of IEEE 837. Every component used shall be able to withstand the fault current with minimum temperature rise.

The earth studs / earth fixing points should be of Brass – Gun Metal or Stainless steel material and shall be 100 % corrosion resistant and shall confirm the requirements of IEC 62561.

Down Conductor for Lightning Protection as well as Bonding conductor for electrical installations (RCC Building) a dedicated 8mm dia copper bonded steel conductor shall run inside columns on the periphery of the building and must be connected to the reinforced steel available in the columns using suitable GUV clamps and 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. Use of Aluminum is strictly prohibited inside the concrete.

Provisions for interconnection of metal frame of wall cladding and curtain walling shall be provided at every floor level and at suitable horizontal sections in line with the Level of ExLPS design based on the architectural layout. Provision for making this interconnection shall be provided by façade supplier / installer. Stainless steel straps, Clamps in combination with Brass – Gun Metal earth points shall be used for interconnecting the copper banded conductor with Aluminum façade and curtain walling.

Testing of down conductor of Structural Earthing used as a part of lightning protection system, overall resistance shall not be more than IEEE norms when measured between the air termination and the earthing test point provided at the ground level.

The air termination system defined above consisting of vertical rods and/or mesh as shown in the drawing and shall be connected to the structural conductor through earth studs / earth fixing points provided at the parapet / columns of the building. For this purpose, sufficient earth studs / earth fixing points 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.

Installation, Testing and Certification: The total installation need to be carried out by a trained Lightning protection installer having experience in carrying out similar structural lightning protection jobs. The installation also needs to be tested and certified by a qualified lightning protection expert.

A detailed technical training to the user on the installation method need to be made in form of a report for easy reference with earth fixing points marked in the drawing for future identification.

Value of distance between down conductors as per Class of LPL / LPS

Class of LPL/LPS	Typical distance (m)
1	10
2	10
3	15
4	20

Test joints:

At the connection of the earth terminal, a test joint should be fitted on each down conductor at a height of 1 m from the ground, except in the case of natural down conductors combined with foundation earth electrode. The purpose of test joint is to measure the earth resistance value. It is recommended to take the test joint at ground level for structural earthing conductors as well and then either can be connected to the foundation earth electrode or taken on the external surface for ring earthing – Type A and B on the external side of the structure in line with IS IEC 62305.

Earth Terminations

Earth mat is most preferable. Where earth mat is not possible, ring earthing is the next best method. Ring earthing must be 1 meter away from the building and 0.5m below the ground level. The resistance of earthing system shall not exceed 10 ohm as per IS IEC 62305. Lower earth resistance is preferable.

For earth termination system, 2 basic types of earth electrode arrangements are applicable. Type A & Type B arrangement.

Type A arrangement: Comprises of horizontal or vertical earth electrode installed outside the structure to be protected connected to each down conductor.

In type A arrangement, the total number of earth electrodes shall not be less than two.

Type A arrangement is suitable in places where electronic equipment are not located.

Type B arrangement: This type of arrangement comprises either a ring conductor external to the structure to be protected, in contact with the soil for at least 80% of its total length or a foundation earth electrode. Such earth electrodes can also be meshed. For structures with extensive electronic systems or with high risk of fire, type B earthing is most preferable method. Petroleum Jelly impregnated fabric has to be used wherever down conductor is connected to earth termination system. Bitumen has to be applied at the point of inter-connection. In potentially corrosive areas, Stainless steel must be used.

Reference Standards:

IS IEC 62305 – Protection against Lightning strikes

Part 1: General Principles

Part 2: Risk Management

Part 3: Protection of structures

Part 4: Protection of Electrical & Electronic equipment within structure

NBC 2016: Applicable section of the electrical installations

IS 3043: 1987: Code of practice for earthing

UL 467: Standard for safety – Grounding and Bonding

BS 7430: Code of practice for Multiple protective earthing for Electrical installations

2.1.2.9 CABLING FOR DATA SYSTEM

2.1.2.9.1 Scope

This document defines the cabling system and subsystem components to include cable, termination hardware, supporting hardware, and miscellany required to supply, and to install a complete cabling infrastructure supporting data and video. The intent of this section is to provide pertinent information to allow the vendor to bid the labor, supervision, tooling, materials, and miscellaneous mounting hardware and consumables to install a complete system. However, it is the responsibility of the vendor to propose any, and, all items required for a complete system whether or not it is identified in the specification, drawings and bill of materials attached to this specification.

2.1.2.9.2 Applicable Documents

The cabling system described in this specification is derived in part from the recommendations made in industry standard documents. The list of documents below (or the latest revisions) has bearing on the desired cabling infrastructure are incorporated into this specification by reference:

- 1) This Technical Specification and Associated Drawings
- 2) ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard – March 2001
- 3) ANSI/EIA/TIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces - February, 1998
- 4) ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - February, 1993
- 5) ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications – August, 1994

2.1.2.9.3 Cabling System and Component Specifications

2.1.2.9.3.1 UTP Cabling System

- 2.1.2.9.3.1.1 Unshielded twisted pair cabling system, TIA / EIA 568-B.1 addendum Category 6 Cabling system

Networks Supported	10 / 100 Ethernet, 155 Mbps ATM, 1000 Mbps IEEE 802.3ab Ethernet, and proposed Cat 6 Gigabit Ethernet
Warranty	25-year systems warranty; Warranty to cover Bandwidth of the specified and installed cabling system, and the installation costs
Performance characteristics to be provided along with bid	Attenuation, Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR for 4-connector channel
2.1.2.9.3.1.2	Unshielded Twisted Pair, Category 6, TIA / EIA 568-B.2
Material:	
Conductors	23 AWG solid bare copper or better
Insulation	Polyethylene
Jacket	Flame Retardant PVC
Pair Separator	Cross-member fluted Spline.
Approvals	UL Listed
Operating temperature	ETL verified to TIA / EIA Cat 6
Frequency tested up to	-20 Deg. C to +60 Deg. C
Packing	Minimum 600 MHz
Delay Skew	Box of 305 meters
Impedance	45ns MAX.
Performance characteristics to be provided along with bid	100 Ohms + / - 15 ohms, 1 to 600 MHz.
	Attenuation, Pair-to-pair and PS NEXT, ELFEXT and PSELFEXT, Return Loss, ACR and PS ACR

2.1.2.9.3.2 UTP Jacks

Type	PCB based, Unshielded Twisted Pair, Category 6, TIA / EIA 568-B.2
Durability	
Modular Jack	750 mating cycles
Wire terminal	200 termination cycles
Accessories	Strain relief and bend-limiting boot for cable
	Integrated hinged dust cover
Materials	
Housing	Polyphenylene oxide, 94V-0 rated
Wiring blocks	Polycarbonate, 94V-0 rated
Jack contacts	Phosphorous bronze, plated with 1.27micro-meter thick gold
Approvals	UL listed
Performance Characteristics to be provided with bid	Attenuation, NEXT, PS NEXT, FEXT and Return Loss

2.1.2.9.3.3 UTP Jack Panels

Type	24-port, PCB based, Unshielded Twisted Pair, Category 6, TIA / EIA 568-B.2
Ports	24
Port arrangement	Modules of 6-ports each, arranged 1port x 6.
Category	Category 6
Circuit Identification Scheme	Icons on each of 24-ports
Port Identification	9mm or 12mm Labels on each of 24-ports (to be included in supply)
Height	1 U (1.75 inches)
Durability	

Modular Jack	750 mating cycles
Wire terminal (110 block)	200 termination cycles
Accessories	Strain relief and bend limiting boot for cable
Materials	
Housing	Polyphenylene oxide, 94V-0 rated
Wiring blocks	Polycarbonate, 94V-0 rated
Jack contacts	Phosphorous bronze, plated with 1.27micro-meter thick gold
Panel	Black, powder coated steel
Approvals	UL listed
Termination Pattern	TIA / EIA 568 A and B;
Performance	Attenuation, NEXT, PS NEXT, FEXT and Return Loss
Characteristics to be provided along with bid	

2.1.2.9.3.4 Faceplates

Type	1-port, White surface box
Material	ABS / UL 94 V-0
No. of ports	One

2.1.2.9.3.5 Workstation / Equipment Cords

Type	Unshielded Twisted Pair, Category 6, TIA / EIA 568-B.2
Conductor	24 AWG 7 / 32, stranded copper
Length	7-feet
Plug Protection	Matching colored snag-less, elastomer polyolefin boot
Warranty	25-year component warranty
Category	Category 5
Plug	
Housing	Clear polycarbonate
Terminals	Phosphor Bronze, 50 micron gold plating over selected area and gold flash over remainder, over 100 micron nickel underplate
Load bar	PBT polyester
Jacket	PVC
Insulation	Flame Retardant Polyethylene

2.1.2.9.3.6 Fiber optic Cable

Cable Type	6-core, Multimode, 10G Ethernet OM3, Armored, loose-tube, Gel Filled
Fiber type	50 / 125, Laser Grade, 250 micron primary coated buffers
No. of cores	6
Cable Construction	BELLCORE GR 20 / IEC 794-1
Attenuation	
@850nm	3.5 dB / KM
@1300nm	1.5 dB / KM
Bandwidth	
@850nm	1500 MHz-KM
@1300nm	500 MHz-KM
Network Support	
10 / 100 Ethernet	2000m
155 Mbps ATM	2000m
1000 Base SX	900m
1000 Base Lx	550m without Mode Conditioning launch patch cord.
Tensile rating	1200N
Maximum resistance	Crush 3000N
Operating	-40 Degree C to +60 Degree C

Temperature Armor	Corrugated Steel tape Armor

Note: For Composite fiber optic cables, the above specifications for SM and MM fibers apply

2.1.2.9.3.7 Fiber Optic Connectors

Connector Type	SC-Style, Simplex
Operating temperature	-40 Degree C to +85 Degree C
Durability & color	
MM connectors	500 cycles, Beige
SM connectors	220 cycles, Blue
Ferrules	Pre-radiused Ceramic Ferrules
Attenuation	Not more than 0.75 dB per mated pair

2.1.2.9.3.8 Fiber Optic Patch panels

Fiber optic patch panel	19-inch, Rack mounted Fiber optic patch panel
Height	3 U, 5.25 inches
# of fibers	48,96,192
# of OSP Cables for termination	Minimum 2
Grounding	2 Nos. of earthing lugs, pre-loaded
Cable Management rings	Front and rear cable management rings, pre-loaded
# of 6-port / 12-port adapter plates	8 / 8 Max.

Fiber optic patch panel	19-inch, Rack mounted Fiber optic patch panel
Height	1 U, 1.75 inches
# of fibers	18,36,72
# of OSP Cables for termination	Minimum 2
Grounding	2 Nos. of earthing lugs, pre-loaded
Cable Management rings	Front and rear cable management rings, pre-loaded
# of 6-port / 12-port adapter plates	3 / 3 Max.

2.1.2.9.3.9 Fiber Optic Adapter plates

Fiber Optic adapter plate	6-port, SC-Style, MM
Attenuation	Max of 0.75 dB per mated pair

2.1.2.9.3.10 Fiber Optic Patch Cord.

Fiber Optic Patch Cords	50/ 125 Ethernet Patch Cord
Bandwidth	
@850nm	500 MHz-KM
@1300nm	500 MHz-KM
Insertion Loss	Less than 0.5 dB

2.1.2.9.4 Warranty

Owner seeks warranty for the installed cable plant from the OEM equipment supplier. Bidder shall ensure that the OEM norms for supply, installation, testing and documentation as specified by the OEM supplier shall be adhered to, provided those are in line with TIA / EIA standards and Owner

requirement specifications. The warranty shall be provided by the OEM vendor to Owner and shall be administered in India. The duration of the warranty shall be for a minimum of 25 years and shall cover the system performance, application assurance and the costs of the supply of components and installation.

2.1.2.10 TELEPHONE SYSTEM

GENERAL:

1.0 The electrical Installation work shall be carried out in accordance with Indian Standard Code of practice. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the local Electricity Supply Authority and Fire Insurance Regulations so far as these become applicable to the installation. Electrical work in general shall be carried out as per CPWD Specifications.

2.0 Wherever this specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification, then the specification here under shall take precedence over the said regulations and standards.

TELEPHONE SYSTEM WIRING AND CONDUITING:

2.1.2.10.1 Intent of Specification

2.1.2.10.1.1 These specifications are intended to cover the Cabling and under floor raceway work and conduiting (wherever required) for Telephone & Intercom System. It is not the intent to specify completely herein all aspects of design, constructional features of equipment and details of the work to be carried out, but nevertheless the intent of the specification is to ensure that the equipment and work shall conform in all respects to the relevant Bureau of Indian Standard Specifications, Codes of Practice, and other statutory regulations as may be applicable and to high standards of engineering, design and workmanship. The equipment and work shall perform in continuous operation in a manner acceptable to the Employer who will interpret the meaning of the specifications and drawings and shall have the right to reject or accept any equipment or work which in their assessment is not complete to meet the requirements of these specifications and/ or applicable Codes and Standards.

2.1.2.10.2 Scope of Work

2.1.2.10.2.1 The scope of work under these specifications shall include the design and manufacture (wherever required), work's testing, supply, storage, erection, site testing and commissioning of the following:-

- a) All conduit work including Junction Boxes, outlet boxes and wiring & cabling of telephone & intercom system etc. as specified.
- b) Boxes & cover plates for telephone outlets as specified.
- c) Supplying and laying/fixing of main Telephone cables and Tag Blocks as per the BOQ and line diagrams.
- d) To do the ferruling and identification of all multi core cables / Cat-5(e) / Cat-6 at both the ends of each cable.
- e) To do the testing of new telephone cables & tag blocks before the start of work and intimate the condition of the same to the employer.
- f) The scope of work shall also include all civil works associated with erection of the equipment and making good and painting the civil works as required.
- g) The Contractor shall include for the supply of entire materials in accordance with these specifications and the whole of the work of fixing necessary material for the complete installation as set down in these specifications and with the accompanying schedules of work and drawings. Materials and components not specifically stated in the specifications and / or bill of materials or noted on the drawings but which are necessary for satisfactory installation and operation of the system shall be deemed to have been included in the scope of work.

2.1.2.10.3 Technical Specifications For Cables:

2.1.2.10.3.1 Jelly Filled Cables (Armoured / Unarmoured)

- a) These cables shall be manufactured in accordance with the P&T specifications No. ITD-S/WT-129 D, S/WT-143 B.
- b) The constructional details, technical properties shall be governed by the Dept. of Telecommunications specification No. G/CUG-01/02. Feb. 96 and amended up to date.

2.1.2.10.3.2 Unarmored Telephone Cables & Wires

- a) All Telephone unarmoured cables & wires shall be manufactured in accordance with the relevant latest I.S specifications and ITD Specifications no. ITD-S/WS-113 C, SWS-114 C.

2.1.2.10.4 Telephone Outlets:

2.1.2.10.4.1 Telephone Outlets shall be modular plate type accessories with RJ-11/RJ-45 Telephone Outlet as specified in the BOQ. Cover plate shall match in shape & finish with other light and power accessories.

2.1.2.10.4.2 Front Cover Plates shall match the Existing type and size of the gang box.

2.1.2.10.5 Specifications And Schedules

2.1.2.10.5.1 The Specifications and Schedule of quantities shall be considered as part of this contract and any work or materials shown in schedule and not called for in the specifications or vice versa, shall be executed as if specially called for in both. The drawings indicate the extent and general arrangement of outlets, Junction Boxes etc. and are essentially diagrammatic.

2.1.2.10.5.2 The work shall be installed as indicated on the drawings. However, any minor changes found essential to coordinate the installation of this work with other trades shall be made without any additional cost of the employer. The data given herein and on the drawings is as exact as could be secured, but its complete accuracy is not guaranteed. The drawings are for the guidance of the Contractor. Exact locations, distances and levels will be governed by the site conditions.

2.1.2.10.5.3 Departure From Specifications

Should the tenderer wish to depart from the provisions in these specifications, such departure shall be listed in a separate schedule with full particulars and reasons for the same. No conditions or departures from specifications etc. will be accepted after decisions are communicated by the Engineer-In-Charge.

2.1.2.10.5.4 Materials And Equipment

All materials and equipment shall be of the approved make and design. Only the best quality materials and equipment shall be used. The materials and equipment shall conform to relevant Standards.

Approved List of makes of material are indicated in the annexure to the Specifications. Only such material shall be used. Alternative makes shall be used only with the specific written approval of the Engineer-In-Charge.

2.1.2.10.5.5 Samples

A list of items of materials and equipment, together with a sample of each shall be submitted to the Engineer-In-Charge within 15 days of the award of the Contract.

Samples and drawings of equipment shall not be departed from without the written instructions of the Engineer-In-Charge. Approvals given by the Engineer-In-Charge to any samples or drawings submitted by the Contractor shall not in any way exonerate the Contractor from his liability to carry out the work in accordance with the terms of the contract.

Any item which is proposed as a substitution, shall be accompanied by all technical data given sizes, particulars of materials and the manufacturer's name. At the time of the submission of proposed substitution the Contractor shall state the credit, if any, due to the Client. In the event the substitution is approved, changes and substitutions shall be requested in writing and approvals obtained in writing from the Engineer-In-Charge.

2.1.2.10.5.6 Manufacturer's Instructions

Where manufacturers have furnished specific instructions, relating to the materials used in this covering points not specially mentioned in these documents, manufacturers instructions shall be brought to the notice of the Engineer-In-Charge for further instructions in the matter.

2.1.2.10.5.7 Interchangeability

All similar parts and / or equipment shall be interchangeable with one and other.

2.1.2.10.5.8 Material Testing

The Employer shall have full powers to require the materials of work to be tested by an independent agency at the Contractor's expense in order to prove their soundness and adequacy.

2.1.2.10.5.9 Drawings

2.1.2.10.5.9.1 Prior to the laying and fixing of the conduits, the Contractor shall submit to the Engineer-In-Charge detailed shop drawings of the conduit network and get the same approved. The shop drawing shall indicate number, size and route of the conduits, location of junction/ inspection / pull boxes, location and size of outlet boxes and number and size of wires carried in each conduit.

2.1.2.10.5.9.2

The Contractor shall prepare and submit for the approval of Engineer-In-Charge detailed shop drawings of all Junction Boxes, special pull boxes and any other requirement to be fabricated by the Contractor within 10 days of signing of the contract.

2.1.2.10.5.9.3

General Arrangement drawing giving details of cable, size and type of cables, number of cables, equipment, mode of installation etc.

2.1.2.10.5.10 Cleaning, Final Painting And Marking

2.1.2.10.5.10.1

All exposed steel work not actually embedded will be painted as instructed. All tag blocks shall be properly labeled and numbered. The scope of work shall include the same without any extra charge. The Contractor shall be required to clean all equipment under erection as well as the work area and site at regular intervals to the satisfaction of the Engineer-In-Charge. In case the cleaning is not to the satisfaction of Engineer-In-Charge the same will have to be done again at the Contractor's Cost.

2.1.2.10.5.11 Completion Certificate

2.1.2.10.5.11.1

On completion of the wiring & cabling, a certificate shall be furnished by the Contractor countersigned by the Licensed Supervisor, under whose direct supervision, the installation was carried out. The contractor shall get the certification of the competent authority for the complete system after commissioning.

2.1.2.10.5.12 Works Inspection

2.1.2.10.5.12.1

Prior to shipment of equipment, the Engineer-In-Charge reserves the right to inspect the same at the manufacturers works and the Contractor shall provide and secure for the Engineer-In-Charge and his authorized representative every reasonable access and facility at the manufacturers works for inspection.

2.1.2.10.5.13 Co-Ordination Of Work At Site

2.1.2.10.5.13.1

The Contractor shall work in co-ordination with other agencies at site and shall arrange to place the conduits/ inserts etc. in the masonry and concrete as required, as other works proceed. Any hold up of the building or other works because of delay in placing the conduits / inserts etc. or otherwise shall be the responsibility of the Contractor and shall make him liable for damages as may be considered and levied by the Engineer-In-Charge.

2.1.2.10.5.14 CONDUIT

2.1.2.10.5.14.1 Conduiting shall be done as per the relevant head in the specifications.

2.1.2.10.5.15 LIST OF APPLICABLE STANDARDS

1.0	TIA/EIA-568-A/B-2-1
2.0	TIA/EIA-569
3.0	EIA/TIA-TSB-67
4.0	UL 1863/UL 497A/UL 94V-0
5.0	ULC- C22.2
6.0	ISO 9001:2002 and 14001
7.0	ANSI/TIA/EIA-607
8.0	NFPA-70
9.0	IEEE802 / IEEE802.3 / IEEE 802.3Z
10.0	National Electric Code (NEC)
11.0	Underwriters Laboratories Cable Certification
12.0	Class-E requirements of ISO/IEC 11801:2002.-2nd edition

2.1.2.11 CABLE TV SYSTEM WIRING AND CONDUITING:

2.1.2.11.1 Intent of Specification

These specifications are intended to cover the Conduiting & Cabling work for Cable TV System. It is not the intent to specify completely herein all aspects of design, constructional features of equipment and details of the work to be carried out, but nevertheless the intent of the specification is to ensure that the equipment and work shall conform in all respects to the relevant Bureau of Indian Standard Specifications, Codes of Practice, and other statutory regulations as may be applicable and to high standards of engineering, design and workmanship. The equipment and work shall perform in continuous operation in a manner acceptable to the Engineer-In-Charge who will interpret the meaning of the specifications and drawings and shall have the right to reject or accept any equipment or work which in their assessment is not complete to meet the requirements of these specifications and / or applicable Codes and Standards.

- a) The works shall be carried out as specified in the BOQ.
- b) Conduit works shall be carried as per CPWD Specifications/Relevant section of these specification.
- c) The wires shall be conform to relevant Indian Standards and of approved makes as specified.
- d) Wiring for TV system equipment shall be carried out with insulated coaxial conscope cables as specified and laid in surface/recessed conduit as shown in the drawing or as specified in the BOQ.

2.1.2.11.2 Scope Of Work

2.1.2.11.2.1 The scope of work under these specifications shall include the design and manufacture (wherever required), work's testing, supply, storage, erection, site testing and commissioning of the following:-

- a) All conduit work including Junction Boxes, outlet boxes and wiring & cabling of Cable TV system as specified.
- b) Boxes & cover plates for television outlets as specified.
- c) Supplying and laying / fixing of Junction Boxes and Coaxial TV splitters.
- d) To do the ferruling / termination and identification of all cables at both the ends of each cable.

- e) To do the testing of existing television cables & Splitter boxes (if already existing) before the start of work and intimate the condition of the same to the employer.

2.1.2.11.3 Technical Specifications For Coaxial cable:

2.1.2.11.3.1 The Co-axial cables shall be solid annealed bare electrolytic grade copper conductor co-axial cable with gas injective physical foam PE Dielectric, poly-laminated aluminum tape followed by copper braiding, jelly filled & Overall PVC sheathed. The size shall be as specified in the BOQ.

2.1.2.11.4 Television Outlets:

2.1.2.11.4.1 All TV Outlets shall be modular plate type accessories with Coaxial TV Outlet.

2.1.2.11.4.2 Cover plate shall match in shape & finish with other light and power accessories.

2.1.2.11.4.3 Front Cover Plates shall match the Existing type and size of the gang box.

2.1.2.11.5 CABLE TV WIRING & CONDUITING

2.1.2.11.5.1 Cable TV System

- a) The works shall be carried out as specified in the BOQ. Conduit works shall be carried as per the Specifications under the wiring head of the Technical Specifications.
- b) The wires shall be conform to relevant Indian Standards and of approved make.
- c) Wiring for TV system equipment shall be carried out with insulated coaxial conscope cables of specified makes laid in surface/recessed conduit as shown in the drawing or as specified in BOQ.

2.1.2.11.5.2 Front Cover Plates

- a) Front Cover plates to match the size of gang box.
- b) Front Cover plates for TV cable shall be suitable for mounting modular TV socket.

2.1.2.12 SOLAR PHOTOVOLTAIC SYSTEM

2.1.2.12.1.1 SOLAR PHOTOVOLTAIC MODULE

Solar Photovoltaic Modules shall conform to UL/ CE / IEC-61215 Edition 2 Standards specifications necessary certification from the reputed laboratory shall be provided by bidder.

The peak power rating of the Solar PV array under Standard Temperature Conditions (STC)

shall be equal to the peak power rating of the individual plant. Stabilized output of solar PV array for the plant should not be less than 6 KWp under standard test condition with available terrace area. Modules of SPV power plant shall be of 24 Volt, 175-230 Wp high efficiency multi crystalline silicon solar cells.

The rated maximum power rating of PV modules should have positive tolerance in range of 0 to +3%. And negative temperature coefficient of power for PV modules should be less than or equal to 0.45% per deg. C.

A suitable number of Solar PV modules shall be connected in a series string. A suitable number of series strings shall be connected in parallel to formulate a series - parallel array. The PV strings and array shall be designed to match the inverter input Power conditioning unit specifications.

The peak power point voltage and the peak power plant current of any supplied module and / or any module string (Series connected module) shall be not more than 3% from the respective arithmetic mean for all modules and / or for all modules string as the case may be.

Bidder shall submit the detailed energy generation calculations with sloped angles of installation of SPV. Bidder shall give guarantee for Overall energy generation on annual basis for 20 years.

Electrical Features

Solar Photovoltaic module array shall consist of high efficiency Solar Modules utilizing

Crystalline Silicon Solar Photovoltaic cells. Multi crystalline high power cells are used in the Solar Photovoltaic module. Solar module shall be laminated using lamination technology using established polymer (EVA) and Tedlar / Polyester laminate.

Each Solar module should consist of 60 Photovoltaic cells or as per manufacture standard.

Solar Photovoltaic module efficiency shall be greater than 19.3 %. Module shall be made of high transmissivity glass front surface giving high encapsulation gain.

All materials used must have a proven history of reliable and stable operation in external outdoor applications. Solar modules are designed to operate and perform in relative humidity up to 100% with temperatures between -10 Deg C and +85 Deg C and with stand gust up to 200km/h from back side of the panel. The geological data for Delhi, Maharashtra to be referred for design to get optimum generation of Solar PV System.

Sample modules and production processes employed in the manufacture of the offered module are in accordance with the requirements of IEC 61215 / IEC61730.

The module frame must be made of torsion & corrosion resistant materials, which is electrolytically compatible with the structural material used for mounting the module.

Module Junction box (weather resistant) shall be designed for long life out door operation in harsh environment (IP-67). Degradation of solar panel @ 1% per year is permitted.

The solar modules shall have suitable encapsulation and sealing arrangements to protect the silicon cells from the environment. The arrangement and the material of encapsulation is compatible with the thermal expansion properties of the Silicon cells and the module framing arrangement/material. The encapsulation arrangement ensures complete moisture proofing during life of the solar modules.

Each module must have low iron tempered glass front for strength and superior light transmission. It also must have back sheet for environment protection against moisture and high voltage electrical insulation. The fill factor of modules is not less than 0.70 (Typical).

DC negative conductor shall be bonded to the ground via Ground Fault Detector Interrupter (GFDI). The grounding point shall be as close as possible to the PV Array.

Note: I-V curve of each PV module with SI. Nos. should be submitted along with Modules meeting the IEC Specification.

Mechanical Features

Solar Photovoltaic Module shall be made of toughened, low iron content, high transmissivity front glass. Anodized Aluminum Frame shall be provide around the module. The module frame shall be made of corrosion resistant material electrically compatible with the structural material used for mounting the modules. The module shall be encapsulated with Ethyl Vinyl Acetate (EVA). Silicon edge sealant shall be provided around laminate. The back surface shall be Tedlar /Polyester trilaminate. ABS plastic terminal box shall be provided for the module output termination with gasket to prevent water moisture. The module shall be Resistant to water, abrasion, hail impact, humidity & other environment factor for the worst situation at site. Bypass diode arrangement shall be provided. Weatherproof DC rated Multi contact connector and lead cable coming out as a part of the module to make connection easier and secure not allowing for any loose connection.

2.1.2.12.1.2 MODULE MOUNTING STRUCTURE & PLACEMENT

PV array shall be installed utilizing maximum terrace space to minimize effects of shadows due to adjacent PV panel rows. Adequate spacing shall be provided between two panel frames and rows of panels to facilitate personnel protection, ease of installation, replacement, cleaning of panels and electrical maintenance. PV array shall be oriented in the south direction at a tilt angle of 19 deg. or as per site conditions to be decided by vendor in order to maximize annual energy yield of the plant.

The Structure shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the roof properly. There shall be no requirement of welding or complex machinery at site. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels & shall withstand heavy winds. The supplier / manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings. The PV array structure design shall be appropriate with a factor of safety of min. 1.5. Each PV panel structure shall incorporate one bird repellent spike at a level higher than the panel upper edge. The location of the spike should be selected for minimum shadow effect.

PV modules shall be secured to support structure using screw fasteners and/or metal clamps. Screw fasteners shall use existing mounting holes provided by module manufacturer. No

additional holes shall be drilled on module frames. Module fasteners/clamps shall be adequately treated to resist corrosion. The structure shall be designed to withstand operating environmental conditions for a period of minimum 25 years.

Module mounting structure shall be made up of aluminum anodized for a minimum thickness of 15 microns or hot dipped galvanized for a minimum thickness of 100 microns) section of steel. Super structure shall be designed & fabricated according to site condition.

Support structure for array module shall be design and foundation or fixation mounting arrangements should withstand minimum horizontal wind speed of 200kms / hr (Designed value shall be greater than 200kms /hr). All hardware shall be of Stainless steel - SS 304.

The min. clearance between lower edge of PV panel and terrace ground level shall be 1m. (to allow ventilation for cooling, also ease of cleaning and maintenance of panels as well as cleaning of terrace). The height of each PV panel structure shall not exceed 3m above the terrace floor level.

The entire structure including array shall be earthed to an independent pit with redundant path the structure shall be design to allow easy replacement of any module. The drawings along with detailed design shall be submitted to Engineer-In-Charge for approval before starting of the execution work. The work shall be carried out as per design approved by Engineer-In-Charge.

2.1.2.12.1.3 JUNCTION BOXES

The junction boxes shall be dust free, vermin and waterproof and made of FRP / Thermo Plastic with IP67 protection. The terminals shall be connected to copper bus bar arrangement of proper sizes. The junction boxes shall have suitable cable entry points fitted with strain-relief cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification. Array junction box shall have suitable reverse blocking diodes of minimum DC blocking voltage of 800 V with suitable arrangement for its connecting. The array box shall also have suitable surge protection.

All DC and AC cables shall be terminated using suitable crimped cable lugs/sockets and screw type terminal strips. No soldered cable termination shall be accepted. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. String/Array combiner boxes shall be secured onto walls or metal structures erected separately on the terrace. Conduits/concealed cable trays shall be provided for all DC cabling on the terrace. Conduits/concealed cable trays shall be

adequately secured onto the terrace.

The junction boxes shall have suitable arrangement for the following:

- Combine groups of modules into independent charging sub-arrays that shall be wired to the controller.
- Provide arrangement for disconnection for each of the groups.
- Provide a test point for each sub-group for quick fault location.
- To provide group array isolation.

- The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.

2.1.2.12.1.4 POWER CONDITIONING UNIT (PCU)

Power Conditioning Unit (PCU) is critical equipment in grid connected SPV Power Plant. Solar array shall produce DC energy output at 270 - 600V DC and supplied to the DC bus for inverting to AC voltage. Maximum Peak Power Tracking (MPPT) (The efficiency of PCU shall not be less than 95% & shall be designed to meet the Solar PV Array capacity control) will extract maximum energy from solar array and provides 415VAC +/-5% 50HZ, sine wave output to synchronize with local utility grid. PCU should have 150 % Over load capacity for 60sec. Output wave shape shall be sine wave with < 3% total harmonic distortion (THD). Additionally, it will provide protection features such as, over current, short circuit, over temperature as a minimum. PCU shall be of very high quality having high efficiency and shall be capable of running load in isolated mode. The PCU shall be completely compatible with the SPV array voltage and grid supply voltage. The PCU shall be designed for continuous, reliable power supply as per specifications. The PCU shall have internal protection arrangement against any sustained fault. The dimension, weight, foundation details etc. of the PCU shall be clearly indicated in the detailed technical specification. It has user friendly LCD display for programming and view on line parameters. Such as DC power input, DC input Voltage, DC current, AC power output, AC voltage (All 3 phases and line) and AC current (All the phases and line) and power factor. The PCU shall have arrangement for adjusting DC input current and should trip against sustainable fault downstream and shall not start till fault is rectified. The inverter shall have internal protection against any sustained faults and/or lightening in DC and mains AC grid circuits. The mandatory islanding protection provided by inverter shall isolate the inverter from the LT line in the event LT

mains supply is not available. The 3 phase grid connected PCU shall be sourced from internationally reputed firms which shall incorporate latest technological advances to provide highly reliable and efficient energy conversion from DC to AC. The PCU incorporates a new system design which uses multiple power stacks which work in tandem. PCU shall be communication capable through the RS485 port.

The PCU shall be three phase static solid state type power conditioning unit. Both AC & DC lines shall be protected by suitable rating fuses and contactors to allow safe start up and shut down the system. Fuses used in the DC circuit shall be DC rated. The PCU shall have provision for input and output isolation. Each solid state electronic devices shall be protected to ensure long life of the inverter as well as smooth functioning of the inverter. PCU enclosure shall be fabricated from 14 gauge CRCA sheet steel and painted with RAL-7032 point shade with powder coating. Cooling arrangement shall be provided within the PCU cabinet for operation in a non-AC environment. No external arrangement for PCU cooling shall be accepted. All exposed connection / parts PCU shall be provided with protection covers.

2.1.2.12.1.5 DC AND AC DISTRIBUTION BOARDS\ISOLATORS

The DC and AC distribution boxes shall be wall mounted inside control room/open space. DC distribution box shall incorporate DC disconnect switch, lightening surge protectors, any other protection equipment, screw type terminal

strips and strain-relief cable glands. AC distribution box shall incorporate AC circuit breaker, surge voltage protectors, any other protection equipment, plant energy meter, screw type terminal strips and strain-relief cable glands. DC and AC cabling between inverter and distribution boxes shall be secured with conduits/ cable trays.

2.1.2.12.1.5 CABLES AND ACCESSORIES

a. All the cables shall be supplied conforming to Latest BIS & shall be of 3.3 kV grade as per interconnections, array to junction boxes, junction boxes to main junction box and main junction box to PCU etc shall be so selected to keep the voltage drop and losses to the minimum. The DC and AC cable size shall be selected to maintain losses within specified limits over the entire lengths of the cables

b. Bidders are required to mention each size of cables used and should consider their resistance/impedance in the design optimization. Such calculation should be submitted along with the bid.

c. The contractor shall supply all installation accessories, which are required to install and successfully commission the power plant.

2.1.2.12.1.6 EARTHING AND PROTECTION

PV array, DC equipment, Inverter, AC equipment and distribution wiring shall be earthed as

required. The entire array structure of the PV yard both AC & DC system shall be grounded properly using adequate number of independent earthing kits. All metal casing / shielding of the plant shall be thoroughly grounded to ensure safety of the power plant. Earthing shall be in line with IE rules. Detailed specifications have been provided in the Earthing section.

2.1.2.12.1.8 BILL OF MATERIALS

2.1.2.12.1.8.1 Complete Bill of Materials inclusive of Solar PV Modules, array Junction box, main junction box, cables, PCU, Module mounting structures, etc shall be provided along with the offer. The numbers of each component proposed for supply shall be clearly specified.

- a. Solar Array Capacity-
- b. Module mounting clamps/structure-
- c. Power Conditioning Unit-
- d. Data Logging system-
- e. Junction Boxes-
- f. Cable & Earthing material-
- g. Distribution Panels

2.1.2.12.1.8.2 The items not listed in BOM but required for successful installation / commissioning of SPV Power plant shall also be considered to be part of the supply scope without any extra cost to the purchaser.

2.1.2.12.1.9 SPARE PARTS

Contractor shall mention recommended spares and also furnish details for spare parts at least 3-5 years of their nearest service Centre.

2.1.2.12.1.10 TYPE TEST

Type testing certification should be produced at the time of delivery or earlier. Type test certification should be dated not earlier than 1 year.

2.1.2.12.1.11 INSTALLATION AND COMMISSIONING

2.1.2.12.1.11.1 Detailed project execution program shall be submitted along with the offer.

The bidder will be responsible for arranging all tools & plants for installation and commissioning the complete system.

2.1.2.12.1.11.2 The bidder will also submit the erection, testing & commissioning procedure for approval to the engineer in charge. These procedures will form integral part of the acceptance report for successful erection and commissioning the system. These reports will be prepared and signed by the bidder or his representative & the officials of the engineer in charge concerned with project.

2.1.2.12.1.12 SUPPORT/ TRAINING

The contractor must agree to provide complete support as per site requirement (single point of contact regarding for entire solutions). Contractor shall provide the on site 3 day basic operation & maintenance training to owner's staff in 2 schedules.

Contractor shall provide the operations and maintenance staff for first month in two shifts at site. The O&M staff provided for first month at site should be able to take care the fault finding and repair system to maintain the desired level of uptime of solar solutions at site.

2.1.2.12.13. TESTING

2.1.2.12.13.1 General

At the completion of the work, the contractor shall carry out the pre-commissioning as well as commissioning checks as given below on the entire installation and records be maintained for reference of any statutory authority, Client or their representatives.

Pre - Commissioning Checks

Note - Pre- Commissioning checks are to be carried out by Electrical contractor in presence of Project Management Team.

Sr. No.	Component	Points to be checked
1	Wires	◆ Correct identification of each wire by continuity check and providing correct ferrules as per approved drawings. ◆ Correct colour coding and correct connection by proper copper lugs. ◆ Wires are dressed and bunched properly. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ IR values of the circuit are measured and recorded.
2	Switch boxes & Receptacles	◆ Wires are connected properly as per wiring diagram. ◆ Correct colour coding and correct connection by proper copper lugs is done. ◆ Wires are dressed and bunched properly. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ Earthing connection is made properly. ◆ Functional check is OK ◆ IR values of the circuit are measured and recorded.
3	Panels	◆ External cables are glanded properly. ◆ Wires are connected properly as per wiring diagram. ◆ Correct colour coding and correct connection by proper copper lugs is done. ◆ Wires are dressed and bunched properly. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ Two Earthing connections are made properly. ◆ Functional check is OK ◆ IR values of the circuit are measured and recorded. ◆ Check proper mechanical operations of circuit breaking devices including alignment of trolley for drawout type device. ◆ Check contact alignment. And proper sequence of closing and opening of main and arcing contacts. ◆ Check electrical relays, meters & controls for correct wiring. ◆ Check polarity and connections of all instrument transformers.
4	Light fittings	◆ Correct colour coding and correct connection by proper copper lugs is done. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal. ◆ Earthing connection is made properly. ◆ IR values of the circuit are measured and recorded.
5	Lighting Poles	◆ Concrete foundation is firmly set and cured. ◆ Correct colour coding and correct connection by proper copper lugs is done. ◆ Connections are properly tightened. ◆ Not more than two wires are connected on any one side of terminal.

Sr. No.	Component	Points to be checked
		◆ Earthing connection is made properly.
6	Cables	◆ Cable identification tags are provided at both ends. ◆ Cable entry in all equipment is through proper sized glands. ◆ Cable termination is made by proper crimping type lugs. ◆ Connections are properly tightened. ◆ Not more than two conductors are connected on any one side of terminal. ◆ IR values of the circuit are measured and recorded.
7	Earthing	◆ The resistance value of each earth electrode are measured and recorded. ◆ Total resistance of earthing system should be as per the design value and in any case, shall not be more than 1 Ohm as per IS-3043. ◆ Continuity test for earth continuity conductors with ELV tester.
8	Transformer	◆ Check HV and LV cable terminations, earth connections, fittings and accessories, oil levels and oil leaks at various joints. ◆ Check breather, thermometers and buchholz relay for proper functioning and operation. ◆ Check junction boxes / marshalling box for correct wiring. ◆ Check oil test as per IS-1886. Oil shall withstand at least 40 kV with a gap of 4mm. ◆ Insulation resistance shall be carried out on new transformer without drying out the transformer if it has not been idle or stored for a long period. Otherwise, this test shall be carried out during drying out of transformers. This test shall be carried out between primary & secondary to earth as well as between primary and secondary. Winding which is not under test shall be earthed during the test. A megger rated 1000volts or higher shall be used for this test. ◆ Check operation of automatic tap changer and it's control panel for correct functioning. ◆ Check operation of forced cooling system, wherever provided, with it's control panel for it's correct functioning. ◆ Check external connections of the transformer in accordance with the diagram of connection and phase sequence. ◆ Check for CT / PT connections provided on transformer. Check electrical continuity of secondary circuit with ELV tester. ◆ Adjust spacing of arcing horns / rod gaps. ◆ Any other test specifically called for by the manufacturer or the contract.
9	DG set	◆ Check equipment for free movement of rotor, end play, lubrication and any other mechanical defects. ◆ Check commutators, slip ring, brushes, brush holders etc. for satisfactory conditions. ◆ Check insulation test of alternator between windings and ground. Use 500V megger for LV and 1000V megger for HT alternator. ◆ Check if starting batteries are fully charged and properly connected.

Commissioning Checks

Note –Commissioning checks are to be made in following sequence starting from Transformer / DG to main panel to last light fitting. All results of testing and observations are to be preserved for record and reference by any statutory authority.

Sr. No.	Component	Points to be checked
1.	Transformer	A. Ratio test ◆ With 415V applied on high voltage side, measure the voltages between all phases on low voltage side for all tap positions. B. Buchholz Relay ◆ Test for angle, air injection etc.

Sr. No.	Component	Points to be checked
		◆ Check that there is no air in protector. C. Alarm circuit checks for, ◆ Buchholz relay ◆ Oil and winding temperature thermometer ◆ Cooling gear failure D. Fans and pumps (for ONAF transformer) ◆ Ensure that oil valves are open ◆ Check the rotation of pumps, automatic starting, overload device etc. E. Tap changing test to check mechanism, indications etc. F. Check that neutral earthing switch wherever provided is in closed position. G. Ensure that all protective relays in HT and LT panels are set properly. H. All rectification points are attended and correctly rectified j. First switch on the transformer on NO load and keep for 15-20 minutes. K. Slowly one by one switch on the loads
2.	DG set	A. Voltage and frequency test ◆ Ensure that voltage and frequency is developed at no load as per required specification. B. AMF Panel ◆ Check that Dg start signal is given when main power fails. ◆ Check that DG stop signal is given when main power is restored. ◆ Check that ACB close signal is given when DG develops full voltage and frequency. C. Check proper functioning of, ◆ Lub. Oil temperature gauge ◆ Water temperature gauge ◆ Hour meter with RPM indicator ◆ Battery charging ammeter D. Ensure that neutral earthing switch, wherever provided is in closed position. E. ensure that all protective relays in AMF and LT panels are set properly. F. All rectification points are attended and correctly rectified G. First switch on the DG set on NO load and keep for 15-20 minutes H. Slowly one by one switch on the loads
3.	Main LT panel	◆ All rectification points are attended and correctly rectified. ◆ Incoming line voltage is correct as per panel incoming meter or checked by tong tester. ◆ Energize only control circuits and carry out closing and tripping operations (where AC supply is derived from main supply and used for operation, the switch gear bus may be energized). ◆ Check operation of electrical interlocks. ◆ Check tripping of breaker by manual operation of relay. ◆ Check operation of mechanical closing and tripping devices. ◆ If incoming line voltage is correct, switch on out going feeder one by one and note that each one is kept ON for 5 – 10 minutes without any problem.
4	Switch boxes & Receptacles	◆ All rectification points are attended and correctly rectified. ◆ Check the voltage with test lamp. ◆ Switch on the circuit.

Sr. No.	Component	Points to be checked
5	Lighting Panels	♦ All rectification points are attended and correctly rectified. ♦ Incoming line voltage is correct as per panel incoming meter or checked by tong tester. ♦ If incoming line voltage is correct, switch on out going feeder one by one and note that each one is kept ON for 5 – 10 minutes without any problem.
6	Light fittings	♦ All rectification points are attended and correctly rectified. ♦ Switch on the circuit.
7	Lighting Poles	♦ All rectification points are attended and correctly rectified. ♦ Check the voltage with test lamp. ♦ Switch on the circuit.
8	Earthing	♦ Check if all earth electrodes in earth pits for it's correct installation and connection to earth grid. ♦ Check if all protective conductors from the earth electrodes to grid and from grid up to all electrical equipment are made correctly. ♦ Remove the protective conductor / grid connection with earth electrode and measure earth electrode resistance by using earth megger. ♦ Repeat above procedure for all electrodes. ♦ Ensure that total earth resistance of the installation is less than 1 mega- ohms.

2.2 FIRE FIGHTING WORKS

FIRE FIGHTING & FIRE PROTECTION	
I. S. CODE NO.	SUBJECT
NBC Part – IV	National Building Code of India; Part IV Fire & Life Safety
TAC	Tariff Advisory Committee fire protection manual Part-I.
TAC	Rules of Tariff Advisory Committee for automatic sprinkler system.
NFPA : 13	Installation of Sprinkler System
NFPA : 14	Installation of Standpipe & Hose System
NFPA : 20	Installation of Stationary pump for Fire Protection
IS : 636	Non-percolating flexible fire fighting delivery hose.
IS : 884	Specification for first aid hose reel for fire fighting.
IS : 901	Specification for couplings, double male and double female, instantaneous pattern for fire fighting.
IS : 902	Suction hose couplings for fire fighting purposes.
IS : 903	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner.
IS : 904	Specification for 2-way and 3-way suction collecting heads for fire fighting purposes.
IS : 907	Specification for suction strainers, cylindrical type for fire fighting purposes.
IS : 908	Specification for fire hydrant, stand post type.
IS : 909	Specification for underground fire hydrant, sluice valve type.
IS : 910	Specification for portable chemical foam fire extinguisher.
IS : 933	Specification for portable chemical foam fire extinguisher.
IS : 1648	Code of practice for fire safety of building (general) : Fire fighting equipment and its maintenance.
IS : 2171	Specification for portable fire extinguishers dry powder (cartridge type)
IS : 2190	Selection, installation and maintenance of first aid fire extinguishers – Code of practice.
IS : 2871	Specification for branch pipe, universal, for fire fighting purposes.
IS : 2878	Specification for fire extinguishers, carbon dioxide type (portable and trolley mounted).
IS : 3844	Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises.
IS : 5290	Specification for landing valves.

FIRE PROTECTION SYSTEM

2.2.1. SCOPE

The scope of this section consists of but is not necessarily limited to supply, installation, testing and commissioning of the fire protection system. The philosophy of the system is as follows :

- a. The Fire Suppression System shall comprise the Fire Hydrants System, the Sprinkler System (Wet type), Hand Appliances.
- b. Water from the underground 2nos RCC Fire Water Storage Tanks, each of 75 cum capacity, shall be supplied for the uses listed below.
 - i. Fire Hydrant System (Pressurised) both for the external hydrants, the internal landing valves and the hose reels at landings.
 - ii. Sprinkler System (Wet Type)
- b. The Hydrant System and the Sprinkler System, under normal conditions, shall be lowest pressurized by means of the electric motor driven Jockey Pump.
- c. The Hydrant System shall be provided with two pump sets, one of which will be diesel engine driven and the other electric motor driven.
- d. The Sprinkler System shall be provided with an electric motor driven pump set.
- e. The piping and valve connections shall be done so that the water from the discharge of the Hydrant Pump sets is able to supply water, automatically to the Sprinkler System whenever, the Sprinkler Pump is unable to maintain the pressure or fails and not vice versa.
- f. The starting and stopping of the Jockey pump shall be automatic based on the pressure switches at preset low and high pressure.
- g. The electric motor driven Hydrant Pump starts automatically at a preset pressure by means of a pressure switch. As soon as the Hydrant Pump starts, the Jockey Pump Stops. If for any reason the electric motor driven Hydrant Pump does not start at the preset pressure or is unable to maintain the pressure, the diesel engine driven Hydrant Pump starts at the preset pressure.
- h. The Hydrant Pump, whether electric motor driven or the diesel engine driven shall be stopped only manually.
- i. The Sprinkler Pump shall be started automatically at a preset pressure but shall be stopped only manually.
- j. Contractor shall ensure that all false ceiling voids greater than 800 mm are provided with sprinklers.
- k. Contractor shall ensure Hydro Testing for the complete system.
- l. The Contractor shall obtain the necessary approval of the drawings and the schemes from the local authority / TAC as called for. The contractor shall also take care of any other requirement so that insurance cover can be obtained, if required at minimum premium at a later date.
- m. The contractor shall design and after approval of Project Manager display near each staircase landing at floor levels, a glass covered framed floor plan clearly showing the locations of all landing valves, hose reels, hand appliances, as well as the DO's and DON'T's for the personnel and the exit direction in case of an emergency. The dimensions of the floor plan, its scale, lettering size, colour scheme etc shall be as directed by the Project Manager.

2.2.2 PIPE WORK

2.2.2.1 GENERAL REQUIREMENTS

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Consultants.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps and supports (galvanised after fabrication) at intervals specified. Only approved type of anchor fasteners shall be used for RCC slabs and walls / floors etc.

Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

Pipe accessories such as gauges, meters, control devices, etc. shall have the same working pressure rating as the associated pipe work. All pipe work shall be free from burrs, rust and scale and shall be cleaned before installation. All personnel engaged on welding operations must possess a certificate of competence issued by an acceptable / recognized authority.

2.2.2.2 PIPING

Pipes of following types are to be used:

Mild steel black pipes as per IS:1239 heavy grade(for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside to prevent soil corrosion. M.S. pipes buried below ground shall also be suitably be lagged with 4mm thick protection coating over 2 coats of primer.

Steel pipelines upto 150 mm dia shall be as per IS: 1239, Part-II (heavy grade) while pipelines above 150 mm dia shall be as per I.S.:3589.

All pipe clamps and supports shall be fabricated from MS steel sections and shall be factory galvanised before use at site. Welding of galvanised clamps and supports shall not be permitted.

Pipes shall be hung by means of expandable anchor fastener of approved make and design. The hangers and clamps shall be fastened by means of galvanised nuts and bolts. The size/diameter of the anchor fastener and the clamps shall be suitable to carry the weight of water filled pipe and dead load normally encountered.

Hangers and supports shall be thoroughly galvanised after fabrication. The selection and design of the hanger & support shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor braces, dampener, expansion joint and structural steel to be attached to the building/structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultants.

The piping system shall be tested for leakages at 2 times the operating pressure or 1.5 time shut-off pressure, which ever is highest including testing for water hammer effects for a period of 4 hr. minimum.

Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on two straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.

For pipes under ground installation the pipes shall be buried at least one meter below ground level and shall have 230 mm x 230 mm masonry or concrete supports at least 300 mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand : 8 stone aggregate) of size 380x380x75 thick resting on firm soil.

Mains below ground level shall be supported at regular intervals not exceeding 3.0 metres and shall be laid at least 2.0 metre away from the building.

2.2.2.3. PIPING INSTALLATION & SUPPORT

Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.

Piping shall be properly supported on , or suspended from , on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.

Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. Risers shall be supported at each floor with Galvanised steel clamps. To permit free movement of common piping support shall be from a common hanger bar fabricated from Galvanised steel sections.

Pipe hangers shall be provided at the following maximum spacings:

Pipe Dia (mm)	Hanger Rod Dia (mm)	Spacing between Supports (m)
Up to 25	6	2
32 to 50	6	2.5
65 to 80	8	2.5
80 to 100	10	2.5
125 to 150	10	3.0
200 to 300	12	3.5

The end of the steel rods shall be threaded and not welded to the threaded bolt.

All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.

Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.

Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes pass through walls and slab and annular space filled with fibreglass and finished with retainer rings.

The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used.

Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 15mm pipe size and shall be associated with an equal size gate valves. Automatic air valves shall be provided on hot water risers.

Discharge from the air valves shall be piped through a pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.

Pressure gauges shall be provided as shown on the approved drawings. Care shall be taken to protect pressure gauges during pressure testing.

2.2.2.4 PIPE FITTINGS

Pipe fittings mean tees, elbows, couplings, unions, flanges, reducers etc and all such connecting devices that are needed to complete the piping work in its totality.

Ductile Iron / Cast Iron / Forged steel screwed type fitting shall be used for pipes of 50 mm dia & below.

Fabricated fittings shall not be permitted for pipes diameters 50mm and below.

Fabricated fittings used on pipe size 65 mm & above shall be fabricated , welded in workshops. They shall be inspected by Project Manager before dispatch from the workshop. The welding procedures of the workshop should have been approved by the rules for sprinkler system and applicable to hydrant and sprinkler system. For "T" connection, pipes shall be drilled and reamed. Cutting by gas or electrical welding shall not be permitted.

2.2.2.5. PROCEDURE FOR PYPKOTE / COATEK APPLICATION

A) Surface Preparation - The pipe surface shall be cleaned by a wire brush.

B) Application of Primer - Primer is to be applied on pipes immediately after cleaning. This is to prevent any further accumulation of rust on the pipe. This is a cold applied primer and is applied by brush.

C) Application of 4 mm bitumastic Tape - After the primer is applied on the pipe, it is allowed to dry for about 30 min. till it becomes touch dry. Before adhering the tape to the pipe, it is advisable to gently heat the primer coated pipe by a run of LPG torch. Remove the bottom polyethylene from the tape & then heat bottom surface of the tape by LPG torch or any heat source & start wrapping the tape to the pipe by heating the primer coated pipe & by removing the bottom polyethylene from the tape before wrapping better adhesion between the tape & pipe is obtained. Overlaps are maintained with a minimum of 15.0 mm.

D) Tape coating of weld joints - The tape is applied over the weld joints after the necessary welding & testing methods of the joints is completed. The procedure for application of tape shall be the same as bare pipe procedure. Overlaps on each side of the weld joints shall be 50 mm.

E) A final coat of White wash with water based cement paint is done immediately over the entire coated pipe.

2.2.2.6. JOINTING

2.2.2.6.1. WELDED JOINTS :

Joints between MS pipes and fittings shall be butt joint made with the pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner. But welding without "V" groove shall not be permitted.

2.2.2.6.2. GROOVED JOINTS:

2.2.2.6.2.1 Remove all loose dirt scale & grease from the pipe surface.

2.2.2.6.2.2. Wrap the tape around the pipe, make sure the tape is not twist & make the groove by machine as per the requirement of coupling manufacturer.

2.2.2.6.2.3 Joints between the pipes and grooved fitting shall be made with the pipe by making square groove by grooving machine with out reducing the thickness of pipe wall and fixed with the help of grooved coupling, nut, bolts & gasket etc.

2.6.3. GROOVED MECHANICAL COUPLINGS FOR JOINING CARBON STEEL PIPE :

2.2.6.3.1 Grooved Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used for potable water applications shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard.

a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.

b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three Couplings shall be placed in close proximity to the vibration source.

2.2.2.6.3.2. Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges.

2.2.2.6.3.3. Grooved couplings shall meet the requirements of ASTM F-1476.

2.2.2.6.3.4. Gasket: Synthetic rubber, wide width, conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000.

Grooved End Fittings

Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, with grooved ends for direct connection into grooved piping systems with steel forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9,53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153 with fire lock arrangement. Zinc electroplated fittings and couplings conform to ASTM B633.

2.2.2.6.3.5. Grooved Hole-Cut Branch Outlets:

a. Bolted Branch Outlet: Branch reductions on 2 1/2"(DN65) through 6"(DN150) header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with fire lock type synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183.

b. Strapless Outlet: 1/2"(DN15) or 3/4"(DN20) NPT outlet on 4" (DN100) and larger header sizes rated for 300 PSI (2065 kPa).

- c. Strapless Thermometer Outlet: To accommodate industrial glass bulb thermometers with standard 1-1/4"-18 NEF 2B extra fine thread and 6" (152mm) nominal bulb length on 4" (DN100) and larger header sizes rated for 300 PSI (2065 kPa). Lubricant for fixing the Gasket on pipe should be oil free by manufacture and capable to give the cherectic as required.

2.2.2.6.4. FLANGED JOINTS (65 MM DIA AND ABOVE)

Flanged joints with flanges conforming to IS: 6392 shall be provided on

- a. Straight runs at intervals not exceeding 25-30m on pipe lines of 50 mm dia and above and as directed by the Project Manager.
- b. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings.
- c. Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

2.2.2.6.5. UNIONS (UPTO 50 MM DIA)

Approved type of dismountable unions shall be provided on pipe lines of 40 mm dia and smaller dia, in locations similar to those specified for flanges.

2.2.3 AIR VESSEL

The air vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter-acting pressure, surges, whenever the pumping sets come into operation. Air vessel shall conform to IS:3844. It shall be normally half full of water, when the system is in normal operation. Air vessel shall be fabricated with 8 mm thick M.S. plate with dished ends and suitable supporting legs. It shall be provided with one 100 mm dia flanged connection from pump, one 25 mm drain with valve, one water level gauge and 25 mm sockets for pressure switches. The air vessel shall be tested to pressure for 12 hours at 2 times the operating pressure or 1.5 times the shut-off.

2.2.4 AIR CUSHION TANK

Every wet riser shall be provided with an air cushion tank at its top most point. The air cushion shall be provided with an automatic air release cock, 20 mm dia drain pipe, drain valve and shut off valve.

2.2.5 FIRE BRIGADE CONNECTION

The storage tank shall be provided with a 150 mm fire brigade pumping connection to discharge at least 2275 litres / minute into it. This connection shall not be taken directly into the side of the storage tank, but arranged to discharge not less than 150 mm above the top edge of the tank such that the water flow can be seen. The connection shall be fitted with stop valve in a position approved by the Project Manager. An overflow connection discharging to a drain point shall be provided from the storage tank.

The fire brigade connection shall be fitted with four numbers of 63mm instantaneous inlets in a glass fronted wall box at a suitable position at street level, so located as to make the inlets accessible from the outside of the building. The size of the wall box shall be adequate to allow hose to be connected to the inlets, even if the door cannot be opened and the glass has to be broken. Each box shall have fall of 25mm towards the front at its base and shall be glassed with wired glass with "FIRE BRIGADE INLET" painted on the inner face of the glass in 50 mm size block letter. Each such box shall be provided with a steel hammer with chain for breaking the glass.

In addition to the emergency fire brigade connection to the storage tank, a 150mm common connection shall be taken from the four 63mm instantaneous inlets direct to hydrant main so that the fire brigade may pump to the hydrants in the even of the hydrant pumps being out of commission. The connection shall be fitted with a sluice valve. Location of these valve shall be as per the approval of the Project Manager.

Two way collecting head with two numbers 63 mm instantaneous type inlets shall be connected to the sprinkler header. All other details shall be as described above.

2.2.6. SYSTEM DRAINAGE

The system shall be provided with suitable drainage arrangement with drain valves complete with all accessories.

2.2.7. VALVE CHAMBERS

Provision of suitable brick masonry chambers in cement mortar 1:5 (1 cement : 5 coarse sand) on cement concrete foundations 150 mm thick 1:5:10 mix (1 cement:5 fine sand : 10 graded stone aggregate 20 mm nominal size) with 15 mm thick cement plaster inside and outside finished with a plaster inside and outside finished with a floated coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back-filling complete shall be made.

2.2.8. VALVES

2.2.8.1. SLUICE VALVES

Sluice valves shall be double flanged valves with cast iron body. The spindle, wall seat and wedge nuts shall be of bronze. They shall generally have non-rising spindle and shall be of the particular duty and design called for.

The valves shall be supplied with suitable flanges, non- corrosive bolts and asbestos fibre gaskets. Sluice valves shall conform to Indian Standard IS : 780-1969 and IS : 2906 .

2.2.8.2. BUTTERFLY VALVE

The butterfly valve shall be suitable for waterworks and rated for 300 P.S.I

The body shall be of cast iron to IS:210 in circular shape and of high strength to take the water pressure . The disc shall be heavy duty cast iron with anti corrosive epoxy or nickel coating.

The valve seat shall be replaceable of high grade elastomer EPDM or nitrile rubber with hard backing. The valve in closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure . The shaft shall be EN 8 grade carbon steel.

The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

2.2.8.3. BALL VALVE

The ball valve shall be made forged brass and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections.

The ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon.

The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations. The gap between the ball and the teflon packing shall be sealed to prevent water seeping.

The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

2.2.8.4. GUN METAL VALVES

Gun metal Valves shall be used for smaller dia pipes, and for threaded connections. The Valves shall bear certification as per IS:778 The body and bonnet shall be of gun metal to IS:318. The stem gland and gland nut shall be of forged brass to IS:6912. The hand wheel shall be of cast iron to IS:210.

The Hand wheel shall be of high quality finish to avoid hand abrasions. Movement shall also be easy. The spindle shall be non rising type.

2.2.8.5. FLAP TYPE - NON-RETURN VALVE

Non-Return valves shall be cast iron double flanged with cast iron body and gun metal/ S.S. internal parts conforming to IS:5312.

2.2.8.6. PRESSURE RELIEF VALVE

Each System shall be provided with a Pressure Relief Valves. The Valve shall be spring actuated and set to operate as per field requirement. The Valve shall be constructed of bronze and provided with an open discharge orifice for releasing the water. The Valve shall be open lift type.

2.2.9. PRESSURE SWITCH

The pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by line pressure. The Pressure Switch shall be diaphragm type. The housing shall be die cast aluminium, with SS 316 movement, pressure element and socket. The set pressure shall be adjustable.

The Switch shall be suitable for consistent and repeated operations without change in values. It shall be provided with IP:55 water and environment protection.

2.2.10. PRESSURE GAUGE

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves and near each flow switch assembly of the sprinkler system. Pressure gauge shall be 50 mm dia gunmetal bourdon type with gunmetal isolation ball valve, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate height for easy readability.

2.2.11. PAINTING

All Hydrant and Sprinkler pipes shall be painted with post office red colour paint. All M S pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc.

Painting shall be expertly applied, the paint shall not over run on surfaces not requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

2.2.12. EXCAVATION

Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried with a minimum cover of 1 meter or as shown on drawings.

Wherever required Contractor shall support all trenches or adjoining structures with adequate timber supports, shoring and strutting.

On completion of testing in the presence of the Project Manager and pipe protection, trenches shall be backfilled in 150 mm layers and consolidated.

Contractor shall dispose off all surplus earth as directed by the Project Manager.

2.2.13. ANCHOR / THRUST BLOCK

Contractor shall provide suitably designed anchor blocks in cement concrete/steel support to cater to the excess thrust due to work hammer and high pressure

Thrust blocks shall be provided at all bends, tees and such other location as determined by the Project Manager.

Exact location, design, size and mix of the concrete blocks/steel support shall be as shown on the drawings or as directed by the Project Manager prior to execution of work.

2.2.14. FIRE HYDRANTS

2.2.14.1. EXTERNAL HYDRANTS

- a. Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron sluice valve. Hydrants shall have instantaneous type 63mm dia outlets. The hydrants shall be double outlet conforming to IS:908 with CI duck foot bend and flanged riser or required height to bring the hydrant to correct level above ground.
- b. Contractor shall provide for each external fire hydrant two numbers of 63mm dia. 15 m long controlled percolation hose pipe with gunmetal male and female instantaneous type couplings machine wound with GI wire (hose to IS:636 type certification) , gunmetal branch pipe with nozzle to IS:903. This shall be measured and paid for separately.
- c. Each external hydrant hose cabinet shall be provided with a drain in the bottom plate.
- d. Each external hydrant hose cabinet containing items as above shall also be provided with a nozzle spanner and a Fireman's Axe. This shall be measured and paid for separately.
- e. Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

2.2.14.2. INTERNAL HYDRANTS

- a. Contractor shall provide on each landing and other locations as shown on the drawings double headed gunmetal landing valve with 100 mm dia inlet as per IS:5290, with shut off valves having cast iron wheels as shown on the drawings. Landing valve shall have flanged inlet and instantaneous type outlets as shown on the drawings.
- b. Instantaneous outlets for fire hydrants shall be standard pattern and suitable for fire hoses.
- c. Contractor shall provide for each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric lined hose pipes with gunmetal male and female instantaneous type coupling machine would with GI wire (hose to IS:636 type 2 and couplings to IS:903 with IS certification), fire hose reel, gunmetal branch pipe with nozzle to IS:903. This shall be measured and paid for separately.
- d. Contractor shall provide standard fire hose reels of 20mm dia high pressure dunlop rubber hose 36 m long with gunmetal nozzle, all mounted on a circular hose reel of heavy duty mild steel construction having cast iron brackets. Hose reel shall be connected directly to the wet riser with an isolating valve. Hose reel shall conform to IS:884 and shall be mounted vertically . This shall be measured and paid for separately.
- e. Each internal hydrant hose cabinet shall be provided with a drain in the bottom plate. The drain point shall be lead away to the nearest general drain.
- f. Each internal hydrant hose cabinet containing items as above shall also be provided with a nozzle spanner and a Fireman's Axe. The cabinet shall be recessed in the wall as directed. This shall be measured and paid for separately.
- g. Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

2.2.14.3. HOSE REEL

Hose reel shall conform to IS : 884, heavy duty, 20 mm dia length shall be 36 metre long fitted with gun metal chromium plated nozzle, mild steel pressed reel drum which can swing upto 170 degree with wall brackets of cast iron finished with red and black enamel complete.

2.2.14.4. FIRE HOSE

All hose pipes shall be of 63 mm diameter RRL/ CP as required, conforming to IS : 636 or IS : 8423. The hose shall be provided with copper alloy delivery coupling. The hose shall be capable of withstanding a bursting pressure of 35.7 Kg/Sq.cm without undue leakage or sweating. Hose shall be provided with instantaneous spring-lock, type couplings.

2.2.14.5. BRANCH PIPE, NOZZLE

Branch pipes shall be of gun metal with loaded tin bronze ring at the discharge and to receive the nozzle and provided at the other with a loaded tin bronze ring to fit into the instantaneous coupling. Nozzle shall be of spray type of diameter of not less than 16 mm and not more than 25 mm. Nozzle shall be of loaded tin bronze branch pipe and nozzle shall be of instantaneous pattern conforming to Indian Standard - 903.

2.2.14.6. HOSE CABINET

Hose cabinet shall be provided for all internal and external fire hydrants. Hose cabinets shall be fabricated from 16 gauge MS/SS (as per SOQ) powder coated sheet of fully welded construction with hinged double front door partially glazed (3 mm glass panel) with locking arrangement, stove enamelled fire red paint (shade No. 536 of IS:5) with "FIRE HOSE" written on it prominently (size as given in the schedule of quantities). Cabinet surfaces in contact with the walls shall not be powder coated but instead given two coats of anti-corrosive bitumastic paint.

2.2.14.7. INTERNAL HOSE CABINET

Hose cabinet shall be of glass fronted with hinged door & lock. The cabinet shall be made of 16 gauge thick MS/SS (as per SOQ) sheet and spray painted to shade No. 536 of IS:5. The hose cabinet shall be of size to accommodate the following:

- i. Landing Valves (Single/double headed)
- ii. Hose pipe (2 or 4 length of 15M)
- iii. Hose reel (36.5 mtr.)
- iv. Branch pipes, nozzles (1/2 sets)
- v. Fire man's axe and hand appliances

2.2.14.8. EXTERNAL HOSE CABINET

The hose cabinet shall be of size to accommodate the following:

- i. Single/Double headed yard hydrant valve
- ii. Hose pipe (2 length of 15 m)
- iii. Branch pipes, nozzles (1/2 sets)
- iv. Fire man's axe

2.2.15. SPRINKLER SYSTEM

2.2.15.1. GENERAL SPECIFICATION

The scope of work shall include supply, commissioning, testing of the system as a whole. The sprinkler heads are to be fixed into heavy quality black steel pipes, conforming to IS 1239 or any other approved specification. The size of pipe will vary from 20 mm to 150mm to suit the hydraulics of the system. The System shall conform to CFO Rules for the installation of sprinkler systems in general for 'Ordinary Hazard' category-in respect of design, density and spacing of sprinkler heads. Reduction in pipe sizes shall not be made by use of bushings. All piping shall be done by means of welding, screwed & flanged jointing as per codes.

Due care shall be taken that sprinklers are not applied with paint at the time of applying paint to piping and fittings.

All control, drain, test and alarm valves shall be provided with signs to identify their purposes, functions, direction of flow the satisfaction of the Consultants.

2.2.15.2. QUARTZOID BULB AUTOMATIC SPRINKLER

Sprinkler heads shall be made of brass/quartzoid bulb sufficiently strong, in compression to withstand any pressure, surge or hammer likely to occur in the system. The yoke & body shall be made of high quality gun metal brass with arms streamlined to ensure minimum interference with the spread of water. The deflector of suitable design shall be fitted to give even distribution of water over the area commanded by the sprinkler.

The bulb shall contain a liquid having a freezing point below any natural climatic figure and a high coefficient of expansion. The temperature rating of the sprinkler shall be stamped on the deflector & the colour of the liquid filled in the bulb shall be according to the temperature rating as per HFWA standard. The sprinkler heads shall be of type & quality approved by the local fire brigade authority. The inlet shall be screwed.

The sprinklers shall have 15mm nominal size of the orifice for ordinary hazard.

The orifice size shall be marked on the body or the deflector of the sprinkler.

Metal guards for protection of sprinkler against accidental or mechanical damage shall be provided as desired by the Project Manager.

Contractor shall submit detailed submittal and discharge spray pattern for the Sprinkler for the approval of consultant.

2.2.15.2.1. OPERATING TEMPERATURE

The Operating temperature at which the quartzoid bulb of the sprinkler head shall actuate, shall be 68 degree C or as specifically mentioned.

2.2.15.2.2. SPRINKLER INSTALLATION

Sprinkler heads shall be located in positions shown on the drawings. While slight relocation may result from building construction features or interference from other services, the maximum spacing between sprinkler heads and coverage area shall not exceed those stipulated in the TAC regulations and the NFPA 13-1994 Rules.

Allowance shall be made for such relocations within a radius of 1500 mm of the indicated positions without additional cost. The Fire Protection Services Trade shall co-ordinate with the ceiling Trade to set out the sprinkler locations to suit the site location of the unit grid. In general, all sprinklers shall be located at the centre of the ceiling unit and a provision of about 10% more sprinklers and pipe work than required in TAC and NFPA Rules shall be included in this sub-contract. Chrome plated wire mesh guards shall be used to protect the sprinkler heads which are liable to accidental or mechanical (at no extra cost) damage.

2.2.15.3. FLOW REQUIREMENTS

The flow requirement for sprinkler heads shall be specifically approved for the designated area of installation.

2.2.15.4. ORIFICE PLATES

For restricting pressure at lower levels in the sprinkler system, orifice plates of appropriate sizes shall be fitted at different floor levels, at the branching points from Riser Main.

The Diameter of such orifice shall not be less than 50% of the dia of pipe into which it is to be fitted, which shall not be less than 50mm dia. These orifice plates must be of stainless steel with plain central hole without burrs, and the thickness shall be 3mm for pipe size upto 80 mm, 6 mm for pipes from 80 to 125 mm dia and 9 mm for pipes greater than 125 mm dia. Such orifice plate must have a projecting identification tag.

The orifice plate shall fitted not less than two pipe internal diameters down stream of the outlet from any elbow or brand.

Contractor shall submit the design and identify location on drawing before installation.

2.2.15.5. INSTALLATION CONTROL VALVES

Each installation shall be provided with a set of installation control valves comprising:-

- a. An Alarm Valve.
- b. A Water Motor Alarm & Gong.
- c. Installation valves shall be installed on the sprinkler circuits as shown on the drawings.
- d. Contractor shall submit detailed shop drawings showing the exact location, details of installation of the valves/alarm in all respects.
- e. Installation valve shall comprise of a cast iron body with gunmetal trim, and double seated clapper check valves, pressure gauges, test valve and orifice assembly and drain valve with pressure gauges, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system. A cast iron isolation valve with lock and chain at the inlet of the installation valve shall be provided.

2.2.15.6. INSPECTION AND TEST VALVE ASSEMBLY

Inspection and testing of the automatic starting of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pass valve and orifice assembly as per approved drawing.

2.2.15.7. FLOW SWITCH

Flow switch shall have a paddle made of flexible and sturdy material of the width to fit within the pipe bore. The terminal box shall be mounted over the paddle/ pipe through a connecting socket. The Switch shall be potential free in either N O or N C position as required. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Annunciation Panel. The flow switch shall have connections for wiring the seat shall be of S.S to the Annunciation Panel. The flow switch shall have IP: 55 protection. The flow switch work at a triggering threshold bandwidth (flow rate) of 4 to 10 GPM. Further, it shall have a 'Retard' to compensate for line leakage or intermitted flows.

2.2.15.8. THE MAIN STOP VALVE

These shall be of cast iron body of requisite size. When closed, these will shut off supply of water to the installation.

A location plate must be fixed on the outside or an external wall, as near to the main stop valve as possible, bearing the following words on raised letters or other approved type letter.

- i. Sprinkler Stop Valve Inside : The word 'sprinkler stop valve' shall be in letters of at least 35mm and the word "INSIDE" at least 25 mm in height. The words shall be painted white on black back ground.
- ii. All stop valves shall be right handed i.e. they shall be so constructed that in order to shut the valve the spindle shall turn from left to right. There shall be an indicator which will show whether the valve is open or shut.

2.2.15.9. PIPES FOR DRAINAGE:

Sprinkler pipes shall be so installed that the system can be thoroughly drained. As far as possible all pipes shall be arranged to drain to the installation drain valve as shown in the drawing for ordinary hazard system.

In the case of basement & other areas where sprinkler pipe-work is below the installation drain valve & in other trapped points in the system, auxiliary valves of the following sizes shall be provided.

- 20 mm valves for pipes up to 50 mm dia.
- 25 mm valves for 80 mm dia pipe.
- 50 mm valves for pipes larger than 80 mm dia.

2.2.15.10. SYSTEM DESIGN

The entire sprinkler installation shall be designed to make it a hydraulically balanced system. The pressure requirement at typical floors shall be designed between 2.5 bar and 3.5 bar.

2.2.16. HAND HELD FIRE EXTINGUISHERS

2.2.16.1. HAND APPLIANCES

2.2.16.1.1. SCOPE

Work under this section shall consist of furnishing all labour, materials, appliances and equipment necessary and required to install fire extinguishing hand appliances as per relevant specification of various authorities.

Without restricting to the generality of the foregoing, the work shall consists of the following:

Installation of fully charged and tested fire extinguishing hand appliances of A B C powder type as required and specified in the drawings and schedule of rates.

2.2.16.2. GENERAL REQUIREMENTS

Hand appliances shall be installed in easily accessible locations with the brackets fixed to the wall by suitable anchor fasteners.

Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations. Distribution / installation of fire extinguisher to be in accordance to IS:2190.

2.2.16.3. MEASUREMENT

Fire extinguishers shall be counted in numbers and include installation of all necessary items required as given in the specifications.

2.2.16.4. ABC TYPE DRY POWDER EXTINGUISHER

The Extinguisher shall be filled with ABC grade 40, Mono Ammonium Phosphate 40% from any approved manufacturer.

The capacity of the extinguisher when filled with Dry Chemical Powder (First filling) as per IS 4308, Part II, shall be 5 Kg +/-2% or 10 Kg +/- 3%.

The distribution of fire extinguishers to be as per IS 2190 – 1992.

It shall be operated upright, with a squeeze grip valve to control discharge. The plunger neck shall have a safety clip, fitted with a pin, to prevent accidental discharge. It shall be pressurised with Dry Nitrogen, as expellant. The Nitrogen to be charged at a pressure of 15 Kg/cm²

Body shall be of mild steel conforming to relevant IS Standards. The neck ring shall be also mild steel and welded to the body. The discharge valve body, shall be forged brass or leaded bronze, while the spindle, spring and siphon tube shall be of brass. The nozzle shall be of brass, while the hose shall be braided nylon. The body shall be cylindrical in shape, with the dish and dome welded to it. Sufficient space for Nitrogen gas shall be provided inside the body, above the powder filling.

The Neck Ring shall be externally threaded - the threading portion being 1.6 cm. The filler opening in the neck ring shall not less than 50 mm. Discharge nozzle shall be screwed to the hose. The design of the nozzle shall meet the performance requirement, so as to discharge at least 85% of contents up to a throw of 4 mtrs, continuously, at least for 15 seconds. The hose, forming part of discharge nozzle, shall be 500 mm long, with 10 mm dia internally for 5 Kg capacity and 12 mm for 10 Kg capacity. It shall have a pressure gauge fitted to the valve assembly or the cylinder to indicate pressure available inside. The extinguisher shall be treated with anti-corrosive paint, and it shall be labelled with words ABC 2.5 cm long, within a triangle of 5 cm on each face. The extinguisher body and valve assembly shall withstand internal pressure of 30 Kg/cm² for a minimum period of 2 minutes. The pressure gauge shall be imported and suited for the purpose.

2.2.16.5. WATER TYPE EXTINGUISHER (Gas Pressure Type)

The Extinguishing medium shall be primarily water stored under normal pressure, the discharge being affected by release of Carbon Dioxide Gas from a 120 gms cylinder.

The capacity of Extinguisher, when filled upto the indicated level, shall be 9 ltr +/- 5%

The skin thickness of the Cylinder shall be minimum 4.0 mm, fabricated from Mild Steel sheet, welded as required, with dish and dome, being of same thickness, and of size not exceeding the diameter of body. The diameter of body to be not less than 150 mm and not exceeding 200 mm. The neck shall be externally threaded upto a minimum depth of 16 mm, and leaded tin bronze.

The cap shall be of leaded tin bronze, and screwed on the body upto a minimum of 1.6 cm depth, with parallel screw thread to match the neck ring. The siphon tube to be of brass or G.I. and the strainer of Brass. The cartridge holder, knob, discharge fittings and plunger to be of Brass/Leaded tin bronze, and plunger of stainless steel, spring of stainless steel. The cap to have handle fixed to it. The discharge hose shall be braided nylon, of 10 mm dia and 600 mm long, with a nozzle of brass fitted at end.

The extinguisher shall be treated for anti-corrosion internally and externally, and externally painted with Fire Red paint. The paint shall be stove enamelled/powder coated. The cartridge shall be as per IS, and have 60 gm net carbon dioxide gas for expelling. The extinguisher, body and cap shall be treated to an internal hydraulic pressure of 25 Kg/cm². It shall have external marking with letter A, of 2.5 cm height, in block letters within a triangle of 5 cm each side. The extinguisher shall be upright in operation, with the body placed on ground and discharge tube with nozzle held in one hand to give a throw of not less than 6 mtr, and continue so for atleast 60 secs. The extinguisher body shall be clearly marked with ISI stamp (IS 940).

2.2.16.6. CARBON DIOXIDE EXTINGUISHER

The Carbon Dioxide Extinguisher shall be as per IS: 2878

The body shall be constructed of seamless tube conforming to IS:7285 and having a convex dome and flat base. Its dia shall be maximum 140 mm, and the overall height shall not exceed 720 mm.

The discharge mechanism shall be through a control valve conforming to IS:3224. The internal syphon tube shall be of copper aluminium conforming to relevant specifications.

Hose Pipe shall be high pressure braided Rubber hose with a minimum burst pressure of 140 Kg/cm² and shall be approximately 1.0 meter in length having internal dia of 10 mm. The discharge horn shall be of high quality unbreakable plastic with gradually expanding shape, to convert liquid carbon dioxide into gas form. The hand grip of Discharge horn shall be insulated with Rubber of appropriate thickness.

The gas shall be conforming to IS:307 and shall be stored at about 85 Kg/cm². The expansion ratio between stored liquid carbon dioxide to expanded gas shall be 1:9 times and the total discharge time (effective) shall be minimum 10 secs and maximum 25 secs.

The extinguisher shall fulfill the following test pressures:

Cylinder: 236 Kg/cm²

Control Valve: 125 Kg/cm²

Burst Pressure of Hose: 140 Kg/cm² minimum

It shall be an Upright type. The cylinder, including the control valve and high pressure Discharge Hose must comply with relevant Statutory Regulations, and be approved by Chief Controller of Explosives, Nagpur and also bear IS marking.

The Extinguisher including components shall be IS marked.

2.2.17. FIRE PUMPS AND ALLIED EQUIPMENTS

2.2.17.1. SCOPE

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically operated and diesel driven pumps and as required by drawings and specified hereinafter or given in the schedule of rates.

- a. Electrically operated pumps with motors and diesel engine driven pumps with diesel engine, common base plates, coupling, coupling guard and accessories.
- b. Automatic starting system with all accessories, wiring and connections and pressure switches.
- c. Motor control centre.
- d. Annunciation system with all accessories wiring and connections.
- e. Pressure gauges with isolation valves and piping, bleed and block valves.
- f. Suction strainers and accessories.
- g. Vibration eliminator pads and foundation bolts.
- h. Leak-off drain shall be led to the nearest floor drain.

2.2.17.2. GENERAL REQUIREMENTS

Pumps shall be installed true to levels on suitable concrete foundations. Base plate shall be firmly fixed by properly grouted foundation bolts.

Pumps and motors shall be truly aligned by suitably instruments. Record of such alignment shall be furnished to the Project Manager.

All pump connections shall be standard flanged type with number of bolts as per relevant standard requirement for the working pressure. Companion flanges shall be provided with the pumps.

Manufacturers' instructions regarding installation, connections and commissioning shall be strictly followed.

Contractor shall provide necessary test certificates, type test certificates, performance curves and NPSH curves of the pumps from the manufacturer when called for. The contractor shall provide facilities to the Project Manager & Consultant for inspection of equipment during manufacturing and also to witness various tests at the manufacturer's works without any cost to the Project Manager or Consultant.

Seismic isolation and clamping for each pump and flexible connection on the suction as well as the discharge side shall be provided.

The contractor shall submit with this tender a list of recommended spare parts for three years of normal operation and quote the prices for the same as a separate submittal / annexure.

2.2.17.3. ELECTRIC FIRE PUMP

GENERAL

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 Hz. A.C. system. Both the motor and the pump shall be assembled on a common base plate, fabricated M.S. channel type or cast iron type. The fire pump efficiency shall be in acceptable range of 65 – 70%.

DRIVE

The pump shall be direct driven by means of a flexible coupling. Coupling guard shall also be provided.

2.2.17.4. FIRE PUMP

The fire pump shall be horizontally mounted single/ multistage, single/ multioutlet centrifugal type. It shall have a capacity to deliver 2850 lpm as specified, and developing adequate head so as to ensure a minimum pressure of 3.5 Kg/Sq.cm at the highest and the farthest outlet.

The pump shall be capable of giving a discharge of not less than 150 per cent of the rated discharge, at a head of not less than 65 per cent of the rated head. The shut off head shall be within 120 per cent of the rated head.

The pump casing shall be of cast iron to grade FG 200 to IS: 210 and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be of stainless steel. Provision of mechanical seal shall also be made.

Bearings of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water. The pump shall be provided with a plate indicating the suction lift, delivery head, discharge, speed and number of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

Provision of Jockey Pump for low and high zone shall be made. The pump shall be vertical SS type and of detail as in schedule of quantity. Contractor shall verify that the capacity of the Jockey pump shall not be less than 3% (Minimum 180 LPM) and not more than 10% of the installed pump capacity.

MOTOR

The motor shall be squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz. system. The motor shall be totally enclosed fan cooled type conforming to protection clause IP 55. The class of insulation shall be F. The synchronous speed shall be 1500/ 2900 RPM as specified. The motor shall be rated for continuous duty and shall have a horse power rating necessary to drive the pump at 150 per cent of its rated discharge with at least 65 per cent rated head. The motor shall conform to I.S.325-1978.

MOTOR STARTER

The motor starter shall be as per detail in MCC. The unit shall include suitable current transformer and ammeter of suitable range on one line to indicate the current. The starter shall not incorporate under voltage, no voltage trip overload or SPP.

The starter assembly shall be suitably integrated in the power and control panel for the wet riser system & sprinkler system.

2.2.17.5. DIESEL FIRE PUMP GENERAL

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on wet battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common base plate.

DRIVE

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided. The speed shall be 1500 RPM as specified.

FIRE PUMP

The fire pump shall be horizontally mounted centrifugal single/ multi stage, single/ multi outlet. It shall have a capacity to deliver as specified, and developing adequate head so as to ensure a minimum pressure of 3.5 Kg/Sq.cm at the highest and the farthest outlet. The pump shall be single/ multi stage as specified. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head.

The pump casing shall be of cast iron to grade FG 200 to IS 210 and parts like impeller, shaft sleeves, wearing-ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be stainless steel. Provision of mechanical seal shall also be made.

The pump casing shall be designed to withstand 1.5 times the working pressure.

Bearing of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

DIESEL ENGINE

Engine Rating - The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater, plugs etc.). The engine shall be multi cylinder/vertical 4 stroke cycle, aircooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump. Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and the after correction for altitude, ambient temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum HP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of rated head. The engine shall be capable of continuous non-stop operation for 8 hours and major overhaul shall not be required before 3000 hours of operation. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run. The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002, all amended up to date.

a. Engine Accessories - The engine shall be complete with the following accessories:-

Fly wheel dynamically balanced.

Direct coupling for pump and coupling guard.

Corrosion Resistor.

Air cleaner.

Fuel service tank support, and fuel oil filter with necessary pipe work.

Elect. starting battery (2X24 v).

Exhaust silencer with necessary pipe work.

Governor.

Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual starting).

Necessary safety controls.

b. Fuel System - The fuel shall be gravity fed from the engine fuel tank to the engine driven fuel pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself or suitably wall mounted on bracket. The fuel filter shall be suitably located to permit easy servicing.

All fuel tubing to the engine shall be with copper, with flexible hose connections where required. Plastic tubing shall not be permitted.

The fuel tank shall be of welded steel construction (3 mm. thick) and of capacity sufficient to allow the engine to run on full load for at least 4 hours. The tank shall be complete with necessary wall mounted supports, level indicator (protected against mechanical injury) inlet, outlet, overflow connections and drain plug and piping to the engine fuel tank. The outlet shall be so located as to avoid entry of any sediments into the fuel line to the engine.

As semi rotary hand pump for filling the daily service tank together with hose pipe 5 mtr. long with a foot valve etc. shall also form part of the scope of supply.

c. Lubricating Oil System- Forced feed Lub. Oil system shall be employed for positive lubrication. Necessary Lub. oil filters shall be provided, located suitably for convenient servicing.

d. Starting System- The starting system shall comprise necessary batteries (2x24v), 24 volts starter motor of adequate capacity and axle type gear to match with the toothed ring on the fly wheel. Bi metallic relay protection to protect starting motor from excessively long cranking runs suitably integrated with engine protection system shall be included within the scope of the work.

The capacity of the battery shall be suitable for meeting the needs of the starting system.

The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression.

The scope shall cover all cabling, terminals, initial charging etc.

e. Exhaust System - The exhaust system shall be complete with silencer suitable for outdoor installation and silencer piping including bends and accessories needed for a run of 15 metre from the engine manifold.(Adjustment rates for extra lengths shall also be given). The total back pressure shall not exceed the engine manufacture's recommendation. The exhaust piping shall be suitably supported.

f. Engine shut down mechanism- This shall be auto/ manually operated and shall return automatically to the starting position after use.

g. Governing System- The engine shall be provided with an adjustable governor to control the engine speed within 5% of its rated speed under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.

h. Engine Instrumentation- Engine instrumentation shall include the following:-

- i. Lub. oil pressure gauge.
- ii. Lub. oil temperature gauge.
- iii. Water pressure gauge.
- iv. Water temperature gauge.
- v. Tachometer.
- vi. Hour meter.

The instrumentation panel shall be suitably resident mounted on the engine.

Engine Protection Devices- Following engine protection and automatic shut down facilities shall be provided:-

- i. Low lub.oil pressure.
- ii. High cooling water temp.
- iii. High lub.oil temperature.
- iv. Over speed shut down.
- i. Pipe Work - All pipe lines with fittings and accessories required shall be provided for fuel oil, lub.oil and exhaust systems, copper piping of adequate sizes, shall be used for Lub.oil and fuel oil. M.S. piping will be permitted for exhaust.
- j. Anti Vibration Mounting- Suitable vibration mounting duly approved by Project Manager shall be employed for mounting the unit so as to minimise transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated.
- k. Battery Charger-Necessary float and boost charger shall be incorporated in the control section of the power and control panel, to keep the battery in trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.

2.2.17.6. PUMP SETS ASSEMBLY

On the main fire sprinkler and hydrant headers near pump sets a 150 mm dia by-pass valve located in an accessible location shall be provided along with a rate of flow rota meter calibrated in 1 pm and able to read 200% of the rated pump capacity. The delivery shall be connected to the fire tank.

Each and every pump set assembly shall be provided with suction valve (only for positive suction head), discharge valve, non-return valve and 150 mm dia Bourdon type pressure gauge with isolation valve.

2.2.17.7. FLEXIBLE CONNECTORS

On all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors shall be provided. Connectors should be suitable for maximum working pressure of each pipe line on which it is mounted and tested to a test pressure of 1:5 time the operating pressure. Length of the connector shall be as per manufacturers standard.

2.2.17.8. INTERLOCKING

The following inter-locking between the two main fire pumps (i.e. wet riser pump & sprinkler pump), the jockey pump and the diesel engine driven pump.

Only one category of pumps will work at a time i.e. either jockey pump or main fire pumps (wet riser and sprinkler, both the wet riser and sprinkler can come up at a time) or diesel driven pump.

SR.NO.	JOCKEY PUMP	WER PUMP	RISER	SPRINKLER PUMP	DIESEL PUMP	DRIVEN
i.	ON	OFF		OFF	OFF	
ii.	OFF	ON		OFF	OFF	
iii.	OFF	OFF		ON	OFF	
iv.	OFF	ON		ON	OFF	
v.	OFF	OFF		ON	ON	
vi.	OFF	OFF		OFF	ON	
vii.	OFF	ON		OFF	ON	

17.9. ANNUNCIATION PANEL

One solid state electronic annunciation panel, fully wired with visual display and audible alarm unit shall be provided to indicate :

- a. Flow condition in any flow switch indicating the area of distress and fire alarm.
- b. Starting and stopping of each hydrant pump.
- c. Starting and stopping of each jockey pump.
- d. Starting and stopping of each sprinkler pump.
- e. Failure of Hydrant / Sprinkler pump to start.
- f. High level in fire water storage tank compartment.
- g. Low level in fire water storage tank compartment.
- h. Low level in HSD day tank of the fire pump.

The panel shall be factory fabricated, wired and tested. All details shall be submitted with the tender.

The annunciation panel shall be located in the security office / reception on the ground floor or as instructed by the Project Manager.

17.10. VIBRATION ISOLATION

The pumpset shall be mounted on rolled steel channels and 150 mm thick inertia block spring and ribbed neoprene vibration isolation mounting shall support the inertia block onto a 100 mm thick concrete plinths. The spring mountings shall have a maximum deflection of 15 mm. Reference shall be made to the section on "Noise and Vibration" for further technical requirements.

2.2.18. AUTOMATIC FIRE DETECTION AND SUPPRESSION SYSTEM WITH LINEAR PNEUMATIC HEAT DETECTION TUBE:

2.2.18.1. SCOPE:

The scope covers Supply, Installation, Testing and Commissioning of Automatic Clean Agent Flooding System complete for electrical panels with fire trace tube, cylinder, valves, integration with Main Fire Alarm Control Panel for status monitoring etc. The work to be executed by authorized & certified Fire Trace installer shall cover:

- i. Providing Direct Panel Gas Flooding System with linear Fire trace tube inside the panels.
- ii. Arrangement of Clean Gas Agent for flooding inside the panels.
- iii. Audio-visual annunciation devices for indicating incidence of fire.
- iv. Any other item required to the successful commissioning of the system.

The electrical panel fire suppression system shall be complete with Direct Clean Gas storage cylinders for required capacities, extinguishing agent as specified, linear fire trace tubing, filling and end-of-line adaptors, pressure switches, control equipment and all necessary accessories and push in fittings to form a complete and working installation to protect the Electrical panel in case of fire.

The panels to be protected shall be determined as per the approval of the Engineer-In-Charge.

The system will have an interface with Main Fire Alarm and Control Panel. In case of fire in the concerned Panel, indication of Fire Trace discharge status should come in Main Fire Alarm and Control Panel.

2.2.18.2. REGULATORY REQUIREMENTS:

All the detecting devices, alarm, indicating devices, containers and other related equipment shall be UL Listed and/or FM approved and/or LPCB approved.

All installations shall conform to NFPA requirements.

Clean Agent used should be HFC-227 ea (FM-200)/NOVEC-1230.

2.2.18.3. SYSTEM DESCRIPTION:

The Clean Agent Pre-Engineered automatic direct fire suppression system shall be approved by Underwriters Laboratories/Factory Mutual/LPCB.

Each clean agent pre-engineered automatic system is equipped with its own detection/discharge Fire trace tubing. The pre-engineered concept minimizes the amount of engineering involved in system design. When the detection/Discharge tubing is installed within the limitations stated in the manufacturer manual, no hydraulic calculations are required to determine the pressure drop, agent flow or discharge time.

Each Clean Agent extinguishing unit, when installed, is a self-contained system, meaning that it is equipped with its own automatic (non-electric) detection system, which when actuated, automatically releases the suppression agent into the Electric panel.

The Clean Agent Automatic Direct System consists of the following major components:

- Clean Agent Cylinder/Valve Assembly.
- Cylinder Mounting Bracket.
- Firetrace Detector, Actuation and Discharge Fire trace Tubing and Fittings (No Substitute).
- Pressure Switch

The Clean Agent Automatic Direct System utilizes unique Firetrace flexible tubing that is attached to the top of the cylinder valve. This Fire trace tubing is pressurized with dry nitrogen, is temperature sensitive and acts as a continuous linear thermal detector that ruptures upon Flame impingement. Once the detector tubing is ruptured forming a nozzle at the rupture point, it allows the Clean Agent to flow through, distributing the extinguishing agent into the protected area. Upon system actuation, the pressure switch can be used to indicate system discharge, shutdown ventilation, shut-off electrical power etc may be required.

The Clean Agent Automatic Direct System is designed and listed as an Automatic unit. No manual or electric means is provided for simultaneous actuation of multiple systems. Only one (1) unit can be used to protect one hazard. These extinguishing units cannot be combined to protect a larger size hazard, since they are not designed to provide for simultaneous actuation of two or more units.

The Clean Agent is stored in DOT steel cylinders as a liquefied compressed gas, super-pressurized with Dry Nitrogen to 150 psig at 70oF. The ambient operating temperature range for all system components is: +32oF (0oC to 54.4oC).

Each container is equipped with a nickel-plated brass valve, a pressure gauge to monitor container pressure, and a quarter-turn ball valve that interfaces with the Detection Tubing. The ball valve must be kept closed at all times when the container is not in service. In addition, the container valve is equipped with a pressure relief (rupture disc) device in compliance with DOT requirements.

A wall-mounted painted steel bracket is used to mount the container/valve assembly in a vertical (upright) position. Each bracket is equipped with two integral quick-clamp straps.

For the direct Clean Agent systems, the tubing performs three functions: Heat Detection, System Activation, and Clean Agent discharge. The tubing is installed throughout the Electrical Panel volume, with one end connected to the top of the Clean Agent container valve. The tubing is pressurized with Dry Nitrogen to 150 psig and maintains the system in the "OFF" position. An optional pressure gauge or pressure switch can be connected to the other end of the detector/discharge tube to monitor system pressure and/or signal of system actuation, etc. The detector/discharge tubing is heat sensitive and in a fire situation is designed to rupture at any point upon flame impingement. The rupture of the tube results in a formation of a discharge nozzle that will perform a complete discharge of the Clean Agent. Location and spacing of the tubing should be placed above the hazard areas being protected.

A pressure switch is connected at the end of line of the Detection Tubing to monitor system pressure, system actuation or to energize/de energize electrically operated equipment. Manufacturer

recommends that all systems use a pressure switch coupled with some other devices to alert personnel in the event of a system discharge.

2.2.18.4. DESIGN REQUIREMENTS:

Provide sufficient amount of Clean Agent HFC-227ea (FM-200/FE-227)/Novec-1230 liquid to convert into Clean Agent HFC-227ea (FM-200/FE-227) vapor or Novec-1230. Considering the following when computing volume to verify suitability and to establish design limitations:

- Volume of hazard area.
- Specific volume of Clean Agent.
- Discharge time and flow rates.
- Design concentration and design factors.
- Detector/discharge tubing placement.

Locate Clean Agent supply near each hazard area.

Interface system with main control fire alarm system and BMS (if required).

Provide total flooding of 7 percent Clean Agent concentration by volume as per NFPA-2001.

The pre-engineered automatic system concept minimizes the amount of engineering required when evaluation is design for a specific application.

No calculations are required for pressure drop, flow rates or discharge time as long as the discharge/detection tubing is installed within the limits as specified by this manufacturer.

When the additional limitations of hazard volume, area coverage, maximum height, design concentration, agent quantity, detection tubing arrangement etc are also met, the system installation shall be understood to comply with the design requirements, NFPA-2001, and FMRC approval.

Therefore, no discharge tests or concentration measurements shall be required.

All doors and holes in the enclosed/equipment should be closed or sealed to maintain the tightness of enclosure.

The system should have means to close the exhaust fans if installed in the panel at the time of system activation.

As desired by the Engineer-In-Charge the main supply of panel can be shut off with the system.

SECTION-08 :: ELECTRICAL INSTALLATION

1. SCOPE

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of Motor Control Centre (MCC), wiring and earthing of all air-conditioning equipment, components and accessories.

2. GENERAL

Work shall be carried out in accordance with the accompanying specifications and shall comply with the latest relevant Indian Standards and Electricity Rules and Regulations.

All motor control centres shall be CPRI approved and shall be suitable for operation on 3 phase/single phase 415/230 volts, 50 cycles power supply system.

3. CONSTRUCTIONAL FEATURES

The Motor Control Centre (MCC) electrical panels shall be sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be 3b construction. The control panel shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors with Neoprene gasket. Control panel shall be suitable for the climatic conditions as specified in Specifications. Steel sheets used in the construction of Control panel shall be 2 mm thick and 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 shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall conform to relevant BIS Codes.

All panels and covers shall be properly fitted and 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 wing nuts. Self threading screws shall not be used in the construction of Control panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum clearance of 275 mm shall be provided between the floor of control panel and the lowest unit.

The control panel shall be of adequate size with a provision of 25% spare space to accommodate possible future breakers. Breakers shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Motor Control Centre in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal name plates. All panels shall be provided with circuit diagram mounted on inside of door shutter protected with Hylam sheet. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

4. WIRING SYSTEM

All L T power cabling between MCC and motors shall be carried out with 1100 volts grade PVC insulated, overall PVC sheathed aluminium conductor armoured cables, Cables shall be sized by applying proper derating factor. All control wiring shall be carried out by using PVC insulated copper conductor wires in conduits. Minimum size of control wiring shall be 1.5 sq mm. Minimum size of conductor for power wiring shall be 4 sq. mm 1100 volts grade PVC insulated copper conductor wires in conduit.

5. CIRCUIT COMPARTMENT

Each circuit breaker, contactor and relay shall be housed in a separate compartment and shall have steel sheets on top and bottom of compartment. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the "ON" position. Safety interlocks shall be provided to prevent the breaker from being drawn-out when the breaker is in 'ON' position. The door shall not form an integral part of the draw-out portion of the panel. Sheet steel barriers shall be provided between the tiers in a vertical section.

6. INSTRUMENT ACCOMMODATION

Adequate space shall be provided for accommodating instruments, indicating lamps, control contactors and control MCBs. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker and bus bar 'ON' lamps shall be provided on all outgoing feeders.

7. BUS BAR CONNECTIONS

Bus bar and interconnections shall be of high conductivity electrolytic aluminium complying with requirement of grade E91E of IS:5082-1981 and shall be of rectangular cross section suitable for carrying the rated full load current and short circuit current without overheating of phase and neutral bus bar and shall be extendable on either side. Bus bar and interconnections shall be insulated with heat shrinkable sleeve and shall be colour coded and shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bar shall be provided in a separate chamber and all connections

shall be done by bolting. Additional cross sectional area shall be added to the bus bar to compensate for the holes. All connections between bus bar and breaker shall be through solid aluminium strips of proper size to carry full rated current as per approved for construction shop drawing and insulated with insulating sleeves. Bus bar shall be rated for current density of 1.0 amps/mm² cross section area.

8. TEMPERATURE - RISE LIMIT

Unless otherwise specified, in the case of external surface of enclosures of bus bar trunking system which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per relevant IS Codes.

9. CABLE COMPARTMENTS

Cable compartment of adequate size shall be provided in the control panel for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables as per approved for construction shop drawing.

10. MOULDED CASE CIRCUIT BREAKER (MCCB)

All MCCB's shall be motor duty and Current Limiting type, and comprise of Quick Make - break switching mechanism, preferably Double Break Contact system, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCB's shall be capable of defined Variable overload adjustment. All MCCB's rated 200 Amps and above shall have adjustable Magnetic short circuit pick up.

The trip command shall override all other commands. MCCB shall employ maintenance free double break contact system to minimise the let thru' energies and capable of achieving discrimination upto full short circuit capacity of downstream MCCB. The manufacturer shall provide both discrimination tables and let thru energy curves.

The breaking capacity of MCCB's shall be asked for in the schedule of quantities. The breaking capacities specified will be ICU=ICS i.e type-2. Co-ordination as per relevant IS and IEC Codes.

The MCCB's shall be provided with rotary handle operating mechanism. The handle position shall give positive indication of 'ON', 'OFF' or 'Tripped' thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection.

11. MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with relevant IS Codes and shall be quick make and break type for 230/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) 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.

12. PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be as per relevant BIS code.

13. LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel door and covered with transparent plastic sheet.

14. METERS

- i. All voltmeters and indicating lamps shall be through MCB's.
- ii. Meters and indicating instruments shall be plug type.
- iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
- iv. CT ratio and burdens shall be as specified on the Single line diagram.

15. CURRENT TRANSFORMERS

Current transformers shall be provided for Control panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

16. SELECTOR SWITCH

Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

17. STARTERS

Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant IS Codes. All Star Delta and ATS Starters shall be fully automatic.

18. CONTACTOR

Contactor shall be built into a high strength thermoplastic body and shall be provided with an arc shield for quick arc extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.

Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta and Reduced Voltage Starters. The insulation for contactor coils shall be of Class "E".

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 220/415±10% volts AC, 50 cycles AC supply.

19. THERMAL OVERLOAD RELAY

Thermal over load relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing as well as on overloading. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions.

Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual-reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from -5° C to +55°C.

All overload relays shall be of three element, positive acting ambient temperature compensated time lagged thermal over load relays with adjustable setting. Relays shall be directly connected for motors upto 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacity. Heater circuit contactors may not be provided with overload relays.

20. TIME DELAY RELAYS

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

21. INDICATING LAMP AND METERING

All meters and indicating lamps shall be in accordance with IS:1248 and IS-1258. The meters shall be flush mounted type. The indicating lamp shall be of low wattage . Each MCC and control panel shall be provided with voltmeter 0-500 volts with three way and off selector switch, CT operated ammeter of suitable range with three nos. CTS of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 MCB. Other indicating lamps shall be backed up with fuses as called for in Schedule of Quantities.

22. TOGGLE SWITCH

Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS Codes and shall be of 5 amps rating.

23. PUSH BUTTON STATIONS

Push button stations shall be provided for manual starting and stopping of motors / equipment Green and Red colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push Buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

24. CONDUITS

Conduits and Accessories shall conform to relevant Indian Standards. Wall thickness shall be 16 gauge upto 32 mm dia and 14 gauge above 32 mm dia conduit. Screwed G.I. Conduits shall be used. Joints between conduits and accessories shall be securely made, to ensure earth continuity. All conduit accessories shall be threaded type only. All raw metal shall be painted with bitumastic paint.

Only approved make of conduits and accessories shall be used.

Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

Maximum permissible number of 650/1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or GI Conduits are given below :

Size of wires Nominal Cross section Area (Sq. mm.)	Maximum number of wires within conduit size(mm)				
	20	25	32	40	50
1.5	5	10	14	--	--
2.5	5	8	12	--	--
4	3	7	10	--	--
6	2	5	8	--	--

10	--	3	5	6	--
16	--	2	3	--	6
25	--	--	2	4	6
35	--	--	--	3	5

CABLES

M.V. Cables shall be PVC insulated aluminium conductor and armoured cables conforming to IS Codes. Cables shall be armoured and suitable for laying in trenches, ducts, and on cable trays as required. M.V. Cables shall be termite resistant. Cable glands shall be double compression glands. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armoured cables.

25. CABLE LAYING

Cable shall be laid in accordance with IS code of Practice. Cables shall be laid on 14 gage factory fabricated perforated galvanized sheet steel cable trays, and cable drops / risers shall be fixed to ladder type cable trays factory fabricated out of galvanized steel angle. Access to all cables shall be provided to allow cable withdrawal / replacement in the future. Where more than one cable is running on a cable tray, one dia spacing shall be provided between cables to minimise the loss in current carrying capacity.

Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks/tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable.

26. WIRE AND WIRE SIZES

1100 volts grade PVC insulated copper conductor wires in conduit shall be used.

For all single phase/ 3 phase wiring, 1100 volts grade PVC insulated copper conductor wires shall be used. The equipment inside plant room shall be connected to the control panel by means of insulated copper conductor wires of adequate size in exposed conduits. Final connections to the equipment shall be through wiring enclosed in galvanized flexible conduits rigidly clamped at both ends and at regular intervals. An isolator shall be provided near each motor/equipment wherever the motor/equipment is separated from the supply panel through a partition barrier or through ceiling construction. PVC insulated copper conductor wires shall be used inside the control panel for connecting different components and all the wires inside the control panel shall be neatly dressed and plastic beads shall be provided at both the ends for easy identification of control wiring.

The minimum size of control wiring shall be 1.5 sq. mm PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting Equipment and control panels.

Power wiring, cabling shall be of the following sizes:

i.	Upto 5 HP motors/ 5 KW heaters	3 x 4 sq. mm copper conductor wires.
ii.	From 6 HP to 10 HP motors	3 x 6 sq. mm copper conductor wires 6 KW to 7.5 KW heaters
iii.	From 12.5 HP to 15 HP wires	2 Nos. 3 x 6 sq. mm copper conductor wires
iv.	From 20 HP to 25 HP motors	2 Nos. 3 x 10 sq. mm copper conductor wires

v.	From 30 HP to 35 HP motors	2 nos.3x 16 sq.mm aluminium conductor armoured cable.
vi.	From 40 HP to 50 HP motors	2 Nos. 3x25 sq.mm aluminium conductor armoured cable.
vii.	From 60 HP to 75 HP motors	1 No. 3 x 70 sq. mm aluminium conductor armoured cable.
viii.	100 HP motors conductor	1 No. 3 x 150 sq. mm. aluminium armoured cable
ix.	200 HP motor conductor	2 No. 3 x 150 sq. mm. aluminium armoured cable.

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The following capacity contactors and overload relays shall be provided for different capacity motors or as per manufacturer's recommendation.

TYPE OF STARTER		CONTACTOR OVERLOAD CURRENT RELAY CAPACITY RANGE	
5 HP Motors	D O L	16 amps	6-10 amps
7.5 HP motors	D O L	16 amps	9-15 amps
10 HP Motors	D O L	25 amps	9-15 amps
12.5 HP Motors	Star Delta	16 amps	9-15 amps
15 HP Motors	Star Delta	25 amps	9-15 amps
20 HP Motors	Star Delta	32 amps	14-23 amps
25 HP Motors	Star Delta	32 amps	14-23 amps
200 HP Motors	DOL	325 amps	CT Operated relay

Two speed motors when specified, shall be provided with DOL starter irrespective of its rating.

27. EARTHING

Earthing shall be provided in accordance with relevant BIS Codes and shall be copper strips /wires .The main panel shall be connected to main earthing system of the power supply. All single phase metal clad switches and control panels be earthed with minimum 3 mm diameter copper conductor wire. All 3 phase motors and equipment shall be earthed with 2 numbers distinct and independent copper wires / tapes as follows:

- Motor upto and including 2 Nos. 3 mm dia copper 10 HP rating wires.
- Motor 12.5 HP to 40 HP capacity 2 Nos. 4 mm dia copper wires
- Motor 50 to 75 HP capacity. 2 Nos. 6 mm dia copper
- Motor above 75 HP.2 Nos. 25 mm x 3 mm copper tapes.

All switches shall be earthed with two numbers distinct and independent copper wires' tapes as follows:

- 3 phase switches 2 Nos. 3 mm dia copper and control panels upto wires.60 amps rating.
- 3 phase switches, and 2 Nos. 4 mm dia copper control panels 63 amps to wires. 100 amps rating.

- iii. 3 phase switches and control 2 Nos. 6 mm dia copper panels 125 amps to wires. 200 amps rating.
- iv. 3 phase switches, control 2 Nos. 3 mm x 25 mm panels, bus ducts, above copper tapes. 200 amps rating.

The earthing connections shall be tapped off from the main earthing of electrical installation. The overlapping in earthing strips at joints where required shall be minimum 75 mm. These straight joints shall be riveted with brass rivets & brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance, and properly tinned.

29. DRAWINGS

Shop drawings for control panels and for wiring of equipment showing the route of conduit & cable shall be submitted by the contractor for approval of Architect/Consultant before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

30. TESTING

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS codes and test report furnished by a qualified and authorised person. The entire electrical installation shall be gotten approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Project Manager. Testing of the panels shall be as per relevant BIS Codes :

31. PAINTING

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be baked in an oven. The finishing treatment shall be by application of powder coating of approved shade.

32. MEASUREMENT OF ELECTRICAL CONTROL PANELS

Panels shall be counted as number of units. Quoted rates shall include as lumpsum (NOT measurable lengths) for all internal wiring, power wiring and earthing connections from the control panel to the starter and to the motor, control wiring for interlocking, power and control wiring for automatic and safety controls, and control wiring for remote start/stop as well as indication as per the specifications. The quoted rate of panel shall also include all accessories, switchgear, contactors, indicating meters and lights as per the Specifications and Schedule of Quantities.

33. RUBBER MAT

Rubber mat shall be provided in front to cover the full length of all panels. Where back space is provided for working from the rear of the panel, rubber mat shall also be provided to cover the full length of panel.

2.3 FIRE ALARM & PUBLIC ADDRESS SYSTEM WORKS

2.3.1 TECHNICAL SPECIFICATION FOR FIRE DETECTION AND ALARM SYSTEM

2.3.1.1 GENERAL REQUIREMENTS

The fire detection and alarm system may comprise of Addressable main fire alarm control panels, optical smoke detector, heat detector, manual call points, electronic sounders, and interface units, each with its own short circuit built-in isolators. All loop cabling and any other components and accessories deemed necessary for a safe, reliable and satisfactory system will conform to the relevant and applicable requirements and recommendations with BS EN 54-2 & 4 BS EN 50130-4 LPCB to the requirements of EN54 Parts 2 & 4 or UL approved , NFPA 72 codes and Indian Standard IS 2189.

Contractor will train and instruct client's personnel in the correct use, operation and supervision of the system, prior to the handing over of the project.

The system will be fully programmed, the system will be configured to allow on site modifications with the minimum of disruption. The Panels will be networkable type so that all 3 building will be integrated with same system

2.3.1.2 SYSTEM DESCRIPTION

The fire detection and alarm system will be designed to facilitate accurate identification of the source of heat / smoke / fire in their early stages to minimize occurrences of false alarms due to faulty equipment, electrical transients, system faults etc.

The fire alarm control panels will make final decision on whether a fire or fault exists by comparing the plotted patterns from a fire Detector against known fire and fault patterns held in its memory. System will be true Analogue with the ability to pin point exact location.

All system components and devices will be connected to two-wire loop circuits (as shown in the typical schematics) with each component having its own individual built-in isolator. Removal or disconnection of any component from the loop will not affect the functioning and performance of other components and the system.

System will be of safe addressable type i.e. all the devices on the loops of the FACP will be Allocated addresses automatically from the panel at the time of system power up on a numerically lowest unused value basis (algorithms)

And also given an address during commissioning, the value of which will be stored in non-volatile memory, within the electronics module of the outstation. This value will be read during loop allocation and provided it is valid will be used to setup the outstations primary address.

SAFE Addressing will cover the benefits of Soft Addressing and also overcome the limitations of Hard Addressing. This means that If the devices are inserted or removed all the existing devices will keep the same address.

The panel will allocate the address in strict sequential order when the loop is powered up to speed up commissioning and ensure that it is impossible for two devices to have the same address.

Fire Detection and Alarm Systems, which rely only on soft addressing or hard addressing techniques, are not acceptable.

Facilities will be provided to constantly monitor and check the following circuits and fault conditions:

- The power supply to the loop /s;
- For open-circuit, short-circuit, earth fault and any other fault condition in the loop wiring;
- For communication failure and errors in all cards and loops
- For faults in keyboard and printer circuits
- Monitoring of all devices status every 1.3 minutes to create a table of each 1 analogue channel for event analysis

All devices Optical/Heat Detector, Heat Detector, Optical Smoke /Heat Detector Sounder, Duct and Beam Detectors, Fire Alarm Interface Units, Electronic Sounders, Manual Call Points, etc. will be installed on the same loop. And shall have build in isolators in all outstations

All devices will be assigned a maximum of 32 character alphanumeric label. In case of fire, fault or warning, the label of device sensing threshold will appear on visual display unit of the panel.

Any correction in label will have to be carried out from the built-in keyboard of FACP. Use of separate PC or tools for on-site programming will not be acceptable.

Any event i.e. Fire, fault or warning will be recorded with time, date and place of occurrence in the memory of FACP. These events can either be displayed on VDU or printed, as required.

Provision will be done at the fire alarm control panels to silence the loop powered alarm sounders but the visual indication will remain until the system is reset.

It will be possible to change the sensitivity of analogue Detectors from fire alarm control panel only.

The sensitivity will be varied automatically, if required, by time zoning feature whereby it allows Detectors to be programmed to respond at different sensitivities relative to any time of day, and any day of week.

Facility to introduce / change delay periods in operating loop powered individual sounders / group of sounders /speaker circuits, will be possible to program from FACP without the need to change any hardware.

The main fire alarm control panels will be located as shown on the schematics and the floor drawings.

2.3.1.3 SYSEYEM OF OPERATIONS

In the event of a fire being reported from the smoke/heat Detectors, activation of manual call points or sprinkler operation the sequence of alarm operation will be as follows:

If a fire condition is reported from a smoke or heat detector, Manual Break Glass, or sprinkler flow switch , then the evacuation alarm tone will be done by the electronic sounders in the same zone. Then after a certain delay (to be agreed at the time of commissioning) or after 3 minutes the alarm has not been acknowledged, the evacuation tone from the sounders will activated in the adjacent fire zones. Or on the floor directly above and below. All other floors or zones will be given the Alert tone . The evacuation of the building will be staged in phases to allow orderly movement of people.

Activation of the fire alarm system will directly initiate some or all of the following to be agreed as a part of the overall engineering policy.

- Signal to all elevator machine rooms indicating fire status (to control lifts)
- Release doors normally locked by magnetic devices.
- Release doors normally held open by magnetic devices
- Shutdown mechanical equipment ventilation plant
- Shutdown general exhaust fans
- Start up smoke extract fans /basement ventilations
- Start up exhaust make up fans- NA
- Start up stair vestibule pressurization fans- NA
- Automatically operate fire dampers- NA

Sprinkler valves, flow switches and other monitored valves will be directly supervised by the fire alarm systems to other systems.

2.3.1.4 SYSTEM, COMPONENTS AND DEVICES

MAIN FIRE ALARM Multi-tasking, multi-loop modular type control and indicating panel of SOFT AND SAFE Addressable type will be installed as shown in the drawings. The Fire Alarm Control Panel will comply with BS EN 54-2 & 4 BS EN 50130-4 LPCB to the requirements of EN54 Parts 2 & 4 or UL Approved .

The panel will be computer controlled using analogue technique to detect smoke / heat / fire conditions. The panel will be complete with, but not limited to, the following elements:

- Visual display unit capable of displaying LCD Alphanumeric 40 characters x 8 line display minimum backlit display.
- Built-in full QWERTY keyboard. Labeling of devices will be done from this keyboard. Also, this keyboard if required will do any correction in label and on site programming & maintenance.

- Integral rechargeable sealed lead acid battery and charger, with 24 hour back up in the event of supply mains failure.
- Essential controls - sound alarms, silence alarms and reset fire. These will be enabled by a key switch.
- Cancel fault buzzer
- Fire, fault, warning and power on lamps.
- Simple menu driven function keys with password protection will allow users to an extensive range of software based features such as:
 - Last 100 fire events
 - Last 255 system events
 - Current fault and warning logs.
 - Analysis of analogue Detector information
 - Interrogation of Detector cleanliness
 - Loop map connections
 - Enable/ disable Detectors, zones, sounders, interface unit channels.
 - Fire plan configuration menus
 - Outstation label changes
 - Address allocation
 - Status of outstation
 - Status of all cards
 - Printer on, off, line feed and test facilities.
 - Address allocation including SAFE addressing.
- All control buttons and keyboard will be enclosed behind a lockable cover.
- Up to 200-device capacity per 1km loop.
- RS 232/ RS 485 computer communication option.

2.3.1.5 DETECTORS

All analogue Detectors and bases shall be provided by the manufacturer of the control equipment. The Detector bases for interfacing between the loop wiring and the Detector head shall not contain any electronics. All bases shall have the necessary connections for sending repeat fire signals to a remote LED unit.

The following types of analogue Detectors will be available as standard:

- Heat Detector
- Optical Smoke Detector
- Hooter cum Strobe
- Beam Detector (transmitter and receiver) with 7 programmable sensitivity settings
- Manual call points
- Control relay modules
- Monitor Modules

All of the above shall be compatible with the afore mentioned base providing inter-changeability between Detector heads without the requirement for switch settings. All Detectors will also have an integral short circuit isolator, which in the event of a single cable fault will isolate the faulty section of cable and retain all devices on the loop operationally in less than 1 second.

The sensitivity of all Detectors will be adjustable from the control panel. This may be carried out manually to manage false activation issues or automatically using the system clock i.e. day/night settings for specific risks. It shall be possible to programme Detectors within a range of sensitivity levels from State 0 (high level) through to State 15 (disabled).

Each Detector will possess an integral Red LED giving a flashing indication of a fire signal or a continuous indication for certain fault conditions. The integral LED can also be enabled/disabled to provide operational status i.e. short flashes that indicate the unit is powered and communicating with the control panel. The optical heat Detector with integral CO sensing shall include a further Blue LED providing flashing indication for presence of carbon monoxide making it easier to identify the location of activation.

The CO element shall be incorporated into the optical chamber to sense the presence of carbon monoxide gas emissions from smoldering fires. In normal environments the CO element shall have a life expectancy of a minimum of 5 years. This CO element shall be fault and life monitored and shall be replaceable via a service exchange programmed.

HEAT DETECTORS

Install as shown in the drawings. These will comply with the requirements of BS 5445: Part 5: 1977 and will be LPCB approved. They will be complete with the other elements described for smoke Detectors above, for an analogue safe addressable sensing device.

Detectors mounted in the false ceilings will be provided with a semi flush mounting kits. & it shall have inbuilt short circuit isolator

BEAM DETECTORS

Install as shown in the drawings. The Beam Detectors will be safe addressed, loop powered, loop signaled with built in short circuit isolator and compact and will detect fire by obscuration of an optical beam by smoke. It will utilize a transmitter and receiver unit and be suitable for ranges of up to 100 Mts. It will be used in areas as indicated in the drawings. The traditional false alarm problems associated with the use of beam detection, such as birds, workmen and sunlight will be overcome by the use of True Analogue Detection.

A method of automatic gain control will be employed to minimize the effects of a build up of dust and dirt on the lens. LED's will be provided integral with the transmitter/receiver units to assist in the alignment set-up. The Beam Detectors will be LPCB approved and to BS 5839 Part 5. It should be IP40 rated. & it shall have inbuilt short circuit isolator

Manual Call Points:

The manual call points shall be electrically compatible with all of the aforementioned Detector types. Each device shall contain its own microprocessor giving a 1 second response time from initiation as required within BS5839. The MCP shall be available as a semi-flush mounting unit fixing to a standard single gang recessed box or as surface mounting unit on a matching red plastic back box.

The MCP will have the ability to be tested functionally without the need to remove the front cover or breaking the glass with a special test key (supplied as standard). The key shall insert in the front face of the MCP ensuring easy access of the key at all times. The key will also be used to reset the MCP when fitted with a resettable plastic element. The option to retrofit a clip-on transparent plastic cover to prevent accidental or malicious activation should be available as standard and give the unit an IP55 ingress rating when fitted to the plastic back box.

ALARM SOUNDERS /HOOTERS

Install as shown in the drawings. These will comply with the requirements of BS EN 54-3 BS EN 50130-4 , UL APPROVED . Alarm Sounders are all Electronic sounders Addressable and loop powered and Standard Evacuate & Alert tone with voice messaging Programmable tones selectable by control panel. Programmable tones are selectable by control panel Sounder frequency as defined in BS5839.

Synchronisation of all sounders to be fully synchronised with all other analogue addressable loop powered sounder speech devices on the system.

The safe addressable Alarm Sounders will be loop wired and loop signaled and provided with built-in short circuit isolation and will be sited in the emergency stairwell staff/utility areas and plant rooms. The sounders will be configured via software to operate individually or in sectorised groups, totally independent of the way they have been connected to the loops. The sounders will have the synchronization feature to ensure that all the sounders give alert and evacuate tones that are totally in phase. Conventional Sounders that "free-run" and therefore be out of phase with each other will not be accepted.

The Sounders will have Minimum sound pressure level 103 dBA at 1 metre with frequencies of 970 Hz and 910 Hz. Variety of sounds will be available.

REPEATER PANEL

The Repeat Panel with built-in short circuit isolation will be sited at the indicated locations. It will provide system repeat facilities to repeat all of the liquid crystal display messages as well as the common indications. It will have essential alarm controls, menu facilities and an optional printer allowing it to take the role of the main system indicator for the day to day running of the system. The Repeat Panel will be loop driven and provided with an inbuilt isolator. The Repeat Panel will be complete with built-in battery and charger to comply with BS EN54 Parts 2 & 4 and will require 220V AC supply and will be located as shown in the floor layout drawings.

2.3.1.6 INSTALLATION

Fire alarm components will be installed directly to conduit outlet boxes at the following mounting heights above finished floor level, measured to the Centre of box unless stated otherwise.

Fix manual call station semi-recessed at 1.50 Mt. heights above finished floor.

Automatic smoke and heat Detectors: Ceiling mounted

Alarm sounders: 2.20 Mt. above finished floor

Outdoor alarm: fix where indicated by fire dept. and approved by the Client / Consultant engineer.

External response indicators: fix beside or above doors as directed by the client engineer / as shown on the drawings.

2.3.1.7 WIRING AND WIRING FACILITIES

Supply and install the necessary conduit, enclosed trucking to the Fire Cable and accessories and wiring for the fire alarm system.

All cables associated with Fire Alarm installation will be of fire resistant 2 core 1.5 sq. mm.

The cable for use on the Fire Alarm loop will be of the following type and specification.

The cable is to BS 6207: Part 1 having

Typically no more than 2 cores:

A maximum of 190 pF/m intercore capacitance

A maximum of 220 pF/m core to screen capacitance

A maximum of 13 ohms per core

Each core having 1.5 sq. mm cross sectional area

A red cover sheath (preferred for alarm applications)

Having continuous metal sheath encapsulation
Fire resistant tested to BS6387 categories CWZ.

Multi core cables having more than 2 cores will not be allowed for loop wiring due to inadequate separation and possible interference problems.

All wiring will be installed to provide complete and satisfactory function system in all respects. All cable terminations at components and junction boxes will have identification tags, indicating through out the system.

The Fire Alarm/Detection system wiring will be completely independent from the other system wiring in all respects in accordance with the IEE Regulations.

2.3.1.8 TESTING AND COMMISSIONING

After the installation is complete, the contractor will conduct operating and commissioning tests. The equipment will be demonstrated to operate in accordance with the requirements of the specification. The system installation, testing and commissioning will be as per Local approvals and requirements. The fire alarm system will be completely programmed in accordance with Fire Department requirement and a specialist from the manufacturer will attend and demonstrate the complete system. A company trained representative will personally supervise the complete installation and final testing of the system & he will issue certificates for commissioning.

All tests will be carried out in the presence of the Client or persons authorized by the consultant / client. Upon the completion of the acceptance tests, the representatives will instruct operatives in the proper operation, maintenance programming, configuration, and testing of the system. The vendor will provide equipment and /or software which is necessary to allow field modification of the programming and configuration.

2.3.2 TECHNICAL SPECIFICATION FOR PUBLIC ADDRESS SYSTEM

2.3.2.1 GENERAL DESCRIPTION

The objective is to have an effective public address and evacuation system for the entire area. The system will combine all the essential EVAC functionality- such as zone wise paging & voice evacuation, event logging, digital mixing & feedback cancellation, digital message management and a relay Based fire alarm panel interfacing. The system shall monitor all the peripherals such as speakers & speaker circuits, amplifiers, battery, voice messages, microphones etc. The system shall fully comply with IEC / EN60849 and BS5839 part 8 standards. The same also should be comply NFPA 72 codes and Indian Standard IS 2189

2.3.2.2 SCOPE

The contractor shall supply, install, test, connect and commission a high quality Public Address and Voice Alarm System and Professional Audio System complying strictly as per the standards.

The system shall provide Paging announcements from microphone stations, emergency message from the in-built memory & simultaneous background music from CD/DVD/PC player in different zones. The system shall consist of minimum 8-button Paging security microphone (PSM) working on RS-485 protocol & balanced audio line transmission.

Prior to placing order for any equipment, the contractor shall submit comprehensive document comprising working drawings, catalogues and descriptive literature of components. The contractor shall be required to train and instruct client's personnel in the correct use, operation and supervision of the system, preferably prior to the handing over of the project.

The contractor shall make sure that all power tapping of the speakers must be carried out as specified.

The system shall be fully programmed to accommodate fire alarm and voice communication zones as indicated on the drawings and schematics. The system shall be configured to allow on site modifications with the minimum of disruption.

Metal ceiling speakers

The ceiling mounted 6/3/2.5 W speakers shall be installed as depicted in the drawing. The speakers are finished in RAL 9016 color in stylish metal chassis. The speakers shall have terminals to allow selection of nominal full power, half power & quarter power. Assembly shall comprise of a twin cone loudspeaker and shall be fitted with a 6Watt / 100volt transformer. The loudspeaker baffle shall be a round two part bezel comprising an inner metal mesh grille, and chassis with integral loudspeaker having no visible fixings. Installation shall be by pre-mounted torsion-springs for False ceiling mounting. Loudspeaker shall have wide angle dispersion of Cone shall be a damped, high compliance type with a smooth extended frequency response of 100Hz~17.5 KHz. The speakers shall be very easy to install with mounting clamps. It shall have excellent frequency response with wide opening angle & inbuilt 100V line matching transformer. It should blend aesthetically with interiors.

Technical Specifications

Rated power 6 W

Tappings 100V line 6/3/1.5/0.75/0.25W

Effective frequency range 70 ~ 17.5 KHz

SPL @ 1w/m (test signal 100Hz~10kHz) 90 dB

S.P.L., @Full power/ 1m, dB 97 dB

Colour White / as per site requirement

Ceiling Cut-out 155 mm

Dimensions 180 mm x 70 mm

2.3.2.3 Moulded cabinet wall-mount loudspeakers

The enclosure shall be ported and treated with UV inhibitors. The bowed grille will be manufactured from mild steel construction with an epoxy coated finish. The assembly of the speaker shall comprise of a 160 mm diameter BMSs/midrange treated coned loudspeaker. It shall have in addition a 25 mm Mylar dome tweeter complete with neodymium magnet and a factory fitted 6 watt / 100 volt line transformer. The loudspeaker shall have wide-angle dispersion of 160° and a smooth extended frequency response of 160Hz ~20 kHz. Sensitivity shall be a minimum of 96dB @ 1 metre, 1 watt test signal bandwidth 100Hz ~10 kHz. Transformer shall be 100 volt line with 3dB power taps of 6, 3, 1.5watts to be clearly marked on the assembly. The speaker shall be compliant to BS 5839 part 8 (Voice Alarm Standard) to include all the above features with the addition of thermal fuse and ceramic terminals to take 2 x2.5mm² cables.

Technical Specifications

Rated power 6 W

Tapings 100v line 6/3/1.5 W

Effective frequency range 160 ~18 KHz

SPL @ 1w/m (test signal 100Hz~10 kHz) 96dB Dispersion at 1 k/2kHz 180/120 Axial Q Factor at 1 k/2kHz .6/5.8

Colour White / as per site requirement

2.3.2.4 Amplifiers

The power amplifier shall be of high quality, suitable for the most demanding PA installations and applications. The unit shall have a frequency response of no less than 50Hz - 15 kHz (±3dB). Distortion at 1 kHz shall not exceed 0.5%. The Signal to Noise ratio shall be -82dB or greater. The amplifier shall have two transformer balanced XLR inputs, one of which can be used to feed additional power amplifiers. The amplifier shall be capable of delivering 120/240/480 watts RMS into 100 & 70 Volt or 4 ohm loads. Speaker connection shall be via a rear panel barrier strip. The unit shall operate

from both AC mains power or from a 24V DC battery supply. The amplifier shall include a built-in trickle charge circuit. The amplifier shall feature overload and overdrive protection and shall also include cooling fans, which should only be active if the operating temperature exceeds a factory preset level. The unit shall be packaged in a rugged 2 RU metal chassis suitable for desk or rack mounting.

Rated Output Voltage (RMS) 120/240/480W

Battery Voltage 24VDC (max 10% déviation)

Frequency Response : 50Hz to 15 KHz

Impedance : 10KOhm

S/N Ratio : >82 dB

Sensitivity : Max 300mV (set at 1V)

Total Harmonic Distortion : Less than 0.5% @ 1 kHz

2.4 HVAC WORKS

2.4.1 VARIABLE REFRIGERANT FLOW / VOLUME VRF / VRV

General Description

1. All Variable Refrigerant Volume Air Conditioners shall be totally Factory assembled, charged with refrigerant, wired, piped and tested at the factory by OEM.
2. The System shall comprise of Air-Cooled scroll, rotary, inverter / digital compressors type Outdoor units, and a variety of indoor units connected by Common Refrigerant Piping, refnests, piping, etc. and Power and Control Cabling.
3. All bolts, nuts, screws, washers, plates, etc. and all other fittings on all VRV system components shall be plated or passivated to resist corrosion.

VRV/ VRF System

1. The VRV System shall provide stable, trouble free and safe operations, and provide flexibility in operation of Indoor Units with independent control of each Indoor Unit, including stepless partial operation.
2. It shall be possible to switch on only those Indoor Units that require Cooling in individual Areas, zones or shops.
3. The capacity of Indoor and Outdoor Units shall be matched, sleeplessly, and shall include multi Compressor cut off / speed control, by pass or any other means of capacity Control for stable operations of System.
4. The System shall be capable of automatic operation even with varying Outdoor and Indoor requirements and make up of low Outdoor Temperatures to achieve lower Power Consumption, without any manual adjustments.
5. All Systems shall be modular in nature and easily upgradeable / inter connectable for larger capacities.
6. Units shall have hermetically sealed Scroll Compressors, to ensure high EER.
7. The refrigerant gas shall be necessarily R 410a
8. All Units shall be Air Cooled type.
9. The System shall incorporate all required controls for parallel operation of Compressors, Condensers, Fans, and Indoor Units as well as Refrigerant liquid control.

Power Supply

1. All the units shall be suitable for operation with 415V $\pm$ 10%, 50Hz $\pm$ 3%, 3 phase A.C. supply.

Outdoor Units

The Condenser coil shall be Air-cooled type with copper tubes and aluminum fins. The condenser coils shall be of adequate size and shall have an integral sub cooler circuit for sub cooling of the liquid. Condenser coil shall have a refrigerant side working pressure of 400 psig with anti-corrosive treatment.

Condenser shall have multiple piping and cabling connection option. Pump down facility should be provided in the refrigerant system by providing good quality hand / shut off valves to avoid loss of Refrigerant gas during maintenance. The condenser fans shall be propeller type, with aluminum blades, low speed, and low vibration levels and quite in operation with IP 55 Protection.

All the compressors of the outdoor units must be hermetically sealed scroll type. Each module of outdoor unit must have separate 1 No. of inverter compressor, suitable to operate at heat load proportional to indoor requirement.

“Anti-Corrosive” treatment (Blue Fins) for Al fins of Condenser Coils is mandatory and shall carry warranty of at least Five (5) years. The treatment should be suitable for areas of high pollution and salt laden air.

The outdoor units must be suitable for more than 150 Meter Refrigerant piping between outdoor unit & the farthest indoor units and total piping of 300 Meter for all the indoor units. Allowable level difference between outdoor unit & indoor units shall be 50 Meter in case of outdoor unit on top & 40 Meter in case of outdoor unit at bottom. Allowable level difference between various indoor units connected to one outdoor unit shall be up to 15 m.

Back up operation, in case of failure of one of the compressors of outdoor unit, for single module outdoor units or failure of one of the modules in case of multiple modules outdoor units shall be possible. The VRV outdoor unit shall always be supplying at least 33% of back up operation, of the full load capacity.

The outdoor unit shall employ system of equal run time for all the compressors, inverter or on/ off type, within each outdoor unit – Single Module or Multi Module.

Starter for the Outdoor Unit compressor shall “Direct online” type. Inverter compressor of the unit shall start first & at the minimum frequency, to reduce the inrush current during starting.

Refrigerant control in the outdoor unit shall be through Electronic Expansion Valve. Complete refrigerant circuit, oil balancing/ equalizing circuit shall be factory assembled & tested.

The outdoor units shall confirm to Technological Guideline for Harmonic Suppression – JAE9 9702-1995. High Harmonic Environmental Target Level for Power Distribution system shall be 5%.

Safety Devices to be provided such as High Pressure Switch, Overload protector, Fusible plug, Overload relay etc. Should be part of standard fitments in VRV systems.

ODU shall have all variable speed compressors with its controls to work at 415+/- 20 Volts with all necessary protections for overload, voltage fluctuations.

Indoor Units

Hiwall:

With decorative look to match with the interior Layout of Corded Remote type complete In PVC construction. Evaporating unit comprising of DX Cooling coils, blower, electric motor, insulated sandwiched drain Tray, and junction box for electrical connections, 20-micron HDPE washable filter etc.

Cassette:

The unit must have in built drain pump, suitable for vertical lift of 750 mm. The unit casing shall be Galvanized Steel Plate.

Indoor unit must be insulated with sound absorbing thermal insulation material, Polyurethane foam. The noise level of unit at the highest operating level shall not exceed 45 dB (A), at a vertical distance of 1.5 m from the grille of the unit. Unit shall have provision of connecting fresh air without any special chamber & without increasing the total height of the unit (288 mm maximum). The unit shall be supplied with suitable decorative panel.

The unit shall be supplied with Resin Net filter with Mold Resistance. The filter shall be easy to remove, clean & reinstall.

The unit will be connected in series to a suitable outdoor unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the “Bill of quantities”.

The unit shall be supplied with following from the factory

- Operation Manual
- Installation Manual
- Paper pattern for installation
- Drain hose/ Clamp metal/ Washer fixing plate/ Sealing pads/ Clamps/ Screws/
- Washer for hanging bracket/ Insulation for fitting

Remote controls:

Wired remote controller shall be supplied as specified in the "Bill of Quantities" The controller must have large crystal display screen, which displays complete operating status. The digital display must allow setting of temperature with 1° C interval.

Remote shall be able to individually program by timer the respective times for operation start and stop within a maximum of 72 hours

Remote must be equipped with thermostat sensor in the remote controller that will make possible more comfortable room temperature control The remote shall be able to monitor room temperature & preset temperature by microcomputer& can select cool/ heat

Operation mode automatically. The remote must constantly monitor malfunctions in the system & must be equipped with a "self-diagnosis function" that let know by a message immediately when a malfunction occurs.

In case of corded remote it shall be possible to wire the remote up to 500 RMT.

Refrigerant Piping & Insulation:

All refrigerant piping shall be in high grade copper 18 Gauge (1.21 mm) including all connections, Tees, Reducers, etc. Required nos. of Refrigerant joints with insulation should be provided for uniform flow of refrigerant through all Indoor units.

All refrigerant piping shall be insulated with 19mm/13mm thickness of Closed Cell nitrile rubber Insulation material. All joints on the insulation should be sealed with good quality sticking compound. All joints should be covered with 2" wide Aluminum tape.

Entire Refrigerant piping inside& outside the building should be installed on the wall / ceiling /Terrace/ shaft Laid on the Factory manufactured Perforated 16 G GI Cable Trays.

Sufficient valving shall be included to allow compressors to be removed for service & to allow the refrigerant to be pumped in to and contained in the condenser. The unit shall be equipped with a liquid line shut off valve, filter drier, liquid line sight glass, and solenoid valve & insulation where required to prevent condensation forming.

Pressure Testing & Evacuation

After brazing of the complete piping, the next step is to the test the system for leakages if any. Complete leak testing and proper evacuation is a must as non-condensable gases and moisture in the system will have ill-effects on system behavior as below:

- Pressure in the system rises.
- Operating current rises.
- Cooling or heating performance drops drastically.
- Moisture in the system may freeze and block the small opening of valves and capillaries.
- Moisture in the system reacts with oil in presence of refrigerant and forms organic and inorganic acids, which in turn react with copper. Copper gets deposited on hot surfaces like bearing surface of compressor shaft, discharge side of scroll set etc. and can damage the compressor severely.
- Therefore the tubing connecting the indoor unit and outdoor unit must be pressure tested and evacuated properly to expel the non-condensable gases and moisture from the system.

Pressure Testing

Check visually that all piping is properly brazed.

Note that all service valves of the outdoor unit are closed at this stage.

- Use a TEE connection for connecting both liquid and suction service valve.
- The Oil balance tube leak test is not necessary if only one outdoor unit is installed.
- Add a Pressure Test Oil Equalizer line also in case of multiple ODUs installation.
- Always pressurize both suction and liquid side of piping system.
- Pressurize the system in steps of 100, 200, 300, 400 and 550 psig. Check for any leak at each step using soap bubbles. Pressure must be within 2 psig after two hours.

- Do a leak-test of all joints of the tubing; any bubbles indicate a leak. Wipe off the soap with a clean cloth after a leak test.
- Keep pressurized for 12-24 hours and check for any drop in pressure.
- After the system is found to be free of leaks, release the nitrogen pressure by loosening the charge hose connector at the nitrogen cylinder.
- When the system pressure is reduced to normal, disconnect the hose from the cylinder.

Drain Piping:

Condensate from the Indoor unit shall be drained through properly installed drain piping designed to prevent any accumulation of condensate in the drain pan. Drain piping shall be made of rigid PVC pipe of 6 Kg/cm sq. pressure rating with water tight threaded connections & 9 mm thick nitrile rubber insulation. Leading from the Indoor unit to a suitable drain point. Complete drain piping shall be made leak proof and water tight by means of precise installation and the use of leak proof sealant / adhesives.

2.4.2 TREATED FRESH AIR UNIT

The scope of this section comprises of the supply of double-skin "Treated Fresh Air Units conforming to the following specifications. The manufacturer or their principals shall have at least 10 years of designing and manufacturing experience directly in the product i.e. energy recovery devices, with a two tier, two air stream unit design in India. The heat recovery wheel and box should be from the same manufacturer. The manufacturer of the wheel should have manufacturing units in India. Assembling of The Heat Recovery Wheel and Box at site is not accepted.

The Treated Fresh Air units shall be two stream units in double skin construction, comprising of supply air section, return air section and Heat Recovery Section.

CASING

The units shall be made of extruded Aluminum hollow profile frames. The profile box size shall be of minimum 30 mm for capacities upto 22000 CMH, such that it provides the required mechanical strength and rigidity. The unit should be devoid of any welded construction and should be of cabinet type. All the frames should be assembled using pressure die cast Aluminum joints/corners to make a self-supporting frame. The Casing leakage shall be in accordance with relevant EUROVENT standard that is CLASS B.

The panels shall be of double skin construction with inner casing 0.8mm Galvanized Steel Sheet and outer casing 0.8 mm preplasticised precoated GI Sheet. 25 mm thick fire retardant, fibre glass insulation shall be sandwiched between the sheets. The fibre glass density shall be 48 kg/m³. Materials emitting toxic gases like PUF shall not be used for insulation.

The Inspection and access panels shall be hinged type. The hinges shall be Aluminium Die Casting, Locks shall be Galvanized Steel and Handles shall be of PVC. Other panels will be screwed on to the frame with sealant and soft rubber gasket thus making the joints air tight. All screws used for panel fixing shall be covered with PVC caps.

Special hollow gaskets and seals shall be used on inspection doors and to create separation between the airstreams to ensure negligible air leakage and mixing

The entire casing shall be mounted on electro galvanized channel frame work with level screws. Condensate drain pan shall be fabricated from 18 g GSS/SS construction.

SUPPLY AIR SECTION

The supply air section shall comprise of the following.

FAN SECTION

The fan shall be centrifugal forward curved or backward curved, double inlet double width type. The impeller and the fan casing shall be made of hot galvanized sheet steel. The impeller shall be mounted on a solid shaft supported to housing with angle iron frame and pillow block heavy duty ball bearing. The impeller shall be statically and dynamically balanced. The fan shall be selected such that unit noise level is less than 85 db. Fan housing and motor shall be mounted on a common galvanized steel or aluminium block base which can be drawn out from side for ease of maintenance. A quarter

pin lock arrangement between the slide and guide pin lock arrangement between Fan and TFA outlet should be provided.

MOTOR AND DRIVE

Fan motor shall be energy efficient and suitable for 415±10% volts, 50 cycles, 3 phase squirrel cage, totally enclosed fan cooled with IP – 55 protections. Motor shall be designed for quiet operation. Drive shall be provided through belt – drive arrangement. Belts will be of oil resistant type.

FILTER SECTION

The filter section shall be normally designed for deep folded disposable synthetic profilers for Class EU3. The filter elements shall be mounted on rails and shall be easily pulled out for replacement. The rails shall be provided with efficient gaskets to minimize the risk of leakage. If mentioned in the Bill of Quantities the section shall be designed to include filters upto class EU 8.

DAMPER SECTION

Damper section shall contain a built-in damper of aluminium profile with leakage class III the damper blades shall be connected with plastic gear wheels with a gasket of silicon rubber to produce tightness between the blades.

2.4.3 SHEET METAL WORK

OPTION – I (FACTORY FABRICATION AS PER SMACNA STANDARDS)

1. SCOPE

The scope of this section comprises supply fabrication, installation and testing of all sheet metal / aluminum ducts, supply, installation, testing and balancing of all grilles, registers and diffusers. All to be in accordance with these specifications and the general arrangement shown on the Drawings

2. DUCT MATERIALS

1. RAW MATERIALS

Galvanizing shall be Class VII – light coating of zinc, nominal 180gm/sq.m surface area and Lock Forming Quality prime material along with mill test certificates. 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.

2. GAUGES, BRACING BY SIZE OF DUCTS

All ducts shall be fabricated from galvanized steel / aluminum of the following thickness, as indicated as below:

1.2.2.1 For Ducts with external SP upto 250 Pa (To be used for Hotels & Commercial Projects)

Rectangular Ducts G. S.	Pressure 250 Pa		
	Duct Section Length 1.2 m (4 ft)		
Maximum Duct Size	Gauge	Joint Type	Bracing Spacing
1–750 mm	26	C & S/ SS	Nil
751 – 1000 mm	26	4 Bolt Transverse Duct Connector- (TDC) / Slip-on E	Nil
1001 – 1200 mm	24	4 Bolt TDC / Slip-on E	Nil
1201 – 1500 mm	24	4 Bolt TDC / Slip-on F	Nil
1501 – 1800 mm	22	4 Bolt TDC / Slip-on H	Nil
1801 – 2100 mm	20	4 Bolt TDC / Slip-on I	Zeebar Stiffener 1-S
2101 – 2700 mm	18	4 Bolt TDC / Slip-on I	Zeebar Stiffener 1-S

OR

1.2.2. For Ducts with External SP upto 500 Pa (For Hospital & Clean room jobs, where AHU SP is specified as 75 mm and above. Not Suitable for OTs)

Rectangular Ducts G. S.	External Pressure 500 Pa		
	Duct Section Length 1.2 m (4 ft)		
Maximum Duct Size	Gauge	Joint Type	Bracing Spacing
1–600 mm	26	C & S/ SS	Nil
601-750 mm	26	4 Bolt Transverse Duct Connector- (TDC) / Slip-on E	Nil
751-1000 mm	24	4 Bolt TDC / Slip-on F	Nil
1001-1200 mm	22	4 Bolt TDC / Slip-on G	Nil
1201-1300 mm	20	4 Bolt TDC / Slip-on H	Nil
1301-1500 mm	18	4 Bolt TDC / Slip-on H	Zeebar Stiffener 1-S
1501-1800 mm	18	4 Bolt TDC / Slip-on I	Zeebar Stiffener 1-S
1801-2100 mm	18	4 Bolt TDC / Slip-on J	Zeebar Stiffener 2-S
2101-2250 mm	18	4 Bolt TDC / Slip-on J	Zeebar Stiffener 2-S
2251-2400 mm	18	4 Bolt TDC / Slip-on J	Zeebar Stiffener 2-S
2401-2700 mm	18	4 Bolt TDC / Slip-on J	Zeebar Stiffener 2-S

'C'-cleat; 'S'-S cleat; 'SS'-Standing S cleat;

*Distance of reinforcement/bracing from each joint. Bracing material to be same as of material used for joining of duct sections.

FOR ALUMINUM DUCTS MATERIAL SHALL BE ONE COMMERCIAL GAUGE HIGHER WITH 22 G AS MINIMUM

3. FABRICATION STANDARDS & EQUIPMENT

All duct construction and installation shall be in accordance with SMACNA standards. In addition ducts shall be factory fabricated utilizing the following machines to provide the requisite quality of ducts.

1. Coil (Sheet metal in Roll Form) lines to facilitate location of longitudinal seams at corners/folded edges only, for required duct rigidity and leakage free characteristics. No longitudinal seams permitted along any face side of the duct.
2. All ducts, transformation pieces and fittings to be made on CNC profile cutter for requisite accuracy of dimensions, location and dimensions of notches at the folding lines.
3. All edges to be machine treated using lock formers, flanges and rollers for turning up edges.

4. DUCT CONSTRUCTION

All ducts shall be fabricated and installed in workmanlike manner, conforming to relevant SMACNA codes.

Ducts so identified on the Drawings shall be acoustically lined and insulated from outside as described in the section "Insulation" and as indicated in schedule of Quantities. Duct dimensions shown on drawings, are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in Schedule of quantities. The fabricated duct dimensions should be as per approved drawings and care should be taken to ensure that all connecting sections are dimensionally matched to avoid any gaps.

Ducts shall be straight and smooth on the inside with longitudinal seams shall be airtight and at corners only which shall be either Pittsburgh or snap button as per SMACNA practice, to ensure airtightness.

All ducts up to 75cms width within conditioned spaces shall have slip and drive (C & S/SS) joints. The internal ends of slip joints shall be in the direction of airflow. Care should be taken to ensure that S/SS Cleats are mounted on the longer side of the duct and Cleats on the shorter side. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint.

Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Air-turns (vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

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

All sheet metal connection, partitions and plenums, required to confine the flow of air to and through the filters and fans, shall be constructed of 18 gauge GSS / 16gauge aluminum, thoroughly stiffened with 25mm x 25mm x 3mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Access doors shall be not less than 45cm x 45cm in size.

Plenums shall be shop/factory fabricated panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards GS sheet and riveting shall be done from outside.

Self-adhesive Neoprene rubber / UV resistant PVC foam lining 5mm nominal thickness instead of felt, shall be used between duct flanges and between duct supports in all ducting installation.

5. INSTALLATION PRACTICE

All ducts shall be installed generally as per tender drawings, and in strict accordance with approved shop drawings to be 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. The work shall meet with the approval of Owner's site representative in all its parts and details

b) All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and conduits, the ducts shall be transformed, divided or curved to one side (the required area being maintained) all as per the site requirements.

If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the required points by any path available in accordance with other services and as per approval of owner's site representative.

All ductwork shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of galvanized steel rods and galvanized steel angle/channel or a pair of brackets, connected by galvanized steel rod under ducts. The spacing between supports should be not greater than 2.0 meter. All vertical ductwork shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash/anchor fastener driven into the concrete slab by electrically operated

gun. Hanger rods shall then hang through the cleats or fully threaded galvanized rods can be screwed into the anchor fasteners.

Ducting over furred ceiling shall be supported from the slab above, or from beams after obtaining approval of Owner's site representative. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractor's work in the building.

Where ducts pass through brick or masonry openings, it shall be provided with 25mm thick TF quality expanded polystyrene around the duct and totally covered with fire barrier mortar for complete sealing.

All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 10cm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting ductwork rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.

Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

6. DAMPERS

a. Dampers: All duct dampers shall be opposed blade louver dampers of robust 16 G GSS construction and tight fitting. The design, method of handling and control shall be suitable for the location and service required.

b. Dampers shall be provided with suitable links levers and quadrants as required for their proper operation. Control or setting device shall be made robust, easily operable and accessible through suitable access door in the duct. Every damper shall have an indicating device clearly showing the damper position at all times.

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

7. FIRE DAMPER

a. Whenever a supply/return duct crosses from one fire zone to another, it shall be provided with approved fire damper of at least 1½ hour fire rating as per UL555/1995 tested by CBRI. This shall be curtain type fire damper.

b. Fire damper blades shall be one piece folded high strength 16 gage galvanized steel construction. In normal position, these blades shall be gathered and stacked at the frame head providing maximum air passage and preventing passing air currents from creating noise or chatter. The blades shall be held in position through fusible link of temp 70o C.

c. In case of fire, the intrinsic energy of the folded blades shall be utilized to close the opening. The thrust of the suddenly released tension shall instantly drive the blades down and keep it down without the use of springs, weights or other devices subject to failure.

d. Fire damper sleeves and access doors shall be provided within the duct in accordance with the manufacturer's recommendation.

e. The contractor shall also furnish to the Owner, the necessary additional fusible links (spares), as recommended by the manufacturer, at the time of commissioning of the installation.

8. SUPPLY AND RETURN AIR GRILLES

Supply & return air grilles shall be of either steel or aluminum sections as specified in schedule of quantities. Steel construction registers shall have primer Coat finish whereas extruded aluminum grilles / registers shall be either Anodized or Powder Coated as specified in Schedule of Quantities. These registers shall have individually adjustable louvers both horizontal and vertical. Supply air registers shall be provided with key operated opposed blade extruded aluminum volume control damper anodized in matt black shade.

The grilles / registers shall be suitable for fixing arrangement having concealed screws as approved by Architect. Linear continuous supply cum return air register shall be extruded aluminum construction with fixed horizontal bars at 15 Deg. inclination & flange on both sides only (none on top & bottom). The thickness of the fixed bar louvers shall be minimum 5.5 mm in front and 3.8 mm in rear with rounded edges. Flanges on the two sides shall be 20 mm/30 mm wide as approved by Architect. The grilles shall be suitable for concealed fixing. Volume control dampers of extruded aluminum anodized in black color shall be provided in supply air duct collars. For fan coil units horizontal fixed bar grilles as described above shall be provided with flanges on four sides, and the core shall be & suitable for clip fixing, permitting its removal without disturbing the flanges.

- a. All registers shall be selected in consultation with the Architect. Different spaces shall require horizontal or vertical face bars, and different width of margin frames. These shall be procured only after obtaining written approval from Architect for each type of register.
- b. All registers shall have a soft continuous rubber/foam gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers for air flow shall not be less than 66 percent of gross face area.
- c. Registers specified with individually adjustable bars shall have adjustable pattern as each grille bar shall be pivot able to provide pattern with 0 to +45-degree horizontal arc and up to 30-degree deflection downwards. Bars shall hold deflection settings under all conditions of velocity and pressure.
- d. Bar longer than 45 cm shall be reinforced by set-back vertical members of approved thickness.
- e. All volume control dampers shall be anodized aluminum in mat black shade.
- f. In case of continuous grilles / diffusers, dummy grilles shall be blanked-off using GI sheet duly painted black.
- g. All square / rectangular diffusers, slot diffusers to have insulated plenum installed above dampers from OEM factory & not to be constructed at site.

9. DOCUMENTATION & MEASUREMENTS FOR DUCTING

All ducts fabricated and installed should be accompanied and supported by proper documentation viz:

- a) Bill of material/Packing list for every duct section supplied.

Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

Each and every duct piece to have a tag number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement and verification.

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centerline measurements described herewith

Ductwork shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the Centre of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in a similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centerline distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centerline.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 5mm thick between duct and support, vibration isolator suspension where specified or required, inspection chamber/access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications. These accessories shall NOT be separately measured nor paid for.

b) Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith:

- I. Grilles and registers - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.
- II. Fire dampers - shall be measured by their cross-sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.
- III. Flexible connection - shall be measured by their cross-sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.

9. TESTING AND BALANCING

After the installation of the entire air distribution systems completed in all respects, all ducts shall be tested for air leaks by visual inspection as per SMACNA standards.

The entire air distribution system shall be balanced using an anemometer. Measured air quantities at fan discharge and at various outlets shall be identical to or less/excess than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

OPTION- II (SITE FABRICATION)

AIR DISTRIBUTION (AS PER "BIS" STANDARD)

1 SCOPE

The scope of this section comprises supply fabrication installation and testing of all sheet metal / aluminum ducts, supply installation testing and balancing of all grilles registers and diffusers, in accordance with these specifications and the general arrangement shown on the Drawings.

2 DUCT MATERIALS

All ducts shall be fabricated from galvanized steel sheets /aluminum sheets of the following thickness as indicated in Schedule of Quantities.

G S S

Rectangular ducts up to 75 cm	24 gauge
Rectangular ducts 76 to 150 cm	
And all Oval ducts.	22 gauge

Rectangular ducts 151 to 225 cm 20 gages
Rectangular ducts greater than 225 cm 18 gage

Sheet metal ducts shall be fabricated out of galvanized steel sheets. Fabrication of ducts shall be through well-conditioned Triplex lock former or multiple lock formers, conforming to relevant BIS Codes. Sheets used shall be produced by Hot Dip Process and galvanizing shall be Class VII- Light Coating of zinc, Nominal 180 gm /Sq. m surface area.

Samples of sheet from each lot selected at random by Owner's site representative shall be subject to approval & gotten tested for thickness and zinc coating at contractor's expenses.

3 All ducts shall be fabricated and installed in workmanlike manner, generally conforming to relevant BIS Codes. Round exposed ducts shall be die-formed for achieving perfect circle configuration.

- a. Ducts so identified on the Drawings shall be acoustically lined and insulated from outside as described in the section "Insulation" and as indicated in Schedule of Quantities. Duct dimensions shown on Drawings are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in Schedule of Quantities.
 - b. Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight.
 - c. All exposed ducts up to 60 cm width within conditioned spaces shall have slip joints - or flanged joints. The internal ends of slip joints shall be in the direction of air flow. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint.
 - d. Changes in dimensions and shape of ducts shall be gradual. Air-turns (Vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.
 - e. Ducts shall be fabricated as per details shown on Drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.
 - f. All sheet metal connection, partitions and plenums required to confine the flow of air to and through the filters and fans shall be constructed of 18 gage GSS / 16 gauge aluminum, thoroughly stiffened with 25 mm x 25 mm x 3 mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Doors shall be not less than 45 cm x 45 cm in size.
 - g. Plenums shall be panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards G S sheet and riveting shall be done from outside.
 - h. Self-adhesive rubber lining minimum 5 mm thick instead of felt shall be used between duct flanges and between duct and duct supports in all ducting installation.
- 4 All ducts shall be installed generally as per tender Drawings, and in strict accordance with approved shop drawings to be prepared by the Contractor.
- a. 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. The work shall meet with the approval of Owner's site representative in all its parts and details.
 - b. All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the Drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and

conduits, the ducts shall be transformed, divided or curved to one side (the required area being maintained) all as per the site requirements.

- c. If a duct cannot be run as shown on the Drawings, the Contractor shall install the duct between the required points by any path available, in accordance with other services and as per approval of Owner's site representative.
- d. All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of galvanized steel rods and galvanized steel angle/channel under ducts at no greater than 2-meter center. All vertical duct work shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting.
- e. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/ channels shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash /anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats.
- f. Ducting over furred ceiling shall be supported from the slab above, or from beams, after obtaining approval of Owner's site representative. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other Contractor's work in the building. Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick TF quality expanded polystyrene around the duct and totally covered with fire sealant such as fire barrier mortar for complete sealing.
- g. All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of flame retardant, waterproof, silicon rubber impregnated flexible connection at least 10 cm long securely bonded, and flange bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.
- h. Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

5 MEASUREMENTS FOR DUCTING

Unless otherwise specified, measurements for ducting for the project shall be on the basis of Centre-line measurements described herewith:

- a) Duct Work shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the Centre of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the Centre line distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the Centre line.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 3 mm thick between duct and support, vibration isolator suspension where specified or required,

inspection chamber / access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the Specifications. These accessories shall NOT be separately measured nor paid for.

b) Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith:

i. Grilles and registers - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.

ii. Fire dampers - shall be measured by their cross-sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.

iii. Flexible connection - shall be measured by their cross-sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.

6 TESTING AND BALANCING

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks by visual inspection as per BIS standards.

The entire air distribution system shall be balanced using an anemometer. Measured air quantities at fan discharge and at various outlets shall be identical to or less/excess than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

2.4.4 INSULATION

Acoustical Insulation

Acoustical Insulation for Ducts

1. All connecting ducts to TFA shall be sounding insulated to a distance of 4 m or as specified or as shown on the design.
2. Acoustical insulation shall be 19 mm thick class open cell nitrile rubber insulation.
3. Application
 1. Clean all internal duct surfaces
 2. Pre-cut the insulation to the size desired, allowing 50 mm excess at downstream joints.
 3. Install self-adhesive pins spaced along the inner face of duct. The pins should start within 75 mm of upstream transverse edges of the liner and 75 mm from longitudinal joints and should be placed at a maximum of 300 mm on centers around the perimeter of the duct, except that there may be a maximum of 300 mm from a corner break.
 4. Apply coat of Foster Duct as Adhesive 81 - 22 on the duct surfaces as per manufacturer's recommendations.
 5. Impale insulation through the pins and assure insulation is stuck to the adhesive.
 6. Fix self-retaining washers on to the pins. Do not compress insulation more than 3 mm.
 7. Bend the pins so as to prevent protrusions or tears
 8. It is recommended that all exposed leading edges & joints be coated with Foster Duct as Adhesive 81 - 22.

Acoustical Insulation

Acoustical insulation shall be 19 mm thick open cell nitrile rubber insulation.

Application

1. Fix 50 mm x 50 mm GI / Al. angle frame at 600 mm centers.
2. Fix insulation + BGT & finish with 24G perforated aluminum sheets.

THERMAL INSULATION (INDOOR)

External thermal insulation shall be provided as follow:

Thermal insulation shall be 13 mm thick class O, Elastomeric nitrile rubber insulation with fire retardant.

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 elastomeric rubbers sheets to size with sufficient allowance in dimension.

Material shall be fitted under compression and no stretching of material shall

Be permitted.

A thin film of Synthetic Rubber based adhesive shall be applied on the metal surface and then on the back of the insulating material sheet.

When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. Also, care should be taken to prevent the trapping of air bubbles between metal sheets and insulating material sheet.

All duct flanges should be covered properly with a 150mm wide strip of insulation sheet after gaining uniform height by applying multiples layer of 75mm wide strip of insulation sheet from the both side of flanges.

All longitudinal and transverse joints shall be sealed with K-FLEX adhesive tapes of 50mm (wide) x 3mm (thick).

The adhesive shall be strictly as recommended by the manufacturer.

The detailed Application specifications are as per the manufacturers

Application manual.

2.4.5 GRILL& DAMPER

SUPPLY AND RETURN AIR GRILLES/DIFFUSERS

Supply &return air Grille shall be of either steel or aluminum sections as specified in schedule of quantities. Steel construction registers shall have primer Coat finish whereas extruded aluminum Grilles shall be either Anodized or Powder Coated as specified in Schedule of Quantities. These registers shall have individually adjustable louvers both horizontal and vertical. Supply air Grilles shall be provided with key operated opposed blade extruded aluminum volume control damper anodized in matt black shade.

The Grilles shall be suitable for fixing arrangement having concealed screws as approved by Architect. Linear continuous supply cum return air register shall be extruded aluminum construction with fixed horizontal bars at 15 Deg. inclination & flange on both sides only (none on top & bottom). The thickness of the fixed bar louvers shall be minimum 5.5 mm in front and 3.8 mm in rear with rounded edges. Flanges on the two sides shall be 20 mm/30 mm wide as approved by Architect. The grilles shall be suitable for concealed fixing. Volume control dampers of extruded aluminum anodized in black color shall be provided in supply air duct collars. For fan coil units horizontal fixed bar

grilles as described above shall be provided with flanges on four sides, and the core shall be & suitable for clip fixing, permitting its removal without disturbing the flanges.

- a. All Grilles shall be selected in consultation with the Architect. Different spaces shall require horizontal or vertical face bars, and different width of margin frames. These shall be procured only after obtaining written approval from Architect for each type of register.
- b. All Grilles shall have a soft continuous rubber/foam gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers for air flow shall not be less than 66 percent of gross face area.
- c. Grilles / Registers specified with individually adjustable bars shall have adjustable pattern as each grille bar shall be pivot able to provide pattern with 0 to +45-degree horizontal arc and up to 30-degree deflection downwards. Bars shall hold deflection settings under all conditions of velocity and pressure.
- d. Bar longer than 45 cm shall be reinforced by set-back vertical members of approved thickness.
- e. All volume control dampers shall be anodized aluminum in mat black shade.
- f. In case of continuous grilles / diffusers, dummy grilles shall be blanked-off using GI sheet duly painted black.
- g. All square / rectangular diffusers, slot diffusers to have insulated plenum installed above dampers from OEM factory & not to be constructed at site.

DAMPERS

- a. Dampers: All duct dampers shall be opposed blade louver dampers of robust 16 G GSS construction and tight fitting. The design, method of handling and control shall be suitable for the location and service required.
- b. Dampers shall be provided with suitable links levers and quadrants as required for their proper operation. Control or setting device shall be made robust, easily operable and accessible through suitable access door in the duct. Every damper shall always have an indicating device clearly showing the damper position.
- c. Dampers shall be placed in ducts at every branch supply or return air duct connection, whether or not indicated on the Drawings, for the proper volume control and balancing of the air distribution system.

2.4.6 VENTILATION

Scope:

1. Scope of work under this section comprises the supply, erection, testing and commissioning of the ventilation / exhaust system of the capacities set forth in the Schedule of Equipment.
2. All fans shall be static and dynamically balanced.

INLINE FAN

1. Fans shall be 'Buffalo' or equivalent, non-overloading type. The fan C.F.M. static pressure, class arrangement, width, direction of rotation, mode of discharge, etc. shall be as indicated in the Schedule of Equipment and in the applicable drawings or as required.

2. The scroll shall be manufactured from hot dip galvanized sheet steel with side plates of Aero-dynamic profile.
3. Fans shall be provided with stationary inlet vanes as a standard accessory. Movable inlet vanes shall be provided only where specified for automatic control. Movable inlet vanes shall be complete with necessary linkages for actuation by automatic controls.
4. Fans shall also be provided with heavy duty outlet dampers mounted in a separate frame, wherever required.
5. All Class I fans shall be provided with sleeves bearing with generous oil reservoir, drain plug, oil level indicator, etc. Class II and III fans shall be provided with heavy duty ball bearings pre-greased & self-aligning.
6. Fans shall be driven by electric motor as specified in the Schedule of Equipment. Motor ratings are only tentative and where a fan requires a higher capacity motor, the Contractor shall clearly point out the requirements and make his offer accordingly. Motor ratings shall be at least 5% over limit load plus transmission losses.
7. Exhaust fans handling corrosive fumes shall be made of non-corrosive materials or coated with corrosion resistant paints with epoxy or chlorinated rubber base.

CABINET FAN

1. Units shall be complete factory assembled, tested and of approved manufacturers.
2. Casing shall be of heavy gauge galvanized sheets, ribbed and reinforced with access provided by hand holes and casing panels.
3. Fans shall be driven by an electric motor as specified in the Schedule of Equipment. Motor ratings are only tentative and where a fan requires a higher capacity motor, the Contractor shall clearly point out the requirements and make his offer accordingly. Motor ratings shall be at least 5% over transmission losses.
4. Fan shall have limit switch with Aluminum wire guard to shut off the fan.

Testing and Balancing

1. After the installation of the entire system is completed in all respects, system shall be tested & balanced for required performance. Fan shall be tested for the performance and test results shall be furnished.

Painting

1. On completion of the erection and testing, fans shall be painted with the two coats of an appropriate paint of approved color.

Filters

1. Filters shall be non-flammable 90% efficiency down to 10 microns. Filters shall be cleaned by dusting or reverse air blown.

Installation

The concrete foundations required for the fans shall be prepared by the Contractor under Civil scope of work to the drawings supplied by the Contractor. The Contractor Shall supply all foundation bolts, base plate, wherever required, vibration Eliminators, etc. and shall also 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%. Fan inlet and outlet connections shall be by means of flexible canvas connections. Fan belt drive shall be complete with

belts, belt, sheaves and suitable belt guard. For all kitchen exhaust or any other high temperature exhaust, flexible connection at the fan inlet and outlet shall be of double lobe grease and fire-resistant Neoprene sheets. Grease – tight access panels of sufficient size and shall have to be provided with 50 mm drain plug at the bottom of the fan for grease removal.

Tube Axial Fans (Direct Drive):

1. The fans shall be selected for heavy-duty operation. Fan housing shall be one-piece rugged steel construction. The fan shall be in accordance with IS-2312
2. Inline Ducted Tube Axial Fans in PP construction and coated with direct drive TEFC Sq. Cage induction motor and mounting brackets with nuts bolts etc. The framework should be suitable for wall mounting.
3. The motor shall be Flameproof / Non –Flameproof type & totally enclosed type, with capacitor start and run type motor, rated for continuous duty and rugged in construction. The motor shall have pre lubricated double ball bearing and shall be provided with class A / E insulation.

Testing And Balancing

2. After the installation of the entire system is completed in all respects, system shall be tested & balanced for required performance. Fan shall be tested for the performance and test results shall be furnished.

Painting

2. On completion of the erection and testing, fans shall be painted with the two coats of an appropriate paint of approved color.

FILTERS :

2. Filters shall be non-flammable 90% efficiency down to 10 microns. Filters shall be cleaned by dusting or reverse air blown.

Installation:

The concrete foundations required for the fans shall be prepared by the Contractor under Civil scope of work. The Contractor shall supply all foundation bolts, base plate, wherever required, vibration eliminators, etc. and shall also 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%. Fan inlet and outlet connections shall be by means of flexible canvas connections. Fan belt drive shall be complete with belts, belt, sheaves and suitable belt guard.

For all kitchen exhaust or any other high temperature exhaust, flexible connection at the fan inlet and outlet shall be of double lobe grease and fire resistant Neoprene sheets.

Grease – tight access panels of sufficient size and shall have to be provided with 50 mm drain plug at the bottom of the fan for grease removal.

Testing:

1. Fan shall be tested for the performance and test results shall be furnished as given in Section TEST READINGS'.

Painting:

1. On completion of the erection and testing, fans shall be painted with the two coats of an appropriate paint of approved color.

HVLS FAN

1. The Fan shall be CE certified & conforming to ALL Safety clauses below. Certification required along with supply & needs to cover the following standards
 - A. LVD: IEC/ EN 60335-2-80 & AS/NZ 60335-2-80
 - B. MD: EN ISO 12100:2010
 - C. EMC: IEC 61000-6-2 & IEC 61000-6-4 – (Industrial environment)
2. It should be made in India.
3. The Fan shall be complete with minimum 3 (preferably 5) extruded powder coated (or Thermoplastic Polymer) aluminum blades with Silver or Light Grey Colour.
4. The coverage of the fan shall be as follows
 - Minimum 15,000 Sq.ft. for fans above 3 blades (less than 1kw motor)
 - Minimum 30,000 Sq.ft. for fans above 4 blades (less than 1.4kw motor)
5. The Blades shall be Aerofoil shaped with a minimum blade width of 8" from nose to Trailing tip & shall have a PVC winglet at the end of each blade to minimize turbulence. This winglet will be at least 10mm taller at any one side (top or bottom of the blade).
6. The Blade Angle shall be up to 24.5° with a minimum of 21° to the horizontal plane, in order to eliminate span-wise pumping and tip stalling, thereby eliminating blade noise and preventing vibrations that can damage the blades .
7. Each Blade shall be affixed to a solid Powder coated Steel Hub each secured with Four zinc coated bolts, lock nuts and lock washers.
 - A. Stress Relieved Steel Topper profile matched to the Blade
 - B. Each topper shall feature a single safety tab which protrudes with clearance over the base of the Round motor frame to prevent detachment. Each topper shall be affixed to each blade and be Independent of each other. Must meet CE safety standards.
8. The hub shall be made from powder coated steel precision CNC cut & drilled to firmly support the blades and provide a safe connection to the motor/gear reducer.
9. The blades shall be connected to the hub by means of three (4) zinc-plated threaded bolts minimum 90mm long with Nylock nuts that are tightened to 200-ft-lbs to provide rotationally balanced blades and hub.
10. For additional safety purposes, Blade, Topper and Safety Ring should have a Sandwich construction.
11. A welded motor frame from steel tubing and 36 gauge steel plate, powder coated for maximum resistance to rust and corrosion shall house the motor/gear reducer and mount directly to a self levelling adjustable mounting system .
12. The fan shall be supported by a two-axis Self Levelling mounting system that is designed to prevent vibration and movement while supporting the weight of the fan . 5mm stainless steel safety cables shall tie together the beam, mounting system and motor/gear reducer.
13. Stabilization of the fan shall be provided by four (4) 3mm stainless steel guy wires to avoid unnecessary sway and large movements from the fan.
14. The HVLS Fan shall utilize up to a two (2) horsepower, IE2 high efficiency, 230/400VAC split voltage motor. It shall be a Totally Enclosed Fan-Cooled (TEFC) with an IP55 enclosure rating.
 - A. It shall have double coated magnetic wire insulation, Class H, and the Inverter/vector duty insulation system shall conform to NEMA MG1-2006 (or equivalent IEC standard), section 31.4.4.2 voltage spikes.

B. The moisture resistant varnish dipped windings shall be made of improved varnish materials and of inorganic insulating components for tropical protection .

15. The gear reducer shall be triple reduction in-line helical speed reducer with synthetic lubricant. The gear reducer shall be precision finished for long life and low noise level.

16. The HVLS Fan control should include a factory programmed UL Listed, IP54 Variable Frequency Drive (VFD) to provide a soft-start for the fan, variable speed control capability, current limit and motor overload protection for the fan & Each control shall be forward/reverse compatible and offer key pad or optional remote operation .

A. Fan control Certification required along with supply & cover ALL of the following standards

- Based on EU harmonized standards:
 - A. IEC61800-5-1 (2003)
 - B. EN50178 (1997)
 - C. IEC61800-3 (2004), Category C2
- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- UL 508C, Power Conversion Equipment + CSA C22.2 No. 274-13, Adjustable Speed Drives

B. The Fan control should have the following features

- Dual Limb DC Choke for Harmonics reduction meeting EN 61000-3-12 Standard
- 2 Line Alphanumeric detachable Keypad with Password protection facility.
- Built in PID Control
- Efficiency 98% or above with built-in chokes & EMC Filter
- Support MODBUS & Bacnet MSTP, Metasys N2 communication by default
- Cascade control feature & Fire-override mode, Sleep mode
- Faults & Alarms : IGBT Over temperature, Input Phase loss, Voltage imbalance, output short circuit, Overcurrent, Over voltage, Under voltage, Belt failure detection.

17. The Manufacturer / Re-seller should have minimum 5 years of experience in this field in India with reputable installations still working today

2.4.7 FLOW CONTROL DEVICE

Constant Airflow Regulators shall solely operate on duct pressure and require no external power supply. Each regulator shall be pre-set and factory calibrated, requiring no field adjustment to the airflows as indicated on the schedule, and shall be rated for use in air temperatures ranging from -25° to 140°F (-32° to 60°C.) Constant Airflow Regulators shall be capable of maintaining constant airflow within +/- 10% of scheduled flow rates (15% for units 50 CFM or less), within the operating range of 0.2 to 0.8 in. w.g. differential pressure, or 0.6 to 2.4 in. w.g. on high-pressure models, or 0.1 to 0.42 in. w.g. on low-pressure models. Regulators shall be provided as an assembly consisting of a 94V-0 UL ABS plastic body housed within a round sleeve for mounting in round duct. Each round sleeve must be fitted with a lip gasket to ensure perimeter air tightness with the interior surface of the duct.

2.4.8 ELECTRICAL INSTALLATION

Scope

Scope of this section comprises the supply and installation of all electrical equipment such as motors, motor control centers, starters, cables, interlocks, etc. as required.

Codes, Standards and Statutory Regulations

Codes, standards and statutory regulations to be used for design and constructions are given below. In general, all equipment, material as well as design and constructions shall be in accordance with the

latest issues of Indian and relevant standards currently in force. The installation shall be carried out in accordance with the Indian Electricity Act and Rules.

Electric Supply System/Rated Voltage

415 volts, 3 phases, 4 wire, 50 Hz with solidly grounded neutral.

Variation in electric supply under which motor shall be operated continuously without any adverse effect will be as follows:

- a) Voltage : +/- 5%
- b) Frequency : +/- 5% variation
- c) Any combination of voltage and frequency.

Equipment and Materials

All equipment shall be as per specifications, and/or drawings supplied along with the tender documents. Equipment/materials shall be suitable for local climatic conditions as specified in the tender.

All equipment shall be of robust construction. Enclosure of equipment shall be dust, damp and vermin proof. Equipment for outdoor installation shall have weather proof enclosures requiring no further protection by the purchaser.

Approval

The Contractor shall be responsible for obtaining approval of drawings from statutory/local authority as required.

Motor Control Centre

Motor control Centre shall consist of incoming switch fuse units/isolator and a starter mounted inside the wall or floor mounting type cubicle made out 2 mm thick MS sheet. Anti-corrosion and phosphatizing treatment shall be given to the sheets by a standard 5 tank/7 tank process.

All feeders shall be provided with two position (on-off) isolators, load break and quick make and break type. All isolators shall be suitable for front of board operation. Isolators for motor feeders shall preferably be of the 'motor duty' type i.e. capable of interrupting the locked rotor current of induction motors, which will be 6/8 times the full load current.

Isolators shall be interlocked with door to prevent opening or closing of the door in the closed ('ON') position of the isolator, in case of compartmental type of feeders. All live terminals on the isolators shall be adequately shrouded to prevent accidental contact and danger to the personnel.

Caution name plate "CAUTION LIVE TERMINALS" shall be provided at all points where the terminals are likely to remain live and isolation if possible, only at remote ends e.g. Incoming Terminals of Incomer.

Fuses & Fuse Fittings

All fuses shall be of the non-deteriorating, high rupturing capacity, link, mounted in suitable fuse carriers or fuse bases.

Contactors

1. Contactors shall be magnetic, air brake type, generally in accordance with BS 775/IS 2959.

2. All contactors in power circuits of motor starters or other feeders shall be adequately rated for the duty required and operating conditions. Minimum rating shall, however, not be less than 16 amps.
3. Contactor coils shall preferably be of draw out type for easy replacement. Coil voltage shall be 220V AC. Contactor coils shall operate satisfactorily between 110% and 85% of the nominal coil voltage. Drop off voltage for AC coils shall be between 80% and 45% of the nominal voltage.
4. Making and breaking capacities of the contactors shall be suitable for AC2 and AC3 categories of duty as per IS 2959 unless the contactors are required for special duty such as inching or plugging duty or capacitor duty, in which case, they will be suitably rerated.
5. Each contactor shall be provided with 4 normally open and 4 normally closed auxiliary contacts or as required by the control scheme. If necessary, auxiliary relays or contactors may be provided to obtain necessary number of auxiliary

Contacts. Auxiliary contacts shall preferably be convertible from NO to NC and vice versa.

Protective Devices

All feeders shall be protected by appropriate protective devices such as fused, combined bimetallic thermal overload and single phasing preventer relays.

Single phasing preventer relays (SPPRS) shall operate on the principle of unbalanced currents due to single phasing. BMR's and SPPRs shall preferably have a changeover contact which can be converted from hand reset to self-reset and vice versa and used for contactor control as well as alarm/indication.

Current transformer, when specified, shall be of bar primary, ring type or wound type, and in accordance with IS 2705 or BS 2046 or BS 81. Class and ratio of CTs shall be specified. VA burden of CTs shall be suitable for the load burden.

Ammeters (144 square) voltmeters, PF meters, Run Hour meters and Kilowatt Hour meters shall be provided and shall be of industrial grade accuracy, suitable for flush mounting and in accordance with IS 1248. Suitable selector switches shall be provided in conjunction with ammeters and voltmeters.

Indicating Neon lamps used shall be of low voltage, low burden type with series resistor to increase lamp life and to protect equipment from short circuits caused by broken filaments. Lamp covers shall be provided with interchangeable colored lenses of Perspex or equivalent unbreakable materials. Lenses should not get discolored in course of time, due to the heat generated by the lamps. Name plates showing the condition indicated by the lamp shall be affixed near to the lamps.

Rating of terminal blocks for power and control circuits shall be at least 30 Amps and 15 Amps respectively. Terminals in control circuits shall be suitable for receiving one conductor per terminals of specified sizes. Terminals for power circuits shall be designed for receiving aluminum conductors and shall be screw clamp type or equal. Terminals for control circuit shall be suitable for receiving copper conductors. Star/Lock/Shake proof or Spring Washers shall be provided to prevent sparking due to vibrations. Special terminals with copper strips mounted on insulating supports may be provided for large cables. Where terminals, suitable extension bars with off-set may be provided. Location of controls for motor starters or other feeders shall be specified. Normally one 'stop' push button with stay-put feature (lockable) and one reset push button for hand resetting of BMR shall be provided on the door of the compartment. Colors used for push buttons shall be as follows:

Stop push button	- Red
Start push button	- Green
Reset push button	- Black

(Note: In case 'Stop', and 'Reset' are combined, only red colors will be used.) Name plates indicating the function of the push button shall be affixed near to the push buttons.

Wiring

Internal wiring of MCCs for power and control shall be carried out with copper conductor PVC insulated cables of PVC covered copper/ aluminum tapes.

Wiring of components mounted on doors shall be carried out with single strand 2.5 sq. mm copper conductor flexible cables. Wires and cables shall be neatly arranged and bunched together with suitable clamps made of insulating material. Wire harnesses shall be adequately supported along the MCC metal work.

Identification ferrules or tags shall be attached to each wire at each point connection.

Sizes of conductors for power wiring shall be determined by the manufacturers on the basis of full load current under specified conditions, protective fuse rating and appropriate rating factors as applicable. Minimum size of conductor shall be 2.5 sq. mm Minimum size of conductor for control wiring shall be 1.5 sq. mm.

The following color code shall be used for determining the colors of wires used for internal wiring. Manufacturer shall obtain specific approval of the purchases, if this color coding cannot be observed for any reason whatsoever:

Earth	- Green
Neutral	- Black

230V, A.C. phase	- Red/Yellow/Blue,
To neutral	- Black

All wiring shall be carried out in accordance with approval and certified panel wiring diagrams. Vendor shall check all wiring from point to point for correctness. All wires shall be numbered, and the numbers shall be indicated on the relevant drawings.

Earthing

All metal work of the MCC and non-current carrying metallic parts of the equipment in the MCC shall be securely bonded together by adequate means e.g. use of earthing washer for bolted connections or tapped holes for mechanical connections. One copper earth bus running through the entire length of the MCC shall be provided preferably along with the terminal chambers. Size of the earth bus shall be such as to withstand phase to earth or 2 phases to earth short circuit for one second. The minimum size of the busbar shall be 25 x 3 mm. The terminals complete with hardware and cable sockets shall be provided on the earth bus for connection to external system.

Name Plates and Labels

1. One name plate giving designation of the MCC shall be affixed prominently on to the MCC. (Details of designation will be given). Each feeder shall also be labeled giving following details:
 - i) Feeder No.
 - ii) Feeder Designation (Eqpt.Ref.No.etc.)
 - iii) Description
 - iv) Rating (HP/KW/Amps)
2. All components whether mounted inside the MCC or on the door shall be permanently and clearly labeled with their reference number and/or letter or their function (rating of fuse shall form part of the fuse designation).
3. Labels for feeder designation shall be of laminated plastic or rear engraved Perspex with white letters on black background.

4. Labels for feeder designation shall be fixed on the doors on respective feeders with chrome-plated self-tapping screws. Designation labels shall be identical in size to permit interchanging if required later.

Miscellaneous

All hardware used shall be plated or passivated to resist corrosion. Type of plating or passivation shall be subject to the approval of the Consultant. All fixing screws shall preferably be raised head type.

Drawings

1. Contractor shall furnish the following to the Consultant for his approval before commencement of fabrication:
 - a. General Arrangement Drawing showing overall dimensions, arrangement of feeders, foundation plan, positions of cables entries, weight of MCC and sections in which MCC will be dispatched.
 - b. Single Line Diagram for the MCC showing rating of various components used for all feeders complete with feeder numbers, designations, descriptions, ratings, etc.
 - c. Schematic and panel wiring diagrams for all feeders.
 - d. Terminal plan for MCC, showing feeder numbers, terminal numbers and terminal markings.
1. After the final approval, six prints and one clear film reproducible of each of the above drawings shall be furnished.
2. The Contractor shall note that he shall bear full responsibility for any error, discrepancies, omissions, etc. in the drawings irrespective of whether such drawings have been approved or not. Approval of drawings shall not relieve the Contractor of his liability to complete the work in accordance with the specifications and other conditions of contract nor shall it exonerate the vendor from any of his guarantees.

Testing and Inspection

1. The following tests shall be carried out on the Motor Control Centers after completion of all work:
 - I. All power and control circuits for MCCs shall be tested for insulation resistance with a 500-volt megger, before and after the high voltage test.
 - II. High voltage test shall be carried out on all power and control circuits at 2000 volts A.C. voltage applied for one minute.
 - III. Low voltages continuity test on all power circuits shall be carried out from busbars to the outgoing terminals of each feeder with switches and contactors in closed position.
 - IV. All control circuits and operations of equipment for all feeders shall be checked with only control supply made available to ensure satisfactory operation of all equipment such as push buttons, BMR reset, indicating lamps, timing relays, etc. All contactor coils shall be checked for presence of humming or chattering. Special requirements for various feeders indicated in the purchase data sheets shall also be checked.
 - V. Earth continuity test shall be carried out with a low voltage supply of not more than 6 volts, between various non-current carrying metallic parts of equipment, steel work, etc. and the earth bus provided in the MCC.
 - VI. Operation of all instruments and meters provided on the MCC shall be checked.
1. All the tests listed above shall be carried out in the presence of Owner's representative, during final inspection. Contractor shall provide all facilities such as power supply, testing instruments and apparatus required for carrying out the tests.

2. Contractor shall give a notice of not less than two weeks for inspection and testing by the Owner's representative.

Electric Motors

Rating & Duty

1. Rating of the motors shall be as indicated in the Schedule of Equipment. Where the equipment supplied needs a higher rated motor, the Contractor shall clearly point out and motors shall be offered accordingly.
2. All motors shall be rated for continuous duty at maximum output.
3. Rated voltage for three phase motors shall be 415 volts.

Design Features

1. Motor body shall be of close grained cast iron construction and shall be provided with lifting hooks or eye bolts. The motor along with the fan and half coupling shall be dynamically balanced.
2. Fan provided for fan cooled motor shall be non-directional type.

Enclosure/Protections

1. Enclosure for motors shall be totally enclosed fan cooled (TEFC) unless otherwise specified - SPDP motors shall be used only where the desired output is not obtainable in a TEFC frame.
2. All outdoor motors shall be TEFC weather proof type.
3. Degree of protection for all motors shall be IP 44 as per IS 491.
4. Two earthing terminals comprising terminals studs, two plain washers, one spring washer and nut shall be provided on opposite sides of the frame. Studs shall be suitable to receive appropriate size of earth conductor.

Bearings

All motors shall have ball and/or roller bearings with limit lubricators.

Terminal Box

1. Terminal box shall be of ample size, suitable for termination of aluminum conductor cables (with cable sockets) which may be substantially derated for conditions of installation.
2. Motor terminals shall be of stud type, substantially designed and well insulated from the frame. Each terminal shall be complete with two flat washers one lock nut.
3. Number of terminals shall be as given below:
4. Squirrel Cate Motors upto 3.7 Kw - 3 Nos.

Squirrel Cage Motors upto 3.7 Kw
(With tinned copper links for
delta connection) - 3 Nos.

Slip Ring Motors - 3 Nos.

5. Terminal boxes of all motors shall be rotatable in steps of 90 degrees, without disturbing the motor winding connections to the terminal block. Separate terminal box shall be provided for connections to anti-condensation heaters in case of

Motors about 50 HP. If heater terminals are provided in the main terminal box, then insulating barrier shall be provided between them with caution name plate affixed on the terminal box. "CAUTION - LIVE HEATER TERMINALS."

6. Separate terminal boxes for starter and motor leads to be provided for slip ring motors. Where it is not feasible, an approved type of insulating barrier to be provided.

Temperature Rise

The temperature rises of motors when tested in accordance with IS 325 shall not exceed the limits specified therein.

Starting of Motors

1. All squirrel cage motors shall be suitable for full voltage starting. Motors of 10 HP and above will generally be started with star/delta or auto transformer starters which, in addition to protective devices, shall be provided with single phasing preventer.
2. Starting current at full voltage of slip ring motors shall be limited by the rotor resistance starter. Motor manufacturer shall furnish appropriate value of external resistance required to limit the starting current as well as to obtain the required torque. However, starting current with slip rings shorted shall not exceed 600% of full load current. Starting current of squirrel cage motors with full voltage starting shall not exceed 600% of the full load current with tolerance specified in IS 325.
3. Starting torque of squirrel cage motor started on full voltage shall not be less than 200% of the full load torque. Pull out torque of motors shall not be less than 200% of the full load torque.

Insulation

1. All motors shall have Class 'D/F' insulation unless the ambient temperature or other conditions necessitate another class of insulation.

All materials used in the construction of motors shall be non-hygroscopic.

Painting

All motors shall be painted in an approved manner using two priming coats and two finish coats. The final color shall be to the Owner's requirements.

Performance Particulars

1. Following performance particulars for all motors to be furnished well in advance before finalizing orders for motors:
 - a) Make
 - b) Type
 - c) Enclosure
 - d) Class of Insulation
 - e) Temperature Rise above 40 Deg.C ambient

- f) Rated Output
- g) Speed
- h) No load currents
- i) Full load current
- j) Locked rotor current
- k) Starting torque (DOL)
- l) Efficiency at full load, 3/4 load, 1/2 load
- m) Power factor at full load, 3/4 load, 1/2 load
- n) Details of rating for space heater
- o) Max. Size of aluminum conductor cable which could be connected to motor
- p) Rotor current at rated output
- q) Value of rotor resistance for different torque values

MV Distribution Boards

Construction

1. The salient features of constructions panels shall be as follows:
2. Sheet Steel - 2 mm thick for frames, cable gland plates and equipment
Mounting plates and 1.6 mm thick for front and rear
Doors and covers
3. Welded construction, with shipping section bolted together. All such joints to be gasketed. Lifting lugs to be provided.
4. The cubicles shall be totally dust and vermin proof conforming to IP 54 of IS 2147.
5. All doors to be hinged type except busbar chamber covers which shall be bolted type. The panel shall be of flush front design, suitable for access from front and rear.
6. The construction shall be such as to facilitate easy extension at both ends.
7. The design shall be such as to have individual feeders in separate compartments, with proper barriers between adjacent feeders, busbar chamber and cable box chambers.

Painting

1. All sheet steel work shall be properly cleaned and degreased. Rust and scale shall be removed by picking and phosphatizing. After phosphatizing, two coats of primer shall be applied followed by two coats of finishing synthetic enamel paint of approved shade as per IS-5. The painting shall be stove enameled.

Air Circuit Breakers

1. The circuit breaker shall be air-break, horizontal draw-out feature shall show 3 positions viz. SERVICE, TEST and ISOLATED. These positions along with 'OPEN' and 'CLOSE' positions shall be visibly marked.

2. All positions shall have provisions for locking. The ACB shall have shutter assembly and arc-chutes and mechanical trip features.
3. The ACB shall have 6 NO + 6 NC auxiliary contacts rated at 10 A, 240 V, AC.
4. 'RED' and 'GREEN' indicating lamps shall be provided on the cubicle.
5. The ACB door shall not have any lamps or instruments. All such accessories shall be mounted on a separate compartment.
6. The ACB shall have proper interlocks such that it cannot be 'plugged in or out" 'SERVICE' position, if the breaker is in 'ON' condition. It shall not be possible to operate as circuit breaker unless it is properly engaged in any of the three positions.
7. The ACB shall have series CI operated over- current and short-circuit releases with facilities to mount the under voltage and shunt-trip releases.
8. The operating mechanism shall be independent, manual spring charged stored energy type. The mechanism shall ensure quick-break, quick make action and the ACB shall be trip-free in operation.

Air Brake Switches

1. The air brake switches shall be of AC23, (heavy) duty, quick make-quick break, fault- make type as per IS 4047. The contacts shall be silver plated.
2. The switches shall be capable of withstanding the mechanical and thermal stresses produced by overloads and short circuits.
3. All switches of all ratings shall have inter- locks with the compartment doors. Switches of 250 A and above shall be lockable in the 'OFF' position. All live parts shall be shrouded. It shall be possible to intention- ally defeat the interlocks if required.
4. 'RED' indicating lamp shall be provided for 'ON' indication.

Fuses:

All fuses shall be of HRC cartridge fuse-link type having a certified rupturing capacity of not less than 46 KA at 415 volts AC. The HRC fuses shall conform to IS 9224 1979. All fuses shall have visible indication to indicate 'Blown' condition.

HRC Fuse Carriers

1. The HRC fuse carriers/bases shall be of high-grade phenolic moldings. The contacts shall be silver plated, and the contact blocks shall be suitable to receive the rated conductors of aluminum.
2. The fuse carriers shall have an aperture to view the conditions of HRC fuse mounted inside.

Contactors

1. The motor starter contactors shall be of the electro-magnetic, double-break, non-gravity type rated for uninterrupted duty suitable for operation under AC 3 utilization category as per IS 2959. The contacts shall be silver plated.
2. 2 NO and 2 NC auxiliary contacts shall be included.
3. The operating coils shall have Class 'E' insulation of wire and shall be suitable for operation of any specified control supply system.

Thermal Overload Relays

1. The thermal overload relays shall be 3 element, positive action, ambient temperature compensated with a time lag and adjustable settings. The setting range shall be selected in accordance with the ratings of the motor.
2. The relay shall be self-reset/hand reset as called for in the case of hand-reset, the reset button shall be fixed on the compartment door.
3. The relay shall have at least one 'NC' and one 'NO' or one change-over contact.

Moulded Case Circuit Breakers

1. The Moulded case circuit breakers, MCCBs shall be provided where certified. The MCCBs shall conform to the latest applicable IS 2516-1977.
2. For AC Circuits the MCCBs shall be triple pole construction and shall have independent manual opening and closing mechanism. The mechanism shall be quick-make and quick-break type and the breakers shall be trip-free in operation. The 'ON', 'OFF' and 'TRIP' mechanism shall be clearly indicated.
3. Bolted type neutral link to be provided with TP MCCB.
4. It shall be possible to mount accessories on the MCCBs like shunt-trip and under voltage release, alarm contacts, etc.
5. The MCCBs shall have thermal/static trip devices.
6. The MCCBs shall have rupturing capacities as specified in BOQ/Single Line Diagram.

Miniature Circuit Breakers

1. The MCBs shall be of single pole, double pole, triple pole or four poles as required. The MCBs shall be of magnetic type with a maximum rupturing capacity of 9 KA at 415 V.

Current Transformers

1. The CTs shall be of dry type and shall have short-time withstand rating equal to the short-time withstand rating of the associated switchgear for 1 second.
2. The measuring instrument CTs shall be of 15 VA, minimum accuracy class 1.0 and an instrument safety factor of 5.
3. The protection relay CTs shall be of 15 VA, minimum accuracy class 5P and an accuracy limit factor of 10.

Indicating Instruments and Meters

1. Electrical indicating instruments shall be 72 mm/96 mm/144 mm square size, suitable for flush mounting.
2. The zero adjustment shall be done from outside the cover.
3. The dials to be parallax free with black numerals on a white dial.

Indicating Lamps

1. Indicating lamps shall be of the filament type and of low watt consumption, provided with series resistors and HRC fuse link for protection.

2. The lens shall be easily replaceable from the front.

Control and Selector Switches

1. The control and selector switches shall be of rotary type, adequately rated for the application but with a minimum rating of 10 Amps at 240 V AC and 1 Amp at 220 V DC. The plates shall have clear position markings.
2. The control switches shall have pistol grip handles spring return to normal. The selector switches shall have oval knobs and shall be contact stay-put type.

Push Buttons

1. The push buttons shall be of the momentary contact, push to actuate rated for 10 A at 240 V AC and 1 A 220 V DC. The 'START' push buttons shall be green and shrouded. The 'STOP' push button shall be red and unshrouded. All other push buttons shall be black.
2. The elements shall be enclosed with 1 'NO' and 1 'NC' contacts. It should be possible to add on easily extra elements to increase the number of 'NO' and 'NC' contacts.

Main and Auxiliary Buses

1. The busbars shall be of high conductivity aluminum alloy of E91E grade. The busbar shall be of uniform cross-section throughout the length of the panels.
2. All main and auxiliary busbars shall be insulated with sleeves. The sleeves shall be of high dielectric strength, non-corrosive and of phase and neutral colors.
3. The busbars shall be supported on cast epoxy/ resin/DMC/Fiberglass insulators and the spacing of the supports shall be such as to withstand the stresses of the short circuit currents. The busbar spacing's shall be adequate for 3 phase voltage upto 600 V.
4. The busbar shall be a chosen for specific current ratings with a minimum density of 1 amp for sq.mm area.

Internal Wiring

1. All internal wiring shall be carried out with 1100 V/650 V grades PVC insulated, stranded conductor copper wires. The minimum size of wires shall be 2.5 sq.mm copper and for CTs also 2.5 sq.mm copper.
2. All individual control and CTs wiring shall be labeled with engraved identifications ferrules, yellow in color with black letters.
3. All wiring shall be terminated on stud type terminal blocks through crimping sockets. No more than one connection shall be made on any one terminal block.
4. All spare auxiliary contacts of contactors and relays shall be wired to control terminal blocks.

Terminal Blocks

1. Terminal blocks for power and control shall be of reputed make stud type, with washers, nuts and locknuts. All adjacent terminals shall have insulating barriers.
2. All power terminal blocks shall be appropriately rated for current with a minimum of 30 Amps. The control terminal blocks shall be rated for a minimum of 10 A and suitable for at least 2 conductors each of 2.5 sq.mm.

3. All sets of power and control power terminal blocks shall be identified with engraved plastic labels, black background and white letters.

Identification Labels

1. All labels shall be black plastic with white engravings of letters of minimum 6 mm sizes.

Earthing

1. All switchgears shall have continuous run of earth busbar. The size and materials of the earth bus- bar shall be specified.

Tariff Advisory Committee and CPRI Tested

The switchgear shall be approved by the Tariff Advisory Committee (for Fire Insurance) and CPRI tested for short circuit test and enclosure test.

Tests

1. High Voltage test at 2.5 KV.
2. Power and Control Circuits Continuity Tests.
3. Insulation Resistance Test with 1000 V Meggar.
4. Operational Test.
5. Three Sets of Test Certificates to be submitted.

Drawings

1. Three sets of general arrangement drawings and wiring diagrams of all types of feeders shall be submitted.

Control Stations

1. Control station shall be of cast iron or cast aluminum enclosures, consisting of 'START' and 'STOP' push buttons and shall have stay put feature of twist unlock type.

Cable and Accessories

1. All cables shall be heavy duty PVC insulated armored and PVC sheathed of 1.1 KV grade. Aluminum conductor cables shall be used for power and copper conductor cables shall be used for control wiring.

Glands

1. Glands used for termination shall be compression type. Cable glands shall be with single/double seal and cone and clamp for armored clamping.
2. For safe and indoor areas, glands with single seal and for outdoor installation and hazardous areas, gland with double seals will be used. For use in corrosive areas, glands shall be coated with rust proofing lacquer after installation and provided with PVC hoods.
3. Cable lugs shall be of Dowell or equivalent approved make, suitable for connection of aluminum conductor cables. The cable lugs shall be of tinned copper and of soldering type for solid conductor cables. For stranded conductor cables, crimping type, tinned copper cable lugs shall be used.

Conduits and Accessories

Conduits wherever used with prior approval of the Contractor shall be of GI heavy gauge/black enameled/PVC. All accessories, such as junction boxes, shall be duly approved by competent authorities. Terminal blocks of adequate rating are to be provided in the junction boxes.

Saddles

Saddles to be used for cleating cables or conduits shall be fabricated from MS or aluminum strips or any other approved material and shall be painted and dried before installation with chemical works type paint.

Cable Tags and Identification Ferrules

Cable tags and identification ferrules provided on cable cores/wires shall be of PVC/plastic. Cable tags shall be provided at every 15 meters and at all bends or change in routes.

Structural Steel

This shall include MS angles, channels, flats, etc. required for fabrication of cable trays, local supports for cables, control stations, etc. All steel sections shall be new and conform to IS 226.

Miscellaneous Materials

These shall include solders, fluxes, adhesive insulating tapes, PVC sleeves, petroleum conducting jelly, etc.

Earthing Material

Copper strips or wires of suitable sections shall be used for earthing in accordance with IS 3403.

All 3 phase 415 Volts equipment shall be earthed at two points and all single Phase equipment at one point.

Painting

All metal work and metal parts of the MCC shall be thoroughly cleaned to remove rust, scale grease or any other matter. Suitable anti-corrosion treatment such as phosphatizing shall be given to the metal work. All exposed surfaces of the metal work shall then be given a priming coat of zinc chromate or equivalent and finished with two coats of paint of specified shade.

Drawing

Contractor shall submit 3 copies of control of schematic wiring diagram for refrigeration unit showing all protections and interlocks for Consultant's review and approval. After the final approval six prints and one clear reproducible of each drawing shall be furnished.

Installation

Motor Control Centers

Motor Control Centers shall be installed on welded construction channel framework. Framework shall be properly grouted by means of foundation bolts or anchor fasteners.

Cable Laying

As far as possible, cable shall be run in built-up trenches and on walls/ceiling. Cables shall be dressed and clamped to the wall/ceiling by means of GI strap saddles of minimum 3 mm thickness. Cables shall be kept away from wall ceiling by saddle bars of at least 6 mm thickness. Cables running in built-up trenches shall also be properly clamped when cable run

is on side walls of trench. Cable entry into the building shall be through suitable GI pipes or hume pipes or trenches. All cable entry openings into the buildings shall be properly sealed with cold setting, PVC compound or other approved materials.

Cable Termination

PVC cables shall be terminated with compression type glands. For outdoor installation double seal compression glands shall be used. All cables shall be connected by means of suitable crimping type cable lugs. All connections shall be secure and vibration proof. All contact surfaces shall be coated with petroleum conducting jelly before connections are made.

Earthing

All metallic framework and non-current carrying metallic parts and enclosures of electrical equipment such as MCCB, motors, control station, etc. shall be bonded to one another and earthed by means of two separate earth conductors and connected to the plant earthing system

Motors

All motors shall be installed on a common foundation with the driver equipment coupled through flexible couplings or belt drive. levelling and alignment of motor and driven equipment to be carried out as per IS 900 to avoid undue strain on motors. Insulation resistance of motor shall be measured before commissioning. In no case insulation resistance should be less than one Meg ohm. If it is less than one Meg ohm motor should be dried out as per procedure laid on IS 900. Pre- commissioning mechanical checks shall be carried out as per IS 900. Cable termination and earthing of motors shall be carried out by Electrical Contractor.

On commissioning of motor, any defects like excess current, bearings getting hot, undue vibration or noise etc. are observed; it will have to be made good by the Contractor without any extra cost.

Testing and Commissioning

Operation Test

1. Energies only control circuits and carry out closing and tripping operations. (Where AC supply derived from main supply is used for operation, the switchgear bus may be energized). Check tripping of circuit breakers by manual operation of protective relay contacts. Check operation of mechanical closing and tripping devices. Check lockout conditions for closing of circuit breakers by simulating the required conditions. Check control, indications, sequence interlocks and alarms.
2. Polarity and connections of instrument transformers check for correctness of CT and PT connections provided with transformer. Check electrical continuity of secondary circuits with ELV tester. Adjust spacing of arcing horns/rod gaps.
3. Check operation of instruments, meters, relays and tripping of circuit breakers by primary/secondary injection as specified. This test will be carried out only if specifically called for by Contract Documents.
4. Check continuity of power circuits and earth continuity of all non-current carrying metallic parts with a low voltage (6V or less) continuity tester.
5. Carry out IIV test on power and control circuits if specifically called for in Contract Documents.

Motors

Check equipment for free movement of rotor and play, lubrication and for any other mechanical defects and direction of rotation.

Check commutators, slip rings, brushes, brush- holders, etc. for satisfactory conditions. Insulation test of motors between winding and ground. Use 500 V megger for MV motors and 1000 V megger for HV motors. Check electrical continuity with ELV tester.

Control Cables

Carrying insulation test on all power and control circuits. Check all equipment for satisfactory operation and correct wiring.

Wiring

1. Insulation test between phases, between each phase and neutral and between each phase/neutral and ground.
2. DC High Voltage Test on HV Cables in accordance with the relevant Indian Standards and Code of Practice. This test shall be carried out on cables, installed in final position and all joints and terminations have been made. The cables, however, may not be connected to the equipment so that the equipment may not be subjected to the test voltage.
3. In case of lighting wiring, insulation test shall be carried out on lighting feeders with branch circuits open. Branch circuits shall be tested separately with lamp holders, plug receptacles and lighting fittings in position but without lamps. In case of lighting circuits with lamp ballasts and glow starter's insulation resistance may be measured between phase and ground only.
4. In case of directly buried cables, insulation resistance of cables shall be measured before and after the back filling. Test all receptacles for correct phase sequence.

Earthing System

Continuity test for earth continuity conductors with ELV tester.

Operation test

After successful completion of the above tests, operational tests shall be carried out by the Contractor for checking the connections done by him and satisfactory operation of all the equipment supplied by him. This test shall be carried out initially without energizing power circuits. Various control conditions shall be simulated for the purpose of this test. Any defects detected during the tests such as blown fuses, damage to devices, shall be rectified by the Contractors, free of cost.

2.4.9 TECHNICAL DATA FOR ALL MAJOR EQUIPEMENTS

Technical data shall be furnished as follows:

- 1.0 VRV / VRF OR Dx Refrigeration system
 - a) Manufacturer
 - b) Type of Unit -
 - c) Overall dimensions
 - d) Operating weight
 - e) Approx. noise level (db)
 - f) Capacity in HP – IDU
 - g) Total static pressure (ins W.G.)

Cooling Coils:

- a) Coil fin material
- b) Fin thickness
- c) No. of fins
- d) No. of rows deep
- e) Tube dia. (ins)

Filter Section:

- a) Pressure drops through filter When new (ins. WG)
- b) Efficiency

2.0 Ventilation & Exhaust Fans:

- a) Manufacturer
- b) Fan discharge position
- c) Speed (rpm)
- d) Fan dia.
- e) C.F.M.
- f) Motor (hp) and make
- g) Static pressure (ins. WG)
- h) Balance (static and/or dynamic)

3.0 Insulation:

- a) Manufacturer
- b) Material
- c) "K" value

4.0 Controls:

- a) Manufacturer
- b) Thermostat type
- c) Humidistat type
- d) Damper motor type

5.0 Electric Motors:

- a) Manufacturer
- b) Type of motor and frame reference
- c) Rated output (hp)
- d) Range of working voltage
- e) No. of phases and phase connections
- f) Nominal frequency

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- g) Rated speed (rpm)
- h) Rated current (amps)
- i) Class of insulation
 - j) Temperature rise with cooling air at 40 Deg.C
 - k) Efficiency and power factor

6.0 Switch Gear:

A. Circuit Breakers

- a) Manufacturer
- b) Symmetrical short circuit at 415 volts
- c) Normal current (amps)

- d) O/L and E/F trip

2.4.10 MODE OF MEASUREMENT

1 Piping

Measurement of all piping shall be on the basis of Centre-line measurement described below:

Piping shall be measured in units of length along the Centre line of installed pipes including all pipe fittings, wastage, allowances, Pipe / Puff supports, flanges, gaskets, nuts & bolts, unions, bands, elbows, tees, concentric / eccentric reducers, inspection pieces, expansion loops, etc. The above accessories shall be measured as part of piping length along the Centre line of installed pipes, and no special multiples of pipe lengths for accessories shall be permitted.

Only refnet joints as Tees and Y joints shall be paid separately as they are not part of refrigerant piping. All painting, labling, shall form part of the cost of equipment, piping, etc. No separate payment shall be admissible.

2 Sheet Metal Work

Sheet metal work shall be on the basis of measurement described below:

All Sheet metal ducting complete with ducts, supports, hangers, vibration isolation pads, turning vanes, girth angles, flanges, gaskets& food grade sealant, access panels erected in position shall be measured externally on the finished areas of the ducting and paid per unit area.

All manual control / splitter dampers sections with operating linkages, supporting, etc shall be included in the duct area. The price of dampers shall have to be included in the sheet metal installed ducting price. No separate payment shall be admissible.

Tapered rectangular ducts width & depth shall be considered for perimeter whereas for tapered circular ducts the diameter of the section midway between large & small diameter shall be adopted. The length of tapered duct section shall be the Centre line distance between the flanges of the duct section.

The quoted unit rate for external surface of ducts shall include all wastage, allowances where specified or required, inspection chambers / access panel with splitter damper and quadrant / lever for position indication and other accessories. These accessories shall not be separately measured nor paid for.

The measurement of ducts shall be carried out before applying insulation.

3 Insulation

Area of external duct insulation finished as per specification shall be calculated on the basis of finished duct area before insulation including flanges (including double cover of min 200 mm over flanges), dampers, VAV boxes, installation accessories, etc and paid at unit area.

Acoustic insulation shall be calculated on basis of external duct size including nut bolt, flanges, aluminum perforated sheets, all supporting accessories and paid for per unit area.

Room acoustic insulation shall be calculated on basis of finished installed area including all accessories and paid for per unit area.

All pipe insulation shall be linear length through fittings and valves. Pipe shall be measured along the length of the pipe including flanges, coupling, gaskets and all installation accessories. It is to be clearly noted that for the insulation measurement all these accessories including cladding, valves, orifice plates & strainer shall be considered strictly by linear

measurement along the Centre line of pipes and no special rates shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

4 Grilles

Air distribution items shall be measured by the cross-section area.

Grilles / Diffusers, Linear diffusers (to be measured in Rmt / nos.) fire dampers, shall be measured based on cross-sectional area including flanges, mounting arrangements, nuts & bolts (inspection pieces / door with electrical actuator & panel for fire damper), aluminum opposed blade volume control dampers shall form part of supply air diffusers and shall not be separately measured nor paid for. Flexible insulated fiber glass ducting to be measured in Rmt, same as sheet metal ducting with all accessories. Curvature / Round grilles to be also measured in Rmt.

5 Electrical installation

Cost of motors, electrical panel, power and control wiring with GI tray, safeties, installation, all accessories shall be included in the cost of driven equipment (wherever indicated with equipment). Power cables, cable tray & earthing to be measured in Rmt. Cable terminations in double compression gland to be measured in numbers.

Panel shall be counted as no. of units. Quoted rates shall include as lump sum and not measurable length. All internal & power wiring, earthing connections from the control panel to the starter and motor / control wiring for interlocking, safety controls, control wiring for remote start / stop and automation as well as indication as per the specifications. The quoted rate of panel shall also include all accessories, switchgears, contactors indicating lights, meters, Safety controls & interlocking, VFDs as per the specification and schedule of quantities.

The unit rate for cables include the cost of cables & clamps & GI tray installation, testing & commissioning, cable markers, ceiling support. No payment shall be made for left out and installed cut cable pieces.

The rates for cable termination work shall include the cost of copper / aluminum lugs of suitable size, Ni-Cd double compression cable glands etc.

Rubber mat shall be provided in front to cover the full length of all panels, where back space is provided for working from the rear of the panel, Rubber mat shall also be provided to cover the full length of panel. Cost to be included in panel cost.

6 General Notes

- i) Cost of painting, galvanization of all equipment, piping, etc. shall be included in each item, and no extra shall be paid.
- ii) MS Structural work except mentioned above to be measured in Kgs.

2. LIST OF RECOMMENDED MATERIALS FOR MECHANICAL AND ELECTRICAL WORKS

Note:

1. The Contractor shall obtain prior approval from the Principal, Hindu College, before placing order for any specific material or engaging any of the specialized agencies. The Contractor shall make a detailed submittal with catalogues and highlighted proposed specifications, as well as full details of the works proposed to be executed by the specialized agency, as specified.
2. Wherever applicable, the Principal, Hindu College, may approve any material equivalent to that specified in the tender subject to proof being offered by the Contractor for equivalence to his satisfaction.
3. Unless otherwise specified, the brand / make of the material as specified in the item nomenclature, in the particular specifications and in the list of approved materials attached in the tender, shall be used in the work.

Sr.No.	Equipment / Materials	Recommended Manufacturers
A	Electrical Works	
1.A	LT Panel (TTA Panels) OEM Manufactured	LEGRAND / L&T / SCHNIEDER
1.B	LT Panel (NON TTA Panels) and Motor Control Centre.	Arrow Engineers-Vasai / Abak Electrofab Engineering / PowerCon – Rabale / Shivam Elect Bhiwandi
2	Sandwiched Construction Busduct and Rising Mains	Schneider Electric / Legrand/ L&T
3	Final Distribution Board	Hager / Legrand /Siemens
4	Motor Starter	L & T / Schneider / Siemens
5	Air Circuit Breaker	Larsen & Toubro (U-Power) / Schneider Electric (Master Pact NW) / Siemens (3WL)/ Legrand DMX3/ABB
6	Moulded Case Circuit Breaker (MCCB)	Schneider Electric / Larsen & Toubro / Siemens / Legrand/ABB
7	Miniature Circuit Breakers (MCB) Residual Current Circuit Breaker (RCCB)	Hager / Legrand /Siemens
8	Energy Monitoring System	Legrand/Socomec/ Schneider
9.1	Change Over Switch	Havells / HPL – Socomec / Larsen & Toubro
9.2	ATS – Auto Transfer switch	Vitzrotek / ASCO
10	Current Transformer (Epoxy Cast Resin)	Automatic Electric / Indcoil / Pragati
11	Control Transformer/Potential Transformers	Automatic Electric / Indcoil / Pragati
	Protection Relay	
	a. Numeric Type	Larsen & Toubro / Siemens
	b. Electromagnetic Type	Larsen & Toubro
13	Indicating Lamps LED type and Push Button	Larsen & Toubro (ESBEE) / Schneider Electric / Teknik
14	Overload relays with built in Single Phase preventer	Larsen & Toubro / Schneider Electric / Siemens
15	Electronic Digital Display Meters (A/V/PF/Hz/KW/KWH) with LED/ Display	L & T / Schneider Electric(Conserve) / Secure
16	PVC insulated XLPE aluminium / copper conductor armoured MV Cables upto 1100 V grade	Finolex / KEI / Havells / Polycab / CCI/ RR Kable

Sr.No.	Equipment / Materials	Recommended Manufacturers
17	LT Jointing Kit/Termination	3M/Raychem/REPL
18	Cable Gland(Double Compression type)	Comet/Cosmos
19	Bimetallic Cable Lug	Comet / Cosmos / Dowell's (Biller India)
20	PVC insulated copper conductor stranded flexible wires (FRLS) -	Finolex / Havells / Anchor / Polycab / RR Kabel/ KEI
21	Conduit	
	Mettalic / GI Conduit (ISI approved)	AKG / BEC / Vimco
22	Switch & Socket (Modular)	Legrand Myrius / Crabtree (Athena) /Hagger / Schneider
23	Terminal Blocks	Connect Well / Elmex
	Industrial Socket	
	a. Splash Proof	Legrand / Schneider Electric / Hager
	b. Metal Clad	HANSEL / Legrand
25	Ceiling Fan - BLDC	Automberg
26	Lighting Fxiture	
	a. Internal	Philips / Wipro / Havels / Panasonic
	b. External Lighting	VAK/Lime Light / KLight / Philips
27	Timer	Larsen & Toubro / Schneider Electric /Legrand
28	Raceways / GI Trunking Wiremesh tray Ladder/perforated hot dip galvanized cable tray	MK / Legrand / OBO Legrand/OBO Legrand Asian Ancillary Corporation/ Profab Engineer
29	UPVC Wall trunking	MK / Legrand/OBO
30	Lighting Poles	Bajaj Electricals or as per Light manufacturer for decorative pole
31	Fire Sealant & Fire Retardant Paint	3 M India Ltd. / HILTI / OBO
32	Standalone emergency light fixture	PHILIPS/ Wipro
33	Power/Aux.Contractor	Larsen & Tubro/Schneider Electric/Siemens
34	Motor Protection Circuit Breaker(MPCB)	Larsen & Tubro/Schneider Electric/Siemens
35	Selector switches	Kaycee/Salzer/(Larsen & Tubro)
36	Lightning Protection System	Axis / LPI/OBO / Dehn
37	RCC Hume pipes – NP2 Class	Dhere/KK/Indian Hume Pipe/Pranali
B. STRUCTURED CABLING SYSTEM (VOICE / DATA)		
1	Cat-6 Cable, Wires & Fiber Optic Cable	Legrand / Beldon/ Comscop / Molex
2	Patch Cords, patch panels, cross connect, data outlet, LIUs, Pigtails, Splice Holders	Legrand / Beldon / Comscop / Molex
3	Main Distribution Frame for voice, Telephone Tag blocks	Krone / ITL
4	Telephone Armoured Cables	Finolex / KEI / Polycab /Havells
5	Racks for Data Switches / Patch Panels	Valrack / ApwPresident / Rittal
	Lightning Protection	

Sr.No.	Equipment / Materials	Recommended Manufacturers
1	Lightning Arrestor & Earthing	Axis / LPI/OBO / Dehn
Incase of LAN & Telephone works, all the passive components shall be of one make or else 100% compatibility shall be ensured. Required certification for compatibility from component manufacturer to be furnished on demand of Engineer-In-Charge		
1	DG SET - DIESEL ENGINE	CUMINS/ KIRLOSKAR/VOLVO PENTA
2	DG SET - ALTERNATOR	LEROY SOMER / STAMFORD / KIRLOSKAR
3	UPS	Socomec/Vertive/Schneider
4	Battery	Quanta/Exide/Roket
B	Fire Fighting Works	
1	Fire hydrant valves	New Age, Arihant, Bhogilal, Hiren Ind. Corpn. or approved eq.
2	Stand post hydrant	Kejariwal, Orient, Durga, Kamla, Janta or app eq.
3	Sprinkler head	Grinnel, Spray safe, Central, H.D or approved eq.
4	Pumps & Pump sets	Kirloskar, Mather & Platt, Becon, Crompton Greaves, Jyoti, Calama, shehara or approved eq.
5	Pipe coat material (pipe protection)	PYPECOAT
6	Fire Extinguishers	New Age, Arihant, Hiren, Safex, Firestone Ind. or approved eq.
7	Ductile iron pipes	Electro steel, Lanco, SAW or approved eq.
8	Ductile iron specials / fittings	Electro steel, Kejariwal, Kiswock, Truforms or approved eq.
9	Fire hose, First aid hose reel, Branch pipe, Siamese connections, Hose coupling, Nozzle, Sprinklers, Fire Brigade connection etc.	Firex, Minimax, Safex, New Age, Arihant, Bhogilal, Hiren or approved eq.
10	Fire / Sprinkler Main Pump / Jockey	Aurora / Armstrong / Grundfos / ITT (A-C Pumps)
11	Diesel Engine	Cummins / Greaves / KOEL
12	Motor	Bharat Bijlee / Crompton Greaves
13	GI / M.S Pipes (IS : 1239 and IS : 3589)	APL-Apollo / Jindal / Tata Steel / Surya / AST Pipes / Hitech / Swastik
14	Standard M.S. Fittings	Seamless Fittings / Pipeline Products
15	DI / CI / Forged Steel Fittings	Jainsons Industries / VS
16	DI Grooved Fitting & Coupling	Tyco / Victaulic / Viking
17	C.I. Class LA Pipes	Electro Steel Calcutta / IISCO / NECO / Kesoram Calcutta
18	RCC Pipe	K K / Local & Approved Pranali
19	D.I. Manhole Covers & Frames	Kartar valves & fittings / NECO / Raj Iron Foundry Agra
20	Paints	Asian Paints / Berger / ICI / Shalimar Paints
21	Double / Single Headed Landing Valve	New Age / Safeguard / Shah Bhogilal
22	Fire Hose	CRC / Jayashree / Padmini / Safeguard / Safefire
23	First Aid Hose Reel (LPCB Approved)	Monsher / Padmini / Safeguard / Safefire
24	Gun Metal Brach Pipe	New Age / Safeguard
25	Fireman Axe	New Age / Safeguard
26	Installation Control Valve	HD / Newage / Tyco / Viking

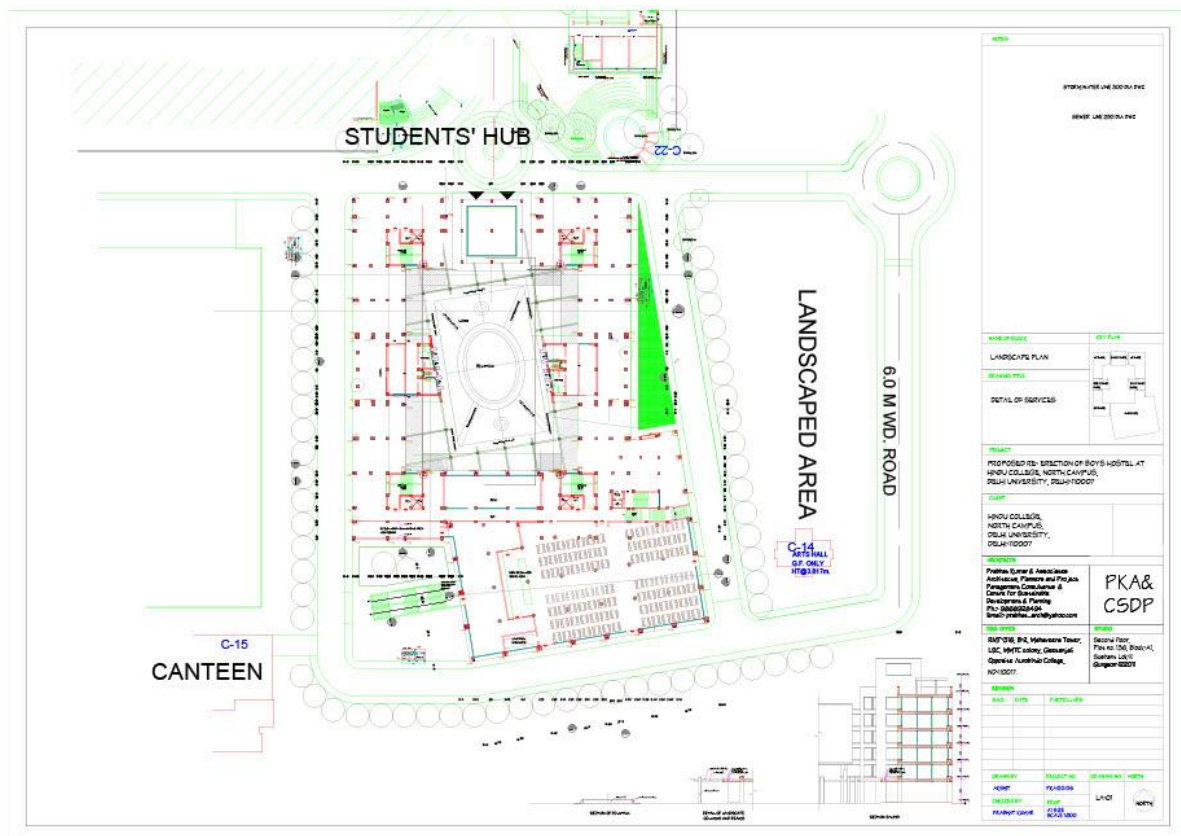
Sr.No.	Equipment / Materials	Recommended Manufacturers
27	Sprinkler Heads	Tyco / Viking / Newage
28	Flexible Drop Connection (UL Listed)	Flexhead / Newage / Tyco
29	AFF Solutiona & Cscillating Nozzle	Ansul / Newage
30	Electrical panel Detection & Supperssion System	Avec India / Fire Trace
31	Fire Extinguishers	Alert – Tyco / Minimax / Safefire / Safeguard
32	Water Flow Switch	Honeywell Potter Rapid Control System Sensor Spray Safe
33	Pipe Protection Wrapping	Rustech – Coatek
34	Pipe clamp & supports	Chilly / Euroclamp / Easyflex / Gripple
C	FAPA Works & Security System	
1	CCTV cameras(All types)	Honeywell/Prama/Bosch
2	Cat-6 Cable, Wires & Fiber Optic Cable	Legrand / Derwiser / Comscop / Molex
3	PoE Switch	HP/Dlink / Hikvision
4	LAN racks	Valrack / ApwPresident / Rittal
5	Hard disk – AI grade	Seagate / Toshiba
6	Fire Alarm System	EST/ Simplex / Notifier
7	FAS Cabling	RR Kable/KEI / Finolex
8	Fire Extinguisher	Ceasfire/Minimax/Kanex
9	Cabinet Fire Suppression	Ceasfire/Minimax/Kanex
10	PA SYSTEM	BOSCH/Simplex Honeywell
11	PA Cabling	RR Kable/KEI / Finolex
12	Access Controller	BOSCH/ Honeywell / ESSL/ HID
13	Reader	BOSCH/ Honeywell / ESSL/ HID
14	Em Lock	Capture/BEL
15	Attendance Software	BOSCH/ Honeywell / ESSL/ HID/ID Cube
16	Cabling	RR Kable/KEI / Finolex
D	HVAC Works	
1	VRV / VRF SYSTEM	Daikin, Blue star, Samsung, LG, Mitsubishi electric, Toshiba
2	Treated Fresh Air (TFA)	Daikin, Blue star, Samsung, LG, Mitsubishi electric, Toshiba
3	Hiwall/Cassette	Daikin, Blue star, Samsung, LG, Mitsubishi electric, Toshiba
4	TFA	Daikin, Blue star, Samsung, LG, Mitsubishi electric, Toshiba
5	Pre-Filters & Filters (non-flammable)	Airtech / Thermodyne / Uccomech
6	Piping	
a)	Cu piping - Soft (20G)	Kobe (Japan) / Mandev Tubes / Met tubes (Malaysia) / Nissan / Rajco
b)	Cu piping - Hard (18G)	Kobe (Japan) / Mandev Tubes / Maxflow / Nissan / Rajco / Simitomo (Japan)

Sr.No.	Equipment / Materials	Recommended Manufacturers
7	Ventilation & Exhaust Fans	
a)	Inline, Propeller, Tube Axial, Cabinet Fan, SISW Fan, DIDW Fan	Dyna Air / Kruger / Greenheck / Nadi / Nicotra / System Air
8	Scrubber Unit	Edgetech, Nuotech, Zeco
9	HVLS Fan	Kruger, Nuotech, Austar, Eco air
10	Sheet Metal	
a)	G I Sheets Class VII - 180 gm/sq.m SMACNA Standards	Sheets -JINDAL /SAIL / TATA ROLASTAR Ducting System with ROLAMATE or equivalent System Components
b)	Factory Fabricated ducts SMACNA Standards	Rolastar / Zeco / Asawa with OEM standard flanges, fittings, bracings
c)	Fire dampers, extended sleeves & control panels(90 minutes rating)Damper & Sleeves - painted orange	Cosmos / George Rao & Co. / Greenheck / Caryaire
11	Flow Control Device	Aldes,Transmonk, Airflow
12	Suspension / Support Systems (Fully galvanized for Ducts, Pipes, etc.)	
a)	Anchor Fasteners	Hilti
b)	Fully threaded rods, nuts, bolts, pipe clamps etc.	Alpha duct / Diamond / Hitech / Hilte / Perfect / Rolastar / Zeco
c)	Channels / Angles – lengths with predrilled holes	Hitech / Hilte / Perfect / Rolastar
d)	Duct Flanges	Alpha duct / Rolamate / Zeco / Asawa
13	Insulation	
a)	Closed cell nitrile elastomeric Class 'O'	Armaflex /Aeroflex / Eurobetex / K – Flex
b)	Adhesives (when dry non-flammable)	Armaflex 520 / Pidilite SR 998 / Foster IIDL
14	Grilles / Diffusers (Powder coated)	
a)	Aluminium Grill	Air-Product / Air Master /Cosmos/Caryaire
b)	Aluminium opposed blade dampers / louvers	Air-Product / Air Master /Cosmos/Caryaire
c)	Disc Valve	Air-Product / Air Master /Cosmos/Caryaire
15	Electricals – (IS)	
a)	Starters	L&T / Merlin Gerlin / Siemens
b)	Contactors	ABB / L&T / Merlin Gerlin / Siemens
c)	Switchgear	Havells / L&T / Merlin Gerlin
d)	Ammeter	Auto-Electric / Rishab

Sr.No.	Equipment / Materials	Recommended Manufacturers
e)	Voltmeter	Auto-Electric / Rishab
f)	All panel accessories	Technics
g)	Capacitors	Asian / Datar / L & T / Siemens
h)	ELCB's	Datar / L & T /MDS / Prok
i)	MCCBs, MCB's	ABB / L&T / Merlin Gerlin / MDS
j)	SFU's	ABB / L&T / Merlin Gerlin / Siemens
k)	Electric Meters	Alacrity / Enercon / Secure
l)	Cables	
	- Power	Polycab /RR Cable
	- Control	Polycab /RR Cable
E	Elevators	Otis, Johnson, Kone, Omega

DRAWING

1) ARCHITECTURAL

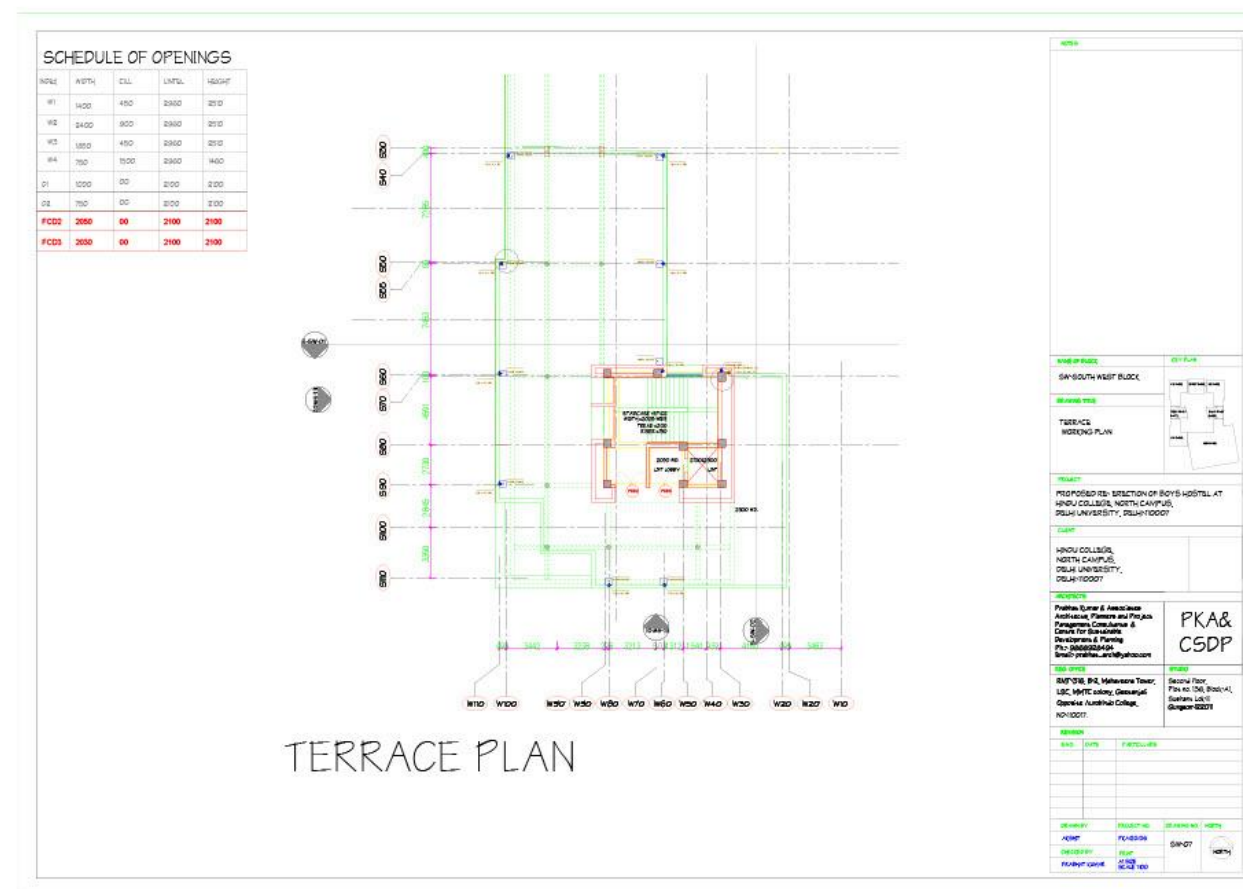
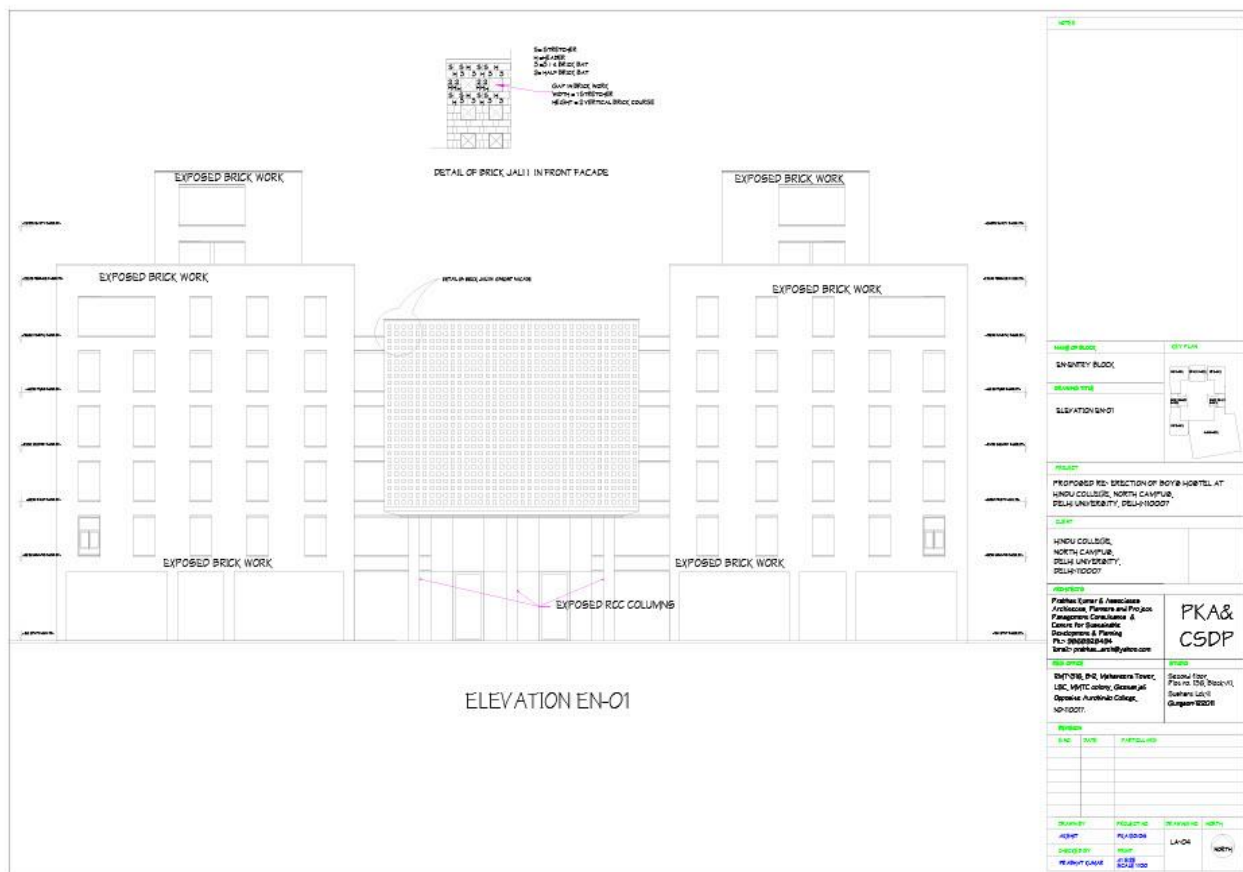




STILT PLAN

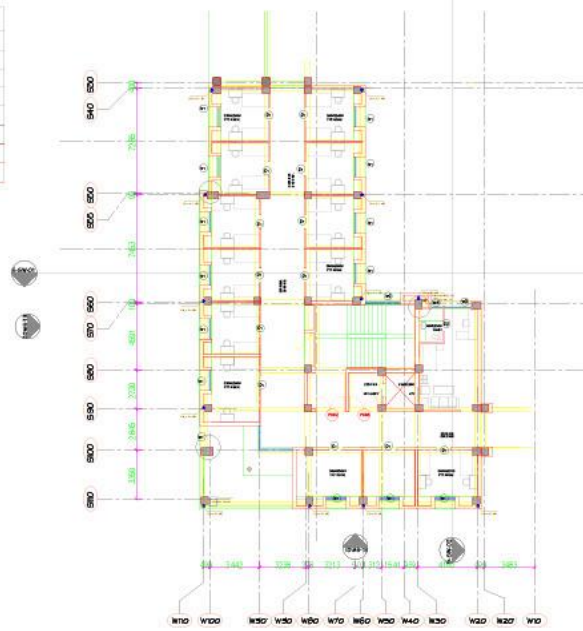
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SCHEDULE OF OPENINGS

NO.	WIDTH	CLL	UNTEL	4030-F
A1	1400	450	2800	2510
A2	2400	900	2800	2510
A3	1850	450	2800	2510
A4	750	500	2800	1440
D1	1000	00	2100	2100
DE	750	00	2100	2100
PC02	3090	00	2100	2100
PC03	3090	00	2100	2100

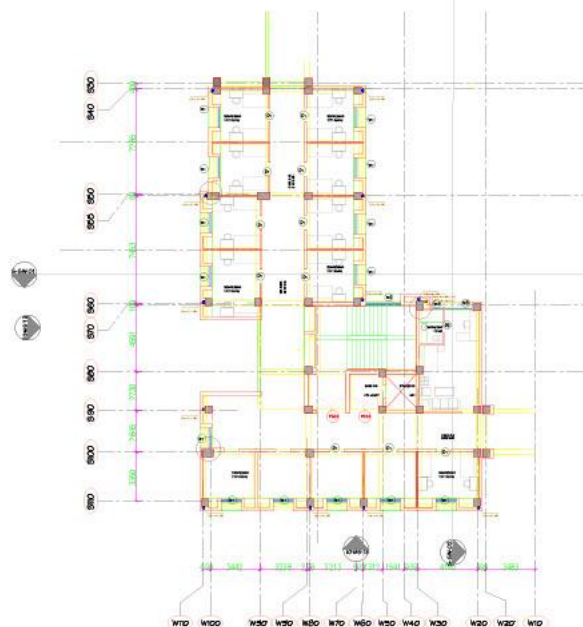


FOURTH FLOOR PLAN

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SCHEDULE OF OPENINGS

INFL	AVTH	CHL	LMFL	LMHFL
#1	1400	400	2000	2500
#2	2400	900	2000	2500
#3	1800	400	2000	2500
#4	750	1500	2000	1400
01	1200	00	2100	2200
02	750	00	2100	2100
#CD2	2050	00	2100	2100
#CD3	2030	00	2100	2100

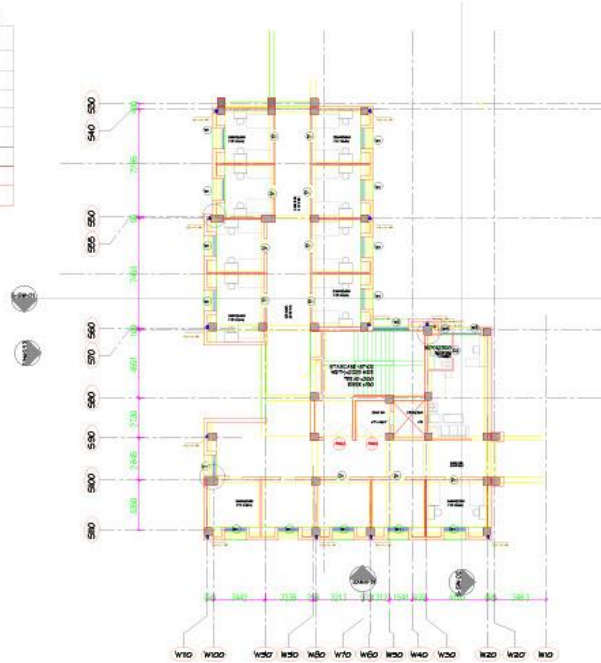


THIRD FLOOR PLAN

10/15/2011			
NAME OF PLACE		EST-FLNR	
SAN-SOUTH WEST BLOCK			
ADDRESS INFO			

SCHEDULE OF OPENINGS

NO.	WIDTH	CALL	UNIT	HEIGHT
#1	1400	450	2360	210
#2	2400	900	2360	210
#3	1850	450	2360	210
#4	700	1500	2360	1400
#1	1000	00	2100	2100
02	700	00	2100	2100
#CD2	2650	00	2100	2100
#CD3	2630	00	2100	2100

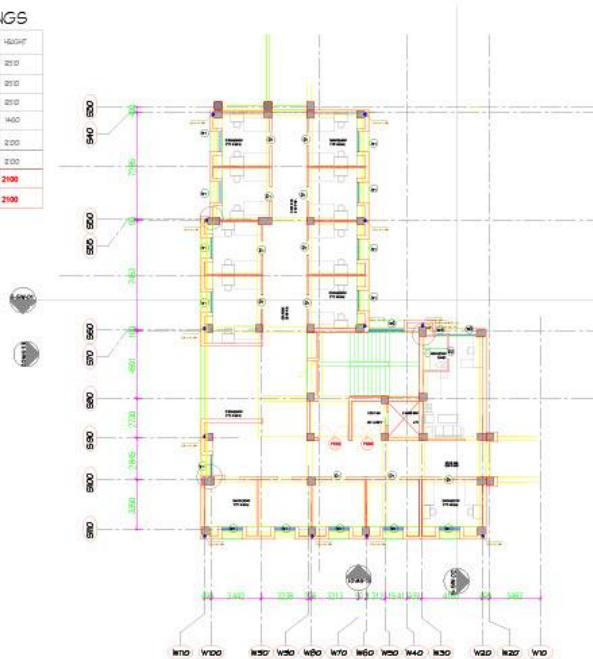


SECOND FLOOR PLAN

NAME OF BUILDING SEA-SOUTH KASSET BUILDING		EST. FUND.	
PLANNING YEAR SECOND FLOOR WORKING PLAN			
REMARKS PROPOSED FOR: DIRECTION OF BOYS HOSTEL AT UNION COLLEGE, NORTH CAMPUS, TAMU UNIVERSITY, TAMU-10007			
LAST UNION COLLEGE, NORTH CAMPUS, TAMU UNIVERSITY, TAMU-10007			
DESIGNERS Prattini Kumar & Associates Architects, Planners and Project Management Consultants & Specialty Services Developers & Planners P-100000000000 Email: prattini.kumar@yahoo.com			
PROJ. OFFICE RAJESH K. P. Malhotra Tower, LSC, MRCET Campus (Deemed to be Engineering College), Hyderabad		PK&A CSDP	
PROJ. OFFICE RAJESH K. P. Malhotra Tower, LSC, MRCET Campus (Deemed to be Engineering College), Hyderabad		PROJ. OFF. Second Floor, P&A-100, B&A-101, B&A-102, B&A-103, B&A-104, B&A-105, B&A-106, B&A-107, B&A-108, B&A-109, B&A-110, B&A-111, B&A-112, B&A-113, B&A-114, B&A-115, B&A-116, B&A-117, B&A-118, B&A-119, B&A-120, B&A-121, B&A-122, B&A-123, B&A-124, B&A-125, B&A-126, B&A-127, B&A-128, B&A-129, B&A-130, B&A-131, B&A-132, B&A-133, B&A-134, B&A-135, B&A-136, B&A-137, B&A-138, B&A-139, B&A-140, B&A-141, B&A-142, B&A-143, B&A-144, B&A-145, B&A-146, B&A-147, B&A-148, B&A-149, B&A-150, B&A-151, B&A-152, B&A-153, B&A-154, B&A-155, B&A-156, B&A-157, B&A-158, B&A-159, B&A-160, B&A-161, B&A-162, B&A-163, B&A-164, B&A-165, B&A-166, B&A-167, B&A-168, B&A-169, B&A-170, B&A-171, B&A-172, B&A-173, B&A-174, B&A-175, B&A-176, B&A-177, B&A-178, B&A-179, B&A-180, B&A-181, B&A-182, B&A-183, B&A-184, B&A-185, B&A-186, B&A-187, B&A-188, B&A-189, B&A-190, B&A-191, B&A-192, B&A-193, B&A-194, B&A-195, B&A-196, B&A-197, B&A-198, B&A-199, B&A-200, B&A-201, B&A-202, B&A-203, B&A-204, B&A-205, B&A-206, B&A-207, B&A-208, B&A-209, B&A-210, B&A-211, B&A-212, B&A-213, B&A-214, B&A-215, B&A-216, B&A-217, B&A-218, B&A-219, B&A-220, B&A-221, B&A-222, B&A-223, B&A-224, B&A-225, B&A-226, B&A-227, B&A-228, B&A-229, B&A-230, B&A-231, B&A-232, B&A-233, B&A-234, B&A-235, B&A-236, B&A-237, B&A-238, B&A-239, B&A-240, B&A-241, B&A-242, B&A-243, B&A-244, B&A-245, B&A-246, B&A-247, B&A-248, B&A-249, B&A-250, B&A-251, B&A-252, B&A-253, B&A-254, B&A-255, B&A-256, B&A-257, B&A-258, B&A-259, B&A-260, B&A-261, B&A-262, B&A-263, B&A-264, B&A-265, B&A-266, B&A-267, B&A-268, B&A-269, B&A-270, B&A-271, B&A-272, B&A-273, B&A-274, B&A-275, B&A-276, B&A-277, B&A-278, B&A-279, B&A-280, B&A-281, B&A-282, B&A-283, B&A-284, B&A-285, B&A-286, B&A-287, B&A-288, B&A-289, B&A-290, B&A-291, B&A-292, B&A-293, B&A-294, B&A-295, B&A-296, B&A-297, B&A-298, B&A-299, B&A-300, B&A-301, B&A-302, B&A-303, B&A-304, B&A-305, B&A-306, B&A-307, B&A-308, B&A-309, B&A-310, B&A-311, B&A-312, B&A-313, B&A-314, B&A-315, B&A-316, B&A-317, B&A-318, B&A-319, B&A-320, B&A-321, B&A-322, B&A-323, B&A-324, B&A-325, B&A-326, B&A-327, B&A-328, B&A-329, B&A-330, B&A-331, B&A-332, B&A-333, B&A-334, B&A-335, B&A-336, B&A-337, B&A-338, B&A-339, B&A-340, B&A-341, B&A-342, B&A-343, B&A-344, B&A-345, B&A-346, B&A-347, B&A-348, B&A-349, B&A-350, B&A-351, B&A-352, B&A-353, B&A-354, B&A-355, B&A-356, B&A-357, B&A-358, B&A-359, B&A-360, B&A-361, B&A-362, B&A-363, B&A-364, B&A-365, B&A-366, B&A-367, B&A-368, B&A-369, B&A-370, B&A-371, B&A-372, B&A-373, B&A-374, B&A-375, B&A-376, B&A-377, B&A-378, B&A-379, B&A-380, B&A-381, B&A-382, B&A-383, B&A-384, B&A-385, B&A-386, B&A-387, B&A-388, B&A-389, B&A-390, B&A-391, B&A-392, B&A-393, B&A-394, B&A-395, B&A-396, B&A-397, B&A-398, B&A-399, B&A-400, B&A-401, B&A-402, B&A-403, B&A-404, B&A-405, B&A-406, B&A-407, B&A-408, B&A-409, B&A-410, B&A-411, B&A-412, B&A-413, B&A-414, B&A-415, B&A-416, B&A-417, B&A-418, B&A-419, B&A-420, B&A-421, B&A-422, B&A-423, B&A-424, B&A-425, B&A-426, B&A-427, B&A-428, B&A-429, B&A-430, B&A-431, B&A-432, B&A-433, B&A-434, B&A-435, B&A-436, B&A-437, B&A-438, B&A-439, B&A-440, B&A-441, B&A-442, B&A-4	

SCHEDULE OF OPENINGS

Model	AVTH	CALL	UNPLD	LEIGHT
#1	1400	450	2360	2510
#2	2400	900	2360	2510
#3	1850	450	2360	2510
#4	750	1500	2360	1460
#1	1000	00	2100	2100
#2	750	00	2100	2100
#CD2	2050	00	2100	2100
#CD3	2030	00	2100	2100

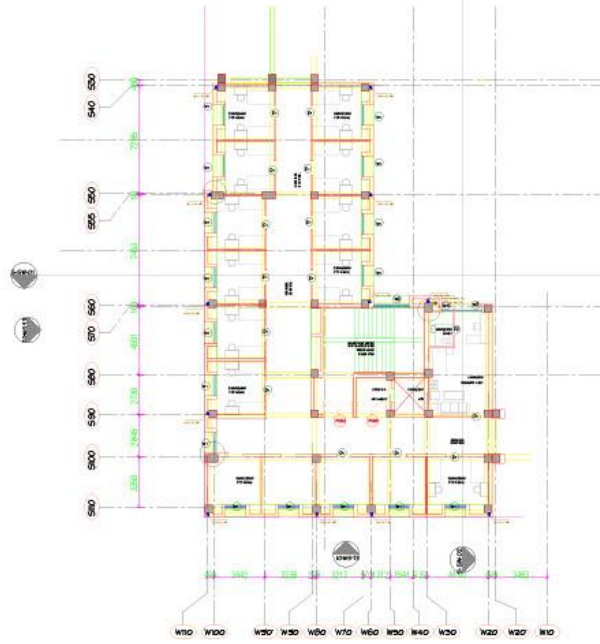


FIRST FLOOR PLAN

[illegible]

SCHEDULE OF OPENINGS

NO.	WIDTH	CLL	UNITS	W30-F
W1	1400	450	2360	2510
W2	2400	900	2360	2510
W3	1800	450	2360	2510
W4	750	500	2360	1400
Q1	2000	00	2100	2100
Q2	750	00	2100	2100
FC02	2050	00	2100	2100
FC03	2050	00	2100	2100

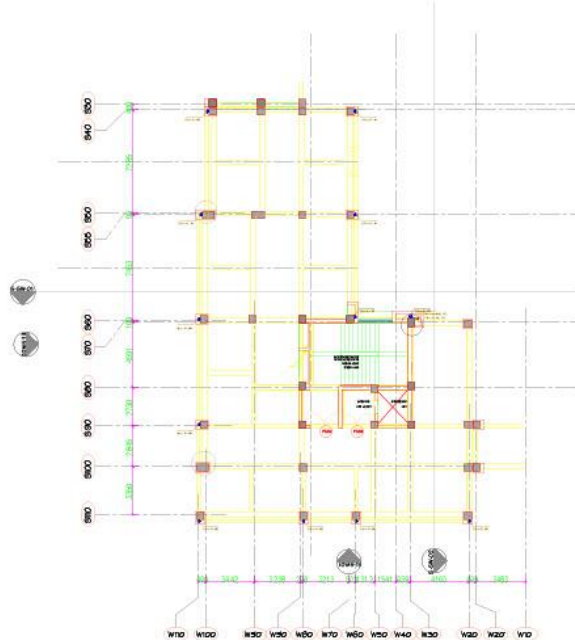


GROUND FLOOR PLAN

PROPOSED 10th SECTION OF BOYS' HOSTEL AT KJ SOMAIYA INSTITUTE OF ENGINEERING & TECHNOLOGY, GANDHINAGAR, MUMBAI	
CLIENT KJ SOMAIYA INSTITUTE OF ENGINEERING & TECHNOLOGY, GANDHINAGAR, MUMBAI	DESIGNER PKA & CSDP
PROJECT PROPOSED 10th SECTION OF BOYS' HOSTEL AT KJ SOMAIYA INSTITUTE OF ENGINEERING & TECHNOLOGY, GANDHINAGAR, MUMBAI	SCALE 1:100
DATE 10/01/2023	REVISION 1.0
DESIGNED BY ARCHITECT	CHECKED BY CIVIL
DATE 10/01/2023	SCALE 1:100

SCHEDULE OF OPENINGS

NO.	WIDTH	CLL	UNITS	W30-F
W1	1400	450	2360	2510
W2	2400	900	2360	2510
W3	1800	450	2360	2510
W4	750	500	2360	1400
Q1	2000	00	2100	2100
Q2	750	00	2100	2100
FC02	2050	00	2100	2100
FC03	2050	00	2100	2100

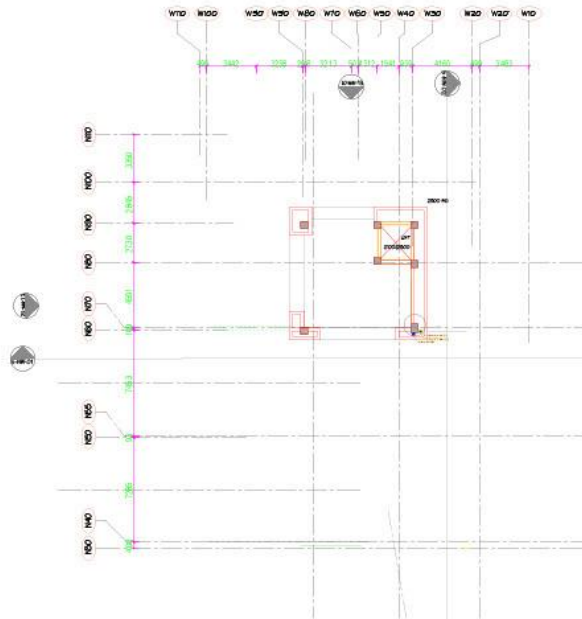


STILT PLAN

PROPOSED 10th SECTION OF BOYS' HOSTEL AT KJ SOMAIYA INSTITUTE OF ENGINEERING & TECHNOLOGY, GANDHINAGAR, MUMBAI	
CLIENT KJ SOMAIYA INSTITUTE OF ENGINEERING & TECHNOLOGY, GANDHINAGAR, MUMBAI	DESIGNER PKA & CSDP
PROJECT PROPOSED 10th SECTION OF BOYS' HOSTEL AT KJ SOMAIYA INSTITUTE OF ENGINEERING & TECHNOLOGY, GANDHINAGAR, MUMBAI	SCALE 1:100
DATE 10/01/2023	REVISION 1.0
DESIGNED BY ARCHITECT	CHECKED BY CIVIL
DATE 10/01/2023	SCALE 1:100

SCHEDULE OF OPENINGS

FDL	ADPH	ELL	LINTEL	HEALTH
W1	1400	400	2900	2500
W2	2400	900	2900	2500
W3	1800	400	2900	2500
W4	750	1500	2900	1400
D1	1000	00	2100	2100
D2	750	00	2100	2100
FD02	3025	00	2100	2100
FD03	3030	00	2100	2100

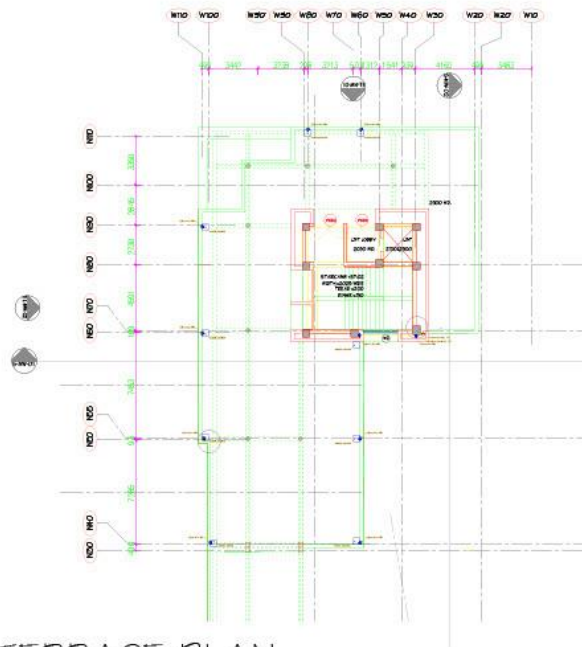


MUMTY PLAN

[illegible]

SCHEDULE OF OPENINGS

INFL	WOTH	ELL	UNTEL	HLIGHT
W1	1400	400	2900	2500
W2	2400	900	2900	2500
W3	1950	450	2900	2500
W4	750	500	2900	1400
D1	1000	00	2100	2100
D2	750	00	2100	2100
FGD2	2520	00	2100	2100
FGD3	2520	00	2100	2100

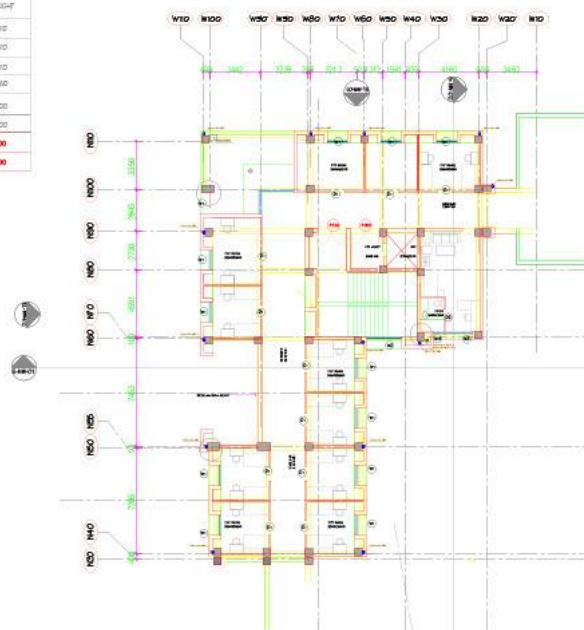


TERRACE PLAN

[illegible]

SCHEDULE OF OPENINGS

NOTE	WIDTH	COL	UNITS	HEIGHT
N1	1400	450	2000	2500
N2	2400	900	2000	2500
N3	1800	450	2000	2500
N4	700	500	2000	1400
C1	1000	00	2100	2100
C2	700	00	2100	2100
FCD2	2020	00	2100	2100
FCD3	2020	00	2100	2100

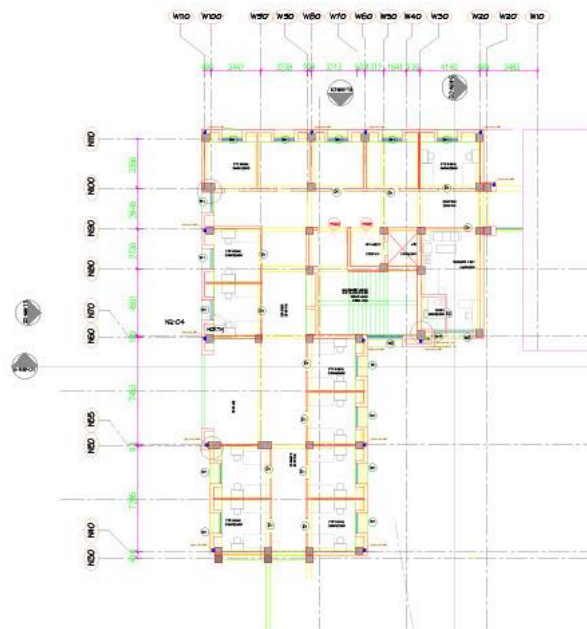


FOURTH FLOOR PLAN

[illegible]

SCHEDULE OF OPENINGS

INDEX	WORTH	CALL	UNTEL	WRIGHT
W1	1400	450	2900	2510
W2	2400	900	2900	2510
W3	1850	450	2900	2510
W4	750	1500	2900	1460
D1	1000	00	2100	2100
D2	750	00	2100	2100
PCD2 2050	00	2100	2100	
PCD2 2030	00	2100	2100	

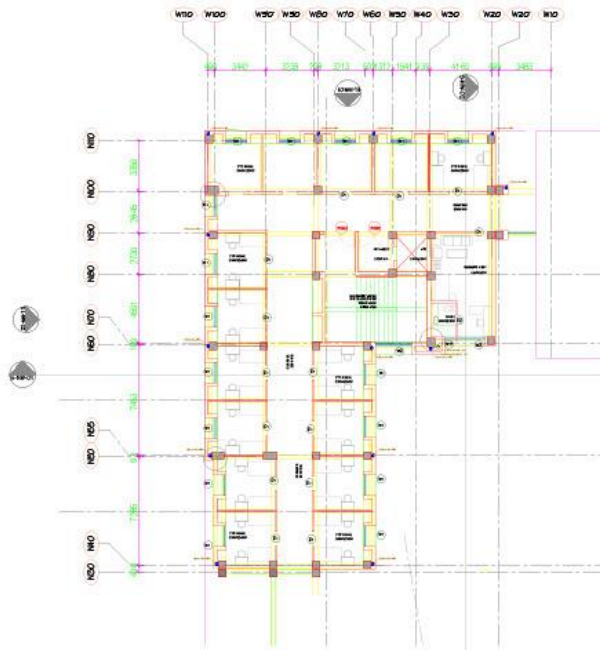


THIRD FLOOR PLAN

[illegible]

SCHEDULE OF OPENINGS

NOTE	WIDTH	CELL	UNTIL	HEIGHT
W1	1400	450	2960	2510
W2	2400	900	2960	2510
W3	1800	450	2960	2510
W4	750	1500	2960	1460
D1	1000	00	2100	2100
D2	750	00	2100	2100
PCD2	2050	00	2100	2100
PCD3	2050	00	2100	2100

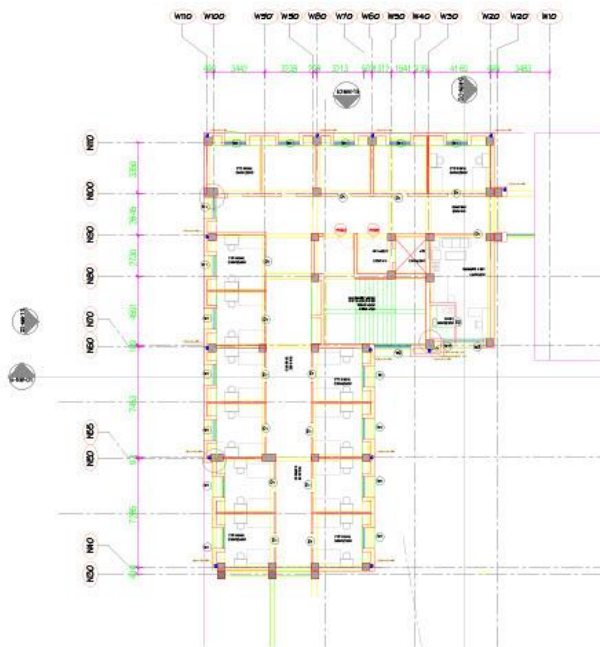


SECOND FLOOR PLAN

[illegible]

SCHEDULE OF OPENINGS

INDEX	WIDTH	CELL	LENGTH	HEIGHT
W1	1400	450	2960	2510
W2	2400	900	2960	2510
W3	1850	450	2960	2510
W4	750	1500	2960	1460
D1	1000	00	2100	2100
D2	750	00	2100	2100
PCD2	2035	00	2100	2100
PCD3	2032	00	2100	2100

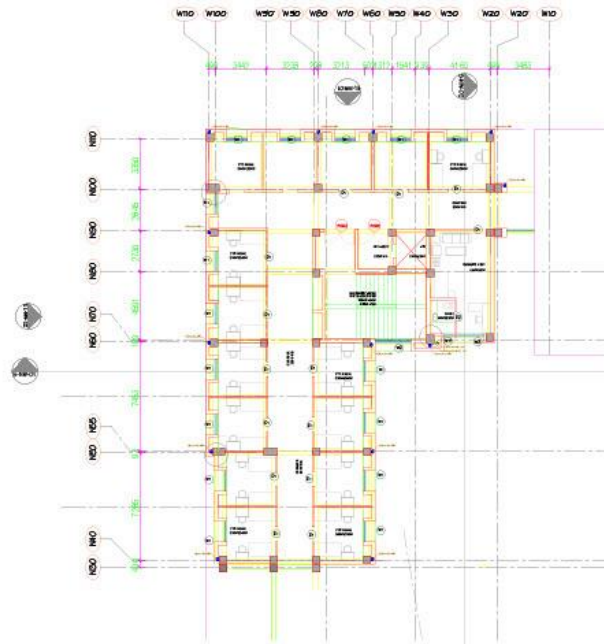


FIRST FLOOR PLAN

[illegible]

SCHEDULE OF OPENINGS

NOSE	WPTH	CLL	UNTSL	ASIS-T
W1	1400	450	2040	2010
W2	2400	900	2040	2010
W3	1800	450	2040	2010
W4	750	1500	2040	1460
D1	1500	00	2100	2100
D2	750	00	2100	2100
FC02	2050	00	2100	2100
FC03	2050	00	2100	2100

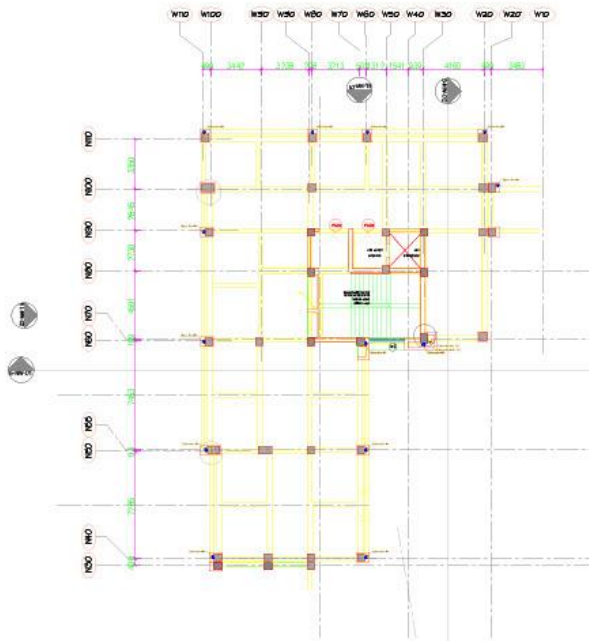


GROUND FLOOR PLAN

PROPOSED EXTENSION OF BOYS HOSTEL AT VINU COLLEGE, NORTH CAMPUS, DLSU UNIVERSITY, DAVAHO CITY	
PROJECT PROPOSED EXTENSION OF BOYS HOSTEL AT VINU COLLEGE, NORTH CAMPUS, DLSU UNIVERSITY, DAVAHO CITY	CLIENT VINU COLLEGE, NORTH CAMPUS, DLSU UNIVERSITY, DAVAHO CITY
DESIGNER Prof. Turner S. Arce Architect, Planner and Project Manager Consultant & Planning Firm Small practice, arce@turner-arce.com	PKA&CSDP Small practice, arce@turner-arce.com
DATE 2023-01-10	REVISION 1. Initial Design 2. Final Design 3. Construction Documents
SCALE 1:100	PROJECT NO. PKA-0001
DESIGNER Prof. Turner S. Arce	PROJECT NO. PKA-0001
DATE 2023-01-10	PROJECT NO. PKA-0001
SCALE 1:100	PROJECT NO. PKA-0001

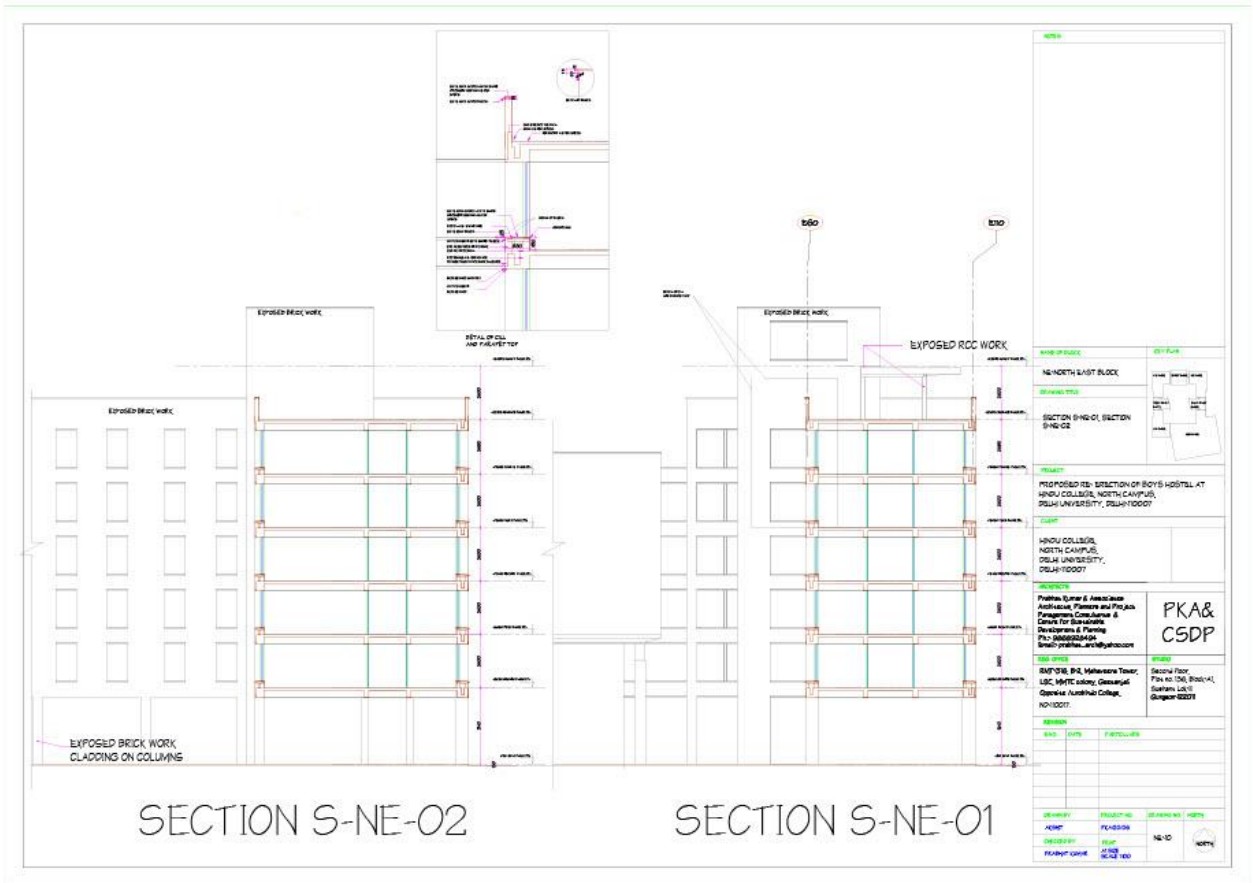
SCHEDULE OF OPENINGS

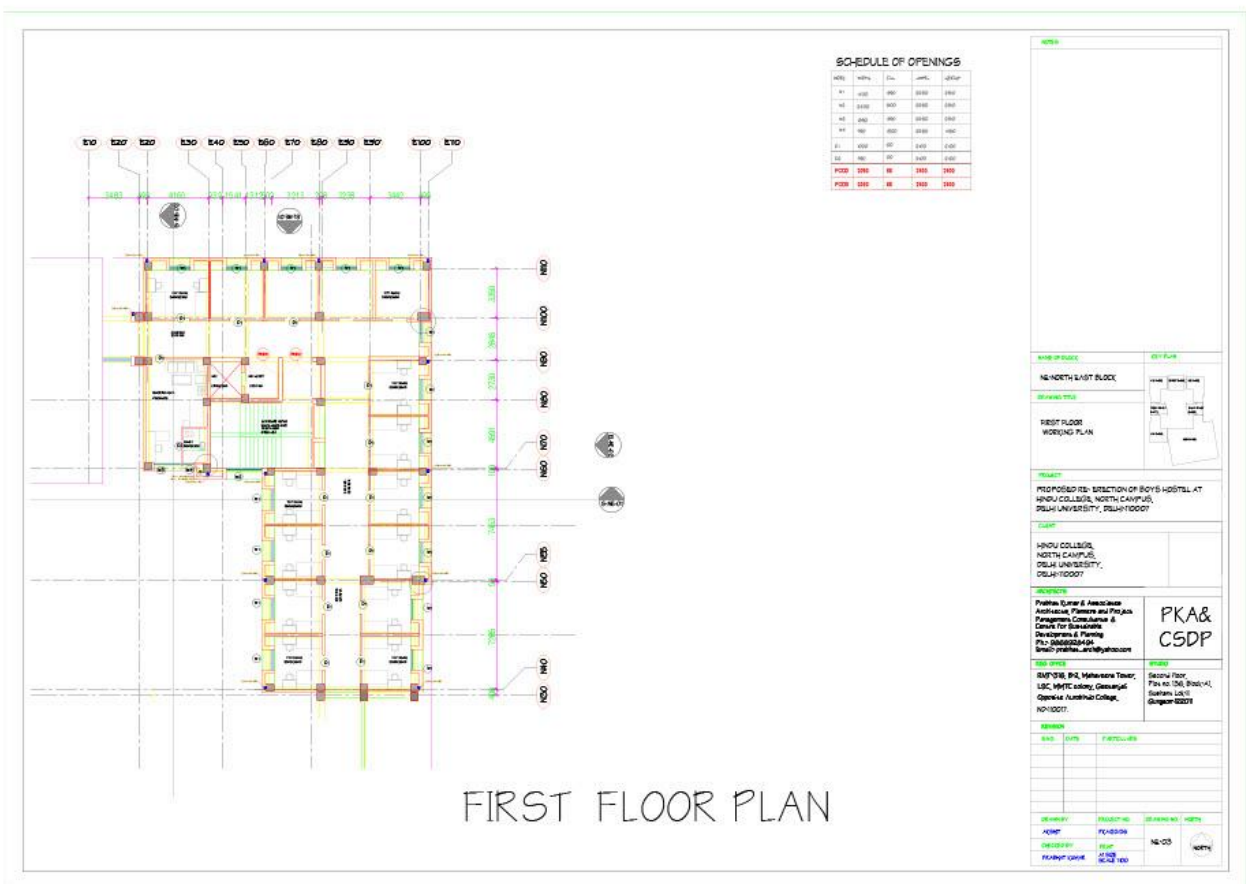
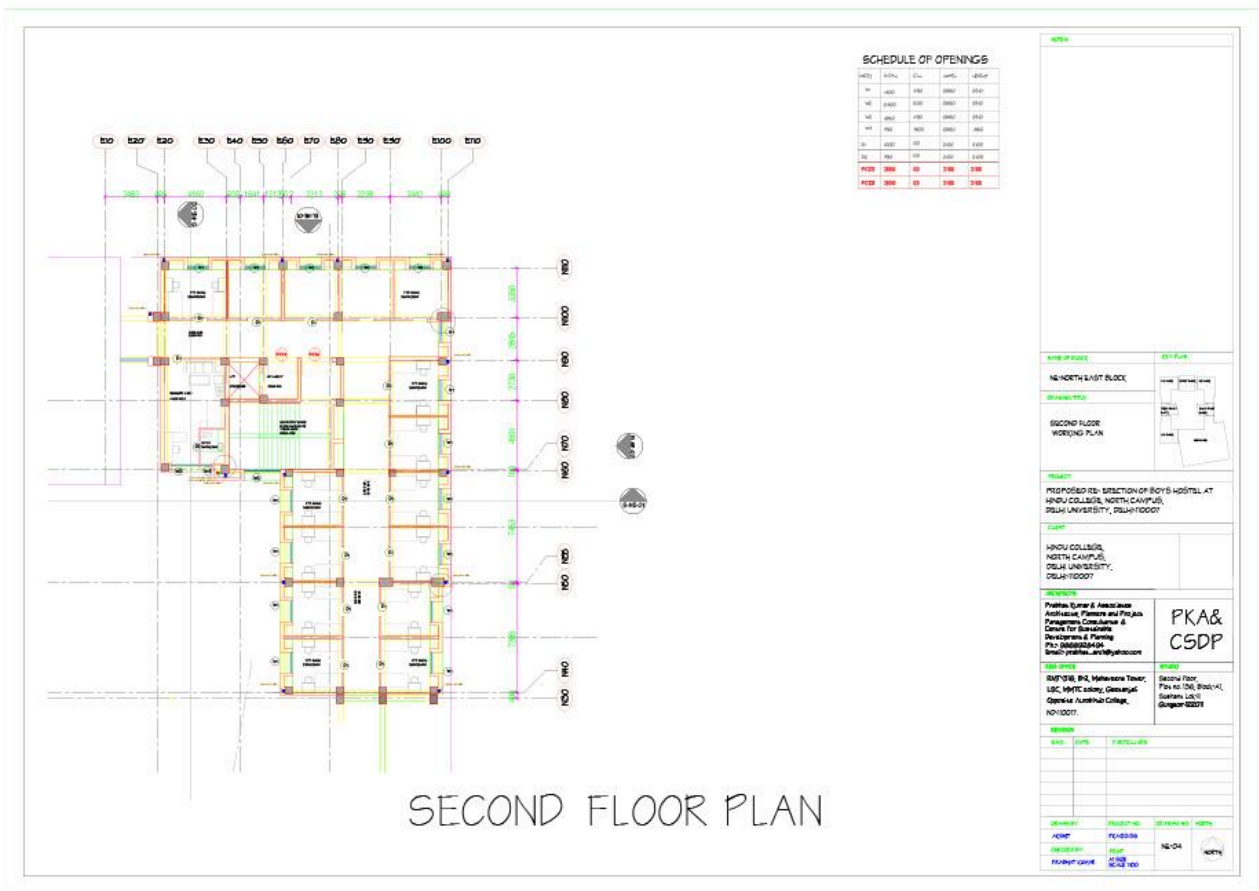
NOSE	WPTH	CLL	UNTSL	ASIS-T
W1	1400	450	2040	2010
W2	2400	900	2040	2010
W3	1800	450	2040	2010
W4	750	1500	2040	1460
D1	1500	00	2100	2100
D2	750	00	2100	2100
FC02	2050	00	2100	2100
FC03	2050	00	2100	2100

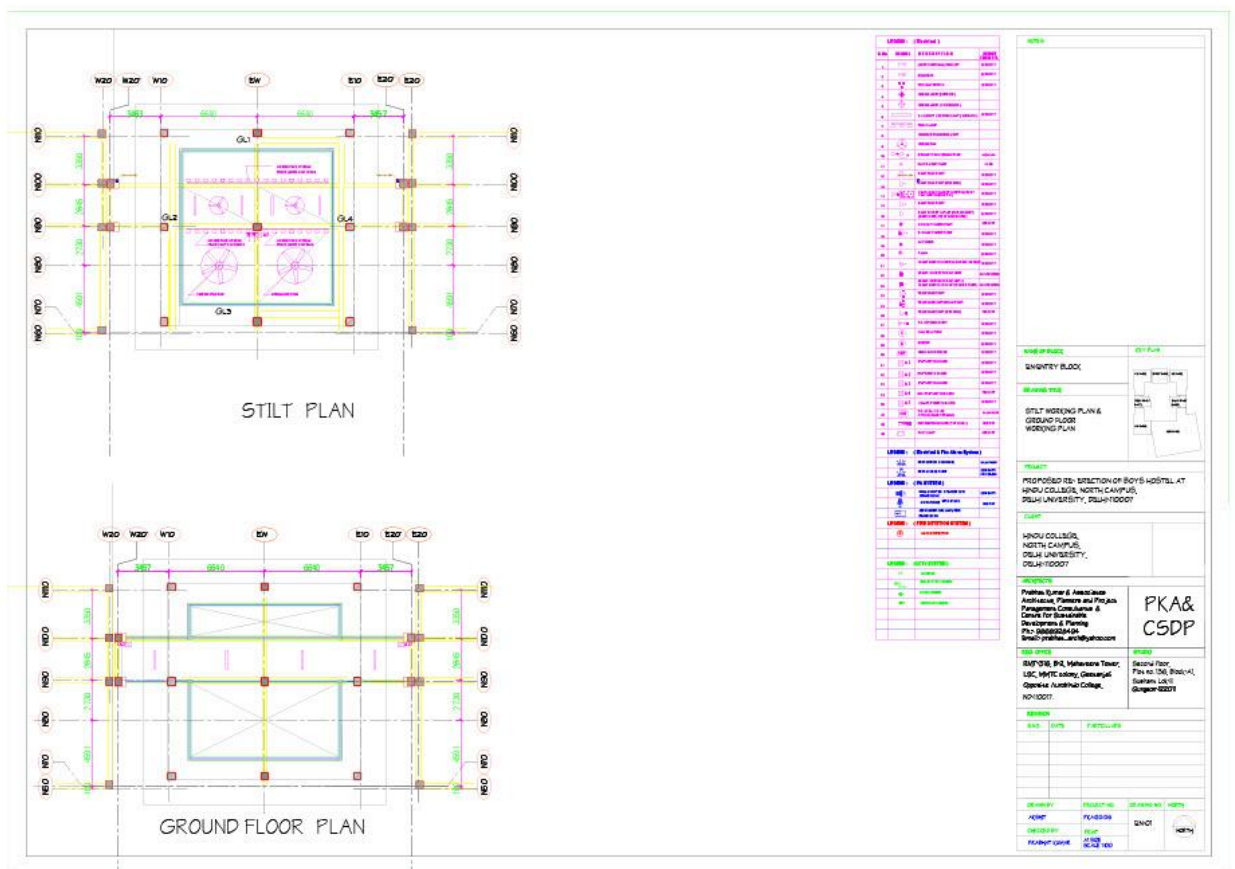
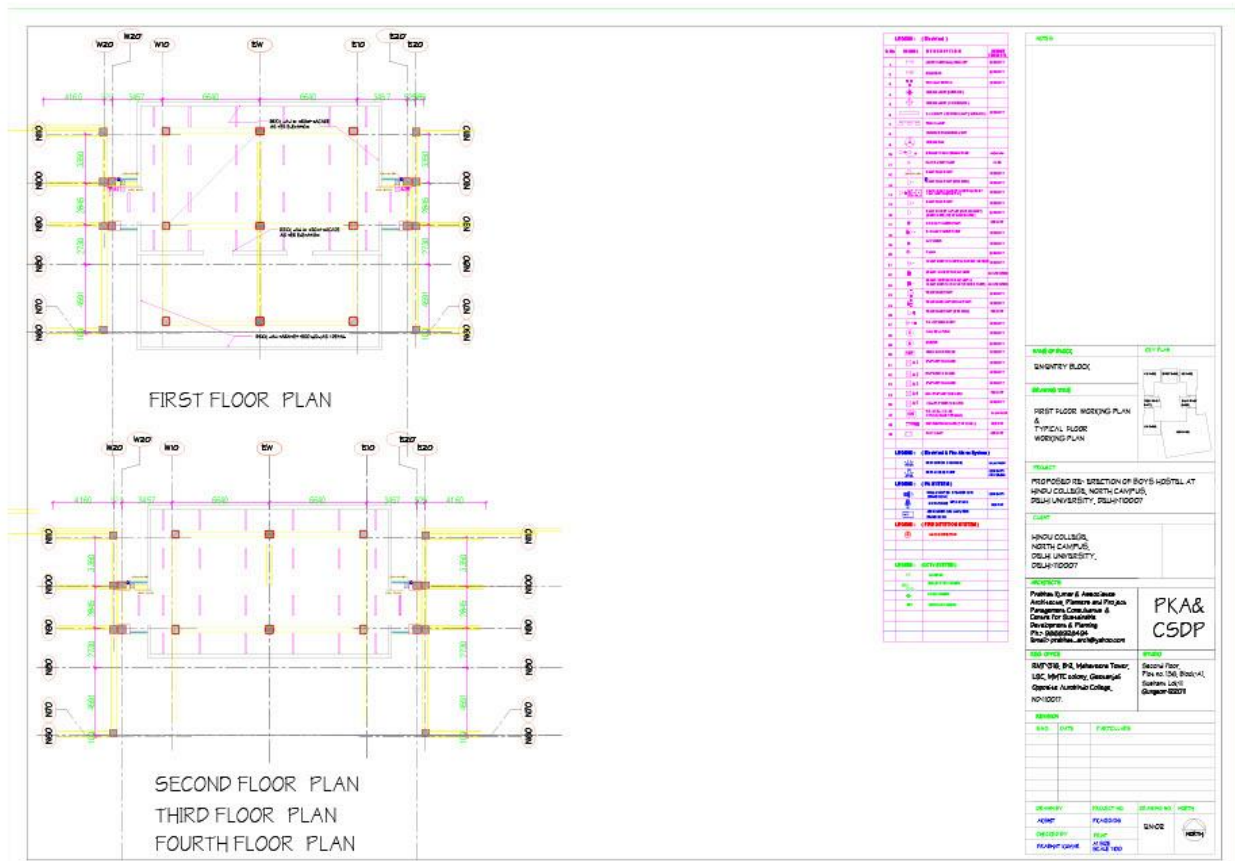


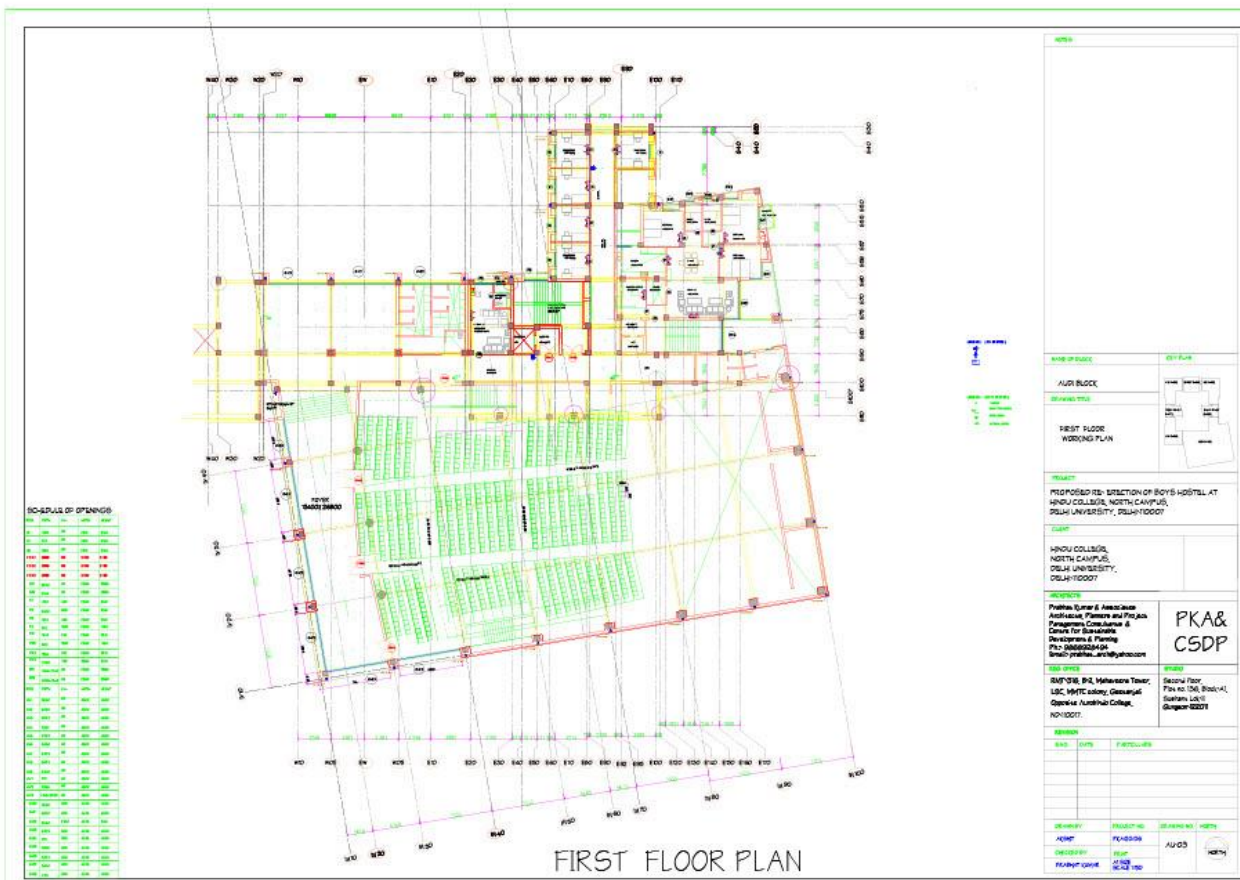
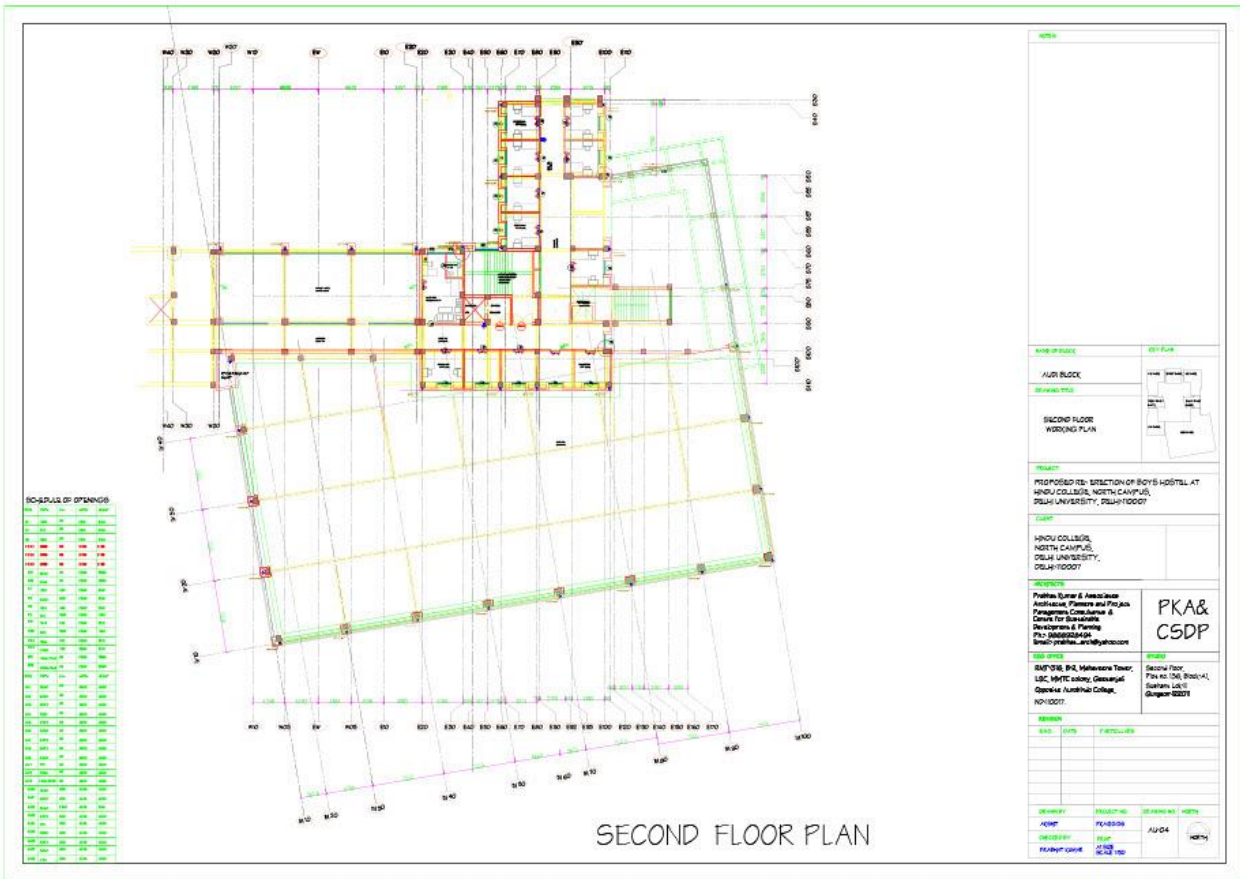
STILT PLAN

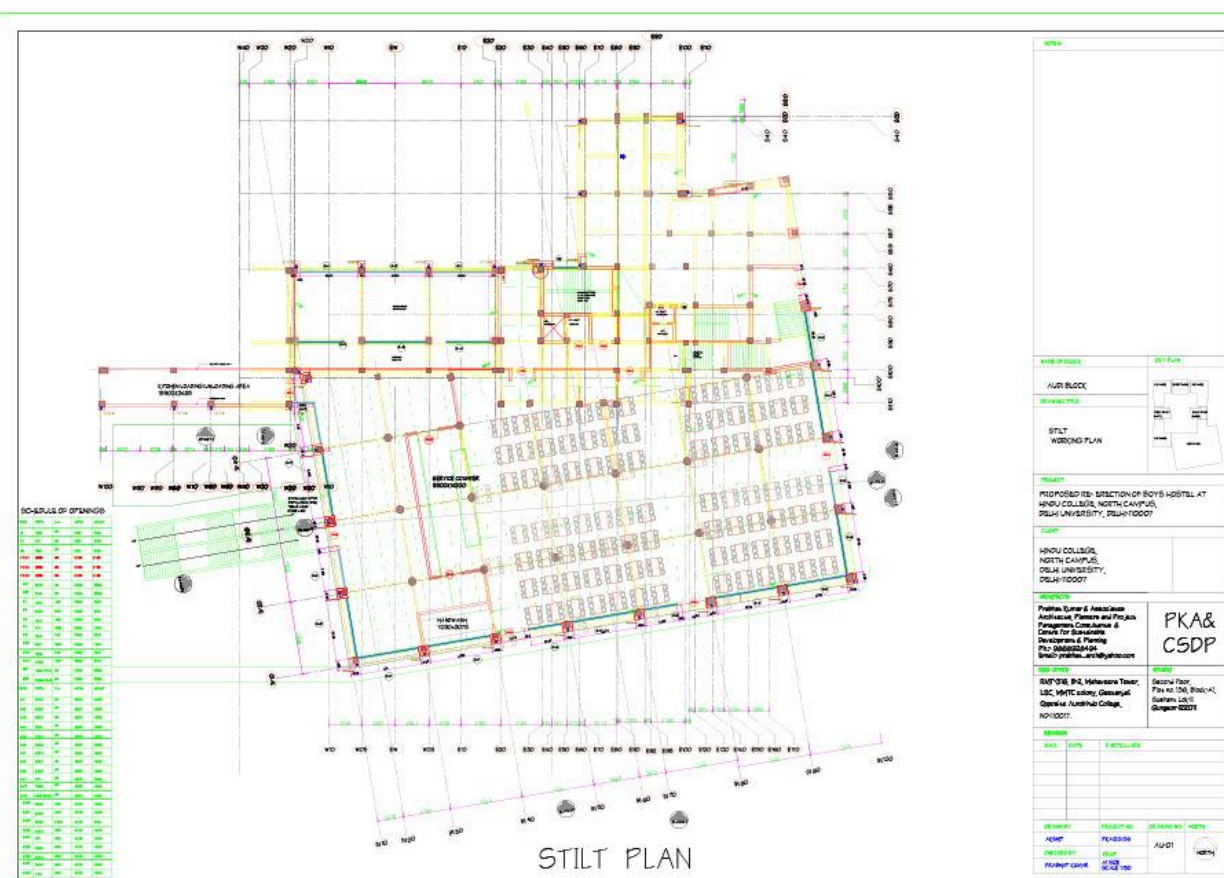
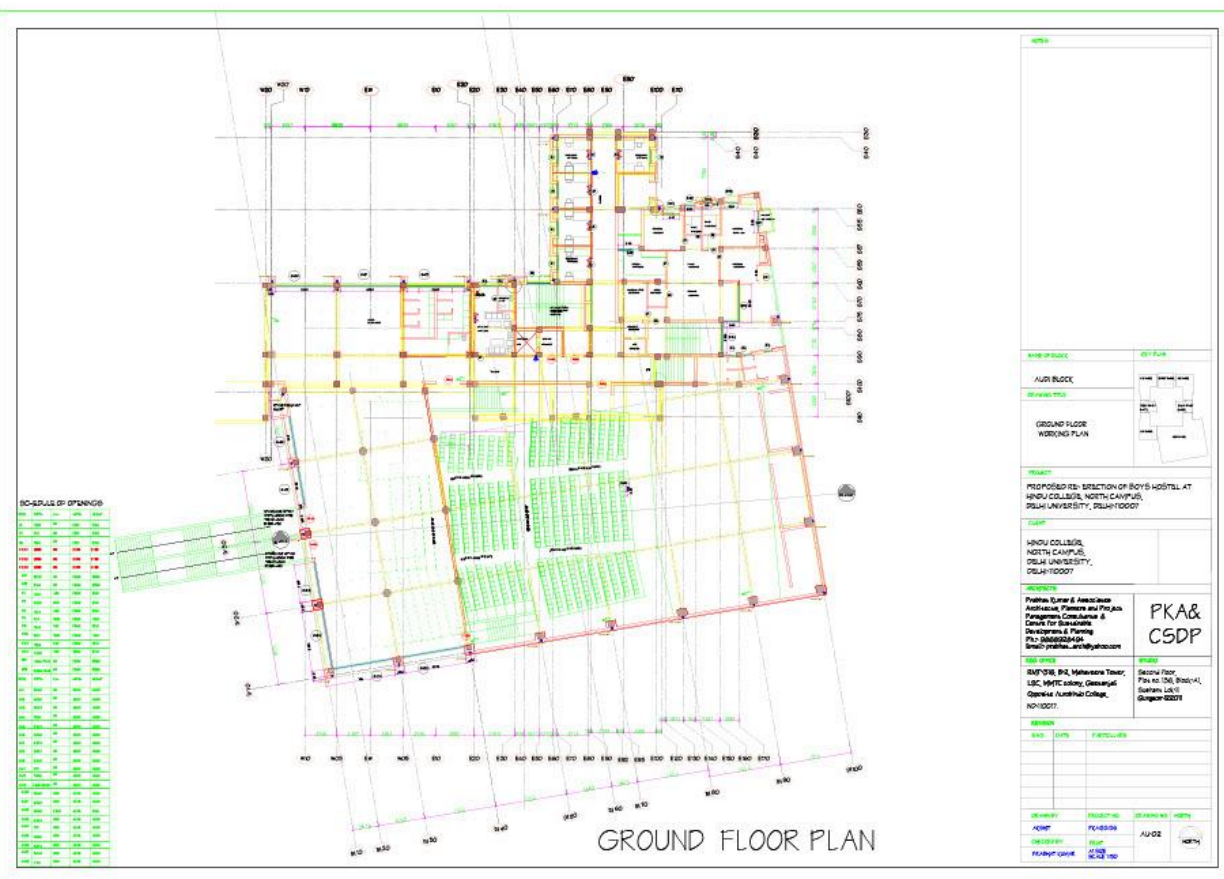
PROPOSED EXTENSION OF BOYS HOSTEL AT VINU COLLEGE, NORTH CAMPUS, DLSU UNIVERSITY, DAVAHO CITY	
PROJECT PROPOSED EXTENSION OF BOYS HOSTEL AT VINU COLLEGE, NORTH CAMPUS, DLSU UNIVERSITY, DAVAHO CITY	CLIENT VINU COLLEGE, NORTH CAMPUS, DLSU UNIVERSITY, DAVAHO CITY
DESIGNER Prof. Turner S. Arce Architect, Planner and Project Manager Consultant & Planning Firm Small practice, arce@turner-arce.com	PKA&CSDP Small practice, arce@turner-arce.com
DATE 2023-01-10	REVISION 1. Initial Design 2. Final Design 3. Construction Documents
SCALE 1:100	PROJECT NO. PKA-0001
DESIGNER Prof. Turner S. Arce	PROJECT NO. PKA-0001
DATE 2023-01-10	PROJECT NO. PKA-0001
SCALE 1:100	PROJECT NO. PKA-0001



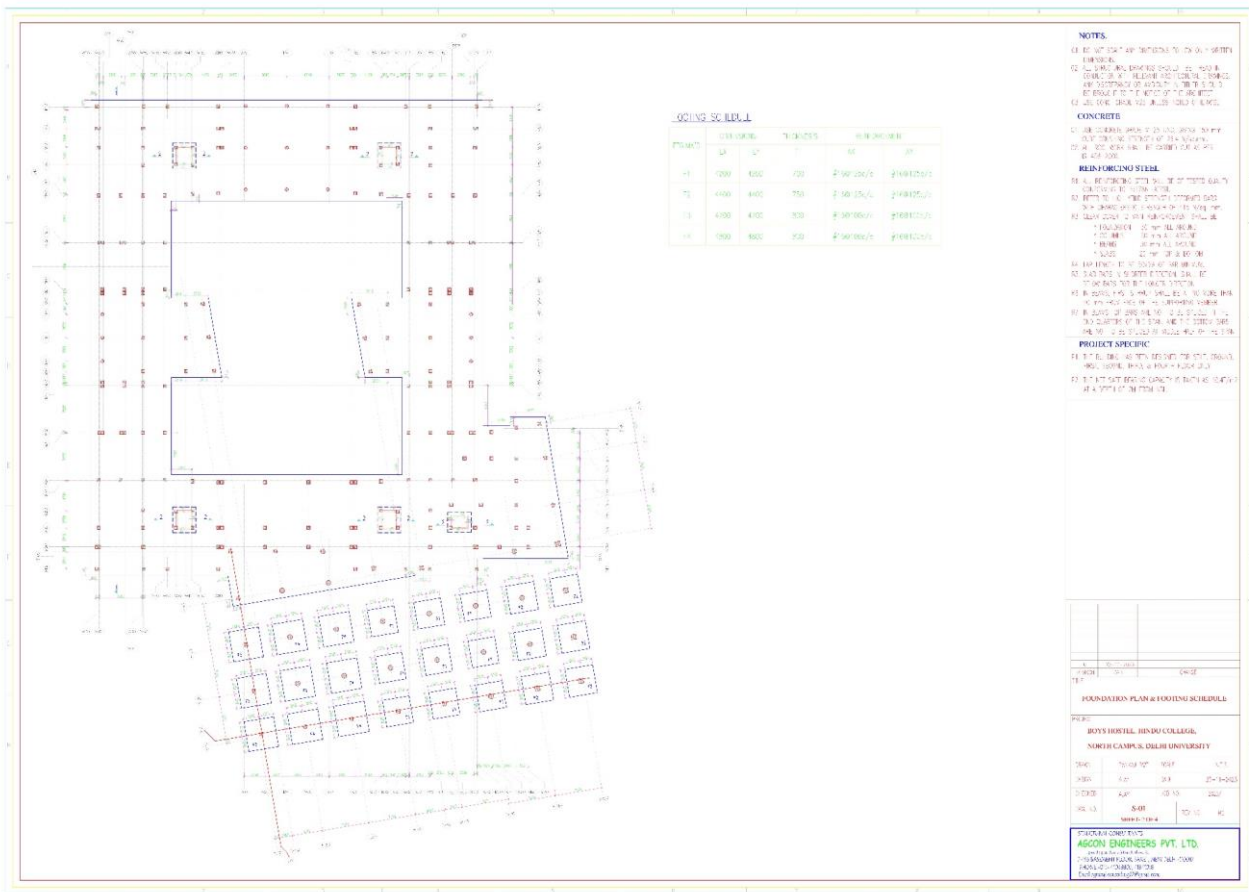
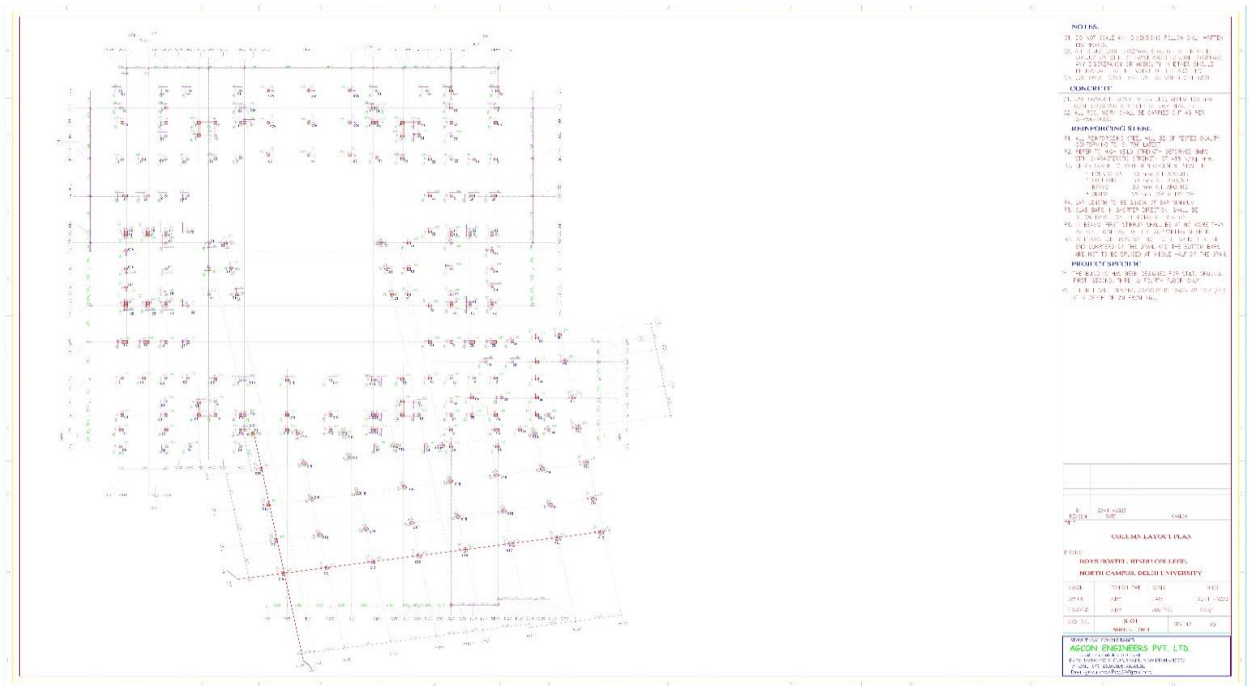




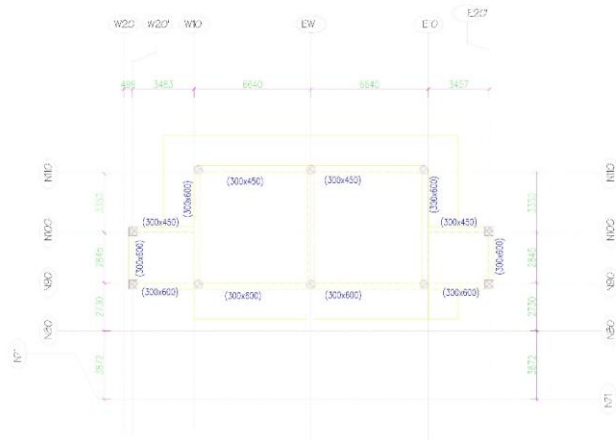


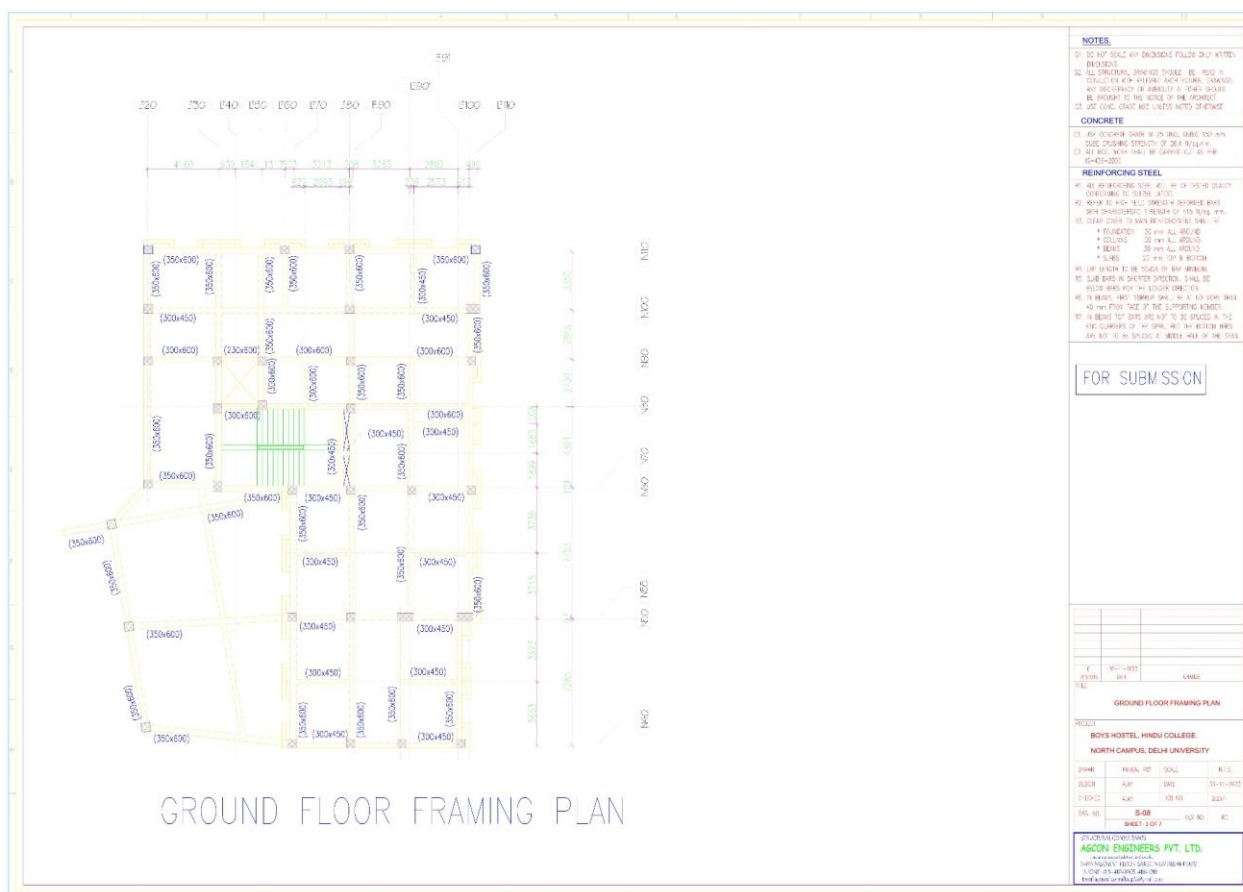


STRUCTURAL DRAWING











PART D: COMMERCIAL BID

BILL OF QUANTITIES (COMPOSITE WORKS)

QUOTED ITEM RATES ON BILL OF QUANTITIES

Validate

Print

Help

[Item Rate BoQ](#)

Tender Inviting Authority: Principal, Hindu College

Name of Work: CONSTRUCTION OF BOYS HOSTEL AT HINDU COLLEGE COMPRISING OF STILT +5 FLOORS FOR 566 STUDENTS INCLUDING STRUCTURAL WORKS, FINISHING WORKS, PART INTERNAL WATER SUPPLY, PART SANITARY, STORM WATER DRAINAGE, ELECTRICAL INSTALLATIONS INCLUDING FIRE ALARM, WI-FI & PA SYSTEMS AND PART EXTERNAL DEVELOPMENT WORKS

Contract No: HC-1/3837 dt: 30.01.2024

Name of the
Bidder/
Bidding Firm
/ Company :

PRICE SCHEDULE

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	BASIC RATE In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT With Taxes i/c GST in Rs. P	TOTAL AMOUNT In Words
1	2	4	5	13	53	55
1.00	Part A Civil Work					
1.01	Surface dressing of the ground including removing vegetation and in-equalities not exceeding 15 cm deep and disposal of rubbish, lead upto 50 m and lift upto 1.5 m.	120 0.00	Sq m		0.00	INR Zero Only
2	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, any width and any area in plan) including getting out and disposal of excavated earth lead upto 200 m and lift upto 1.5 m, as directed by Engineer-in-charge. a) All kinds of soil	131 87.0 0	Cu m		0.00	INR Zero Only
3	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to any and lift upto any	653 9.00	Cu m		0.00	INR Zero Only
4	Carriage of earth by mechanical transport including loading, unloading for a lead upto 10.00 Km.	664 8.00	Cu m		0.00	INR Zero Only
5	Supplying and filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete.	430. 00	Cu m		0.00	INR Zero Only

6	Supplying chemical emulsion in sealed containers including delivery as specified. Chlorpyrifos/ Lindane emulsifiable concentrate of 20%	171 3.00	Litr e		0.00	INR Zero Only
7	Diluting and injecting chemical emulsion for POSTCONSTRUCTION anti-termite treatment (excluding the cost of chemical emulsion) : Treatment of soil before casting of foundation PCC using chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes and plugging with cement mortar 1 :2 (1 cement : 2 Coarse sand) to match the existing floor : With Chlorpyrifos/Lindane E.C. 20% with 1% concentration	392 2.00	Sq m		0.00	INR Zero Only
8	Extra for every additional lift of 1.5 m or part thereof in excavation / banking excavated or stacked materials. All kinds of soil	130 1.00	Cu m		0.00	INR Zero Only
9	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work upto plinth level.					
9.01	1:4:8 (1 Cement : 4 coarse sand (zone-III) : 8 graded stone aggregate 40 mm nominal size)	417. 00	Cu m		0.00	INR Zero Only
9.02	1:5:10 (1 cement : 5 coarse sand (zone-III) derived from natural sources : 10 graded stone aggregate 40 mm nominal size derived from natural sources)	640. 00	Cu m		0.00	INR Zero Only
10	Providing and laying cement concrete in retaining walls, return walls, walls (any thickness) including attached pilasters, columns, piers, abutments, pillars, posts, struts, buttresses, string or lacing courses, parapets, coping, bed blocks, anchor blocks, plain window sills, fillets, sunken floor etc., up to floor five level, excluding the cost of centering, shuttering and finishing :					
10.01	1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	12.0 0	Cu m		0.00	INR Zero Only
10.02	1:3:6 (1 cement : 3 coarse sand derived from natural sources : 6 graded stone aggregate 20 mm nominal size derived from natural sources)	27.0 0	Cu m		0.00	INR Zero Only
11	Extra for concrete work in superstructure above floor V level for each four floors or part thereof.	12.0 0	Cu m		0.00	INR Zero Only
12	Making plinth protection 50mm thick of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including necessary excavation, levelling & dressing & finishing the top smooth.	555. 00	Sq m		0.00	INR Zero Only

13	Providing and laying damp-proof course 40mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand (zone-III): 4 graded stone aggregate 12.5mm nominal size)	280.00	Sq m		0.00	INR Zero Only
14	Extra for providing and mixing water proofing material in cement concrete work in doses by weight of cement as per manufacturer's specification.	73.00	Per 50 kg cement		0.00	INR Zero Only
15	Providing & applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7kg per square metre on damp proof course after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil.	280.00	Sq m		0.00	INR Zero Only
16	Providing and laying in position ready Mixed or site batched design mix cement concrete for reinforced cement concrete work using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana/ordinary Portland/Portland slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate /retard setting of concrete to improve durability and Workability, without impairing strength, including pumping of concrete to site of laying, curing, Carriage for all leads, but excluding the cost of centering, shuttering, finishing and reinforcement as per direction of the Engineer-in-charge, for the following grades of concrete					
17	All works upto Plinth level Concrete of M25 grade with minimum cement content of 350 kg /cum	3555.00	Cu m		0.00	INR Zero Only
18	All works above plinth level upto floor VII level Concrete of M25 grade with minimum cement content of 350 kg /cum	5597.00	Cu m		0.00	INR Zero Only
19	Providing and laying 75x150mm Precast ferro cement beams	22.00	Me tre		0.00	INR Zero Only
20	Extra for R.C.C./ B.M.C/ R.M.C. work above floor V II level for each four floors or part thereof.	130.00	Cu m		0.00	INR Zero Only
21	Reinforcement for RCC work including straightening, cutting, bending, placing in position and binding all complete upto plinth level. Thermo-Mechanically Treated bars	507052.80	Kg		0.00	INR Zero Only
22	Reinforcement for RCC work including straightening, cutting, bending, placing in position and binding all complete. Above plinth level. Thermo-Mechanically Treated bars	755491.5	Kg		0.00	INR Zero Only
23	Centering and shuttering including strutting, propping etc. and removal of form for :					
24	Foundation, footing, bases of columns etc. for mass concrete	778.00	Sq m		0.00	INR Zero Only

24.01	Suspended floors, roofs, landings, balconies and access platform with water proof ply 12 mm thick	138 47.0 0	Sq m		0.00	INR Zero Only
24.02	Lintels, beams, plinth beams, girders, bressumers and cantilevers with water proof ply 12 mm thick	174 78.0 0	Sq m		0.00	INR Zero Only
24.03	Columns, Pillars, Piers, Abutments, Posts and Struts- In exposed RCC finish	116 52.0 0	Sq m		0.00	INR Zero Only
24.04	Stairs, (excluding landings) except spiral-staircases- in Water proof ply 12 mm thick	623. 00	Sq m		0.00	INR Zero Only
24.05	Small lintels not exceeding 1.5 m clear span, moulding as in cornices, window sills, string courses, bands, copings, bed plates, anchor blocks and the like	292. 00	Sq m		0.00	INR Zero Only
24.06	Edges of slabs and breaks in floors and walls with water proof ply 12 mm thick in exposed RCC finish Under 20 cm wide	454 8.00	me tre		0.00	INR Zero Only
24.07	Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	349. 00	Sq m		0.00	INR Zero Only
24.08	Weather shade, Chajjas, corbels etc., including edges with water proof ply 12 mm thick in exposed RCC finish	794. 00	Sq m		0.00	INR Zero Only
24.09	Extra for shuttering in circular work (20% of respective centering and shuttering items) in exposed RCC finish	116 7.00	Sq m		0.00	INR Zero Only
24.10	Shelves (Cast in situ)	116. 00	Sq m		0.00	INR Zero Only
25	Add for plaster drip course/ groove in plastered surface or moulding to R.C.C. projections. Including Grooves/ drip course in Exposed RCC with neat finishing in RCC itself using aluminum channels etc.	171 9.00	Me tre		0.00	INR Zero Only
26	Extra for additional height in centering, shuttering where ever required with adequate bracing, propping etc., including cost of de-shuttering and decentering at all levels, over a height of 3.5 m, for every additional height of 1 metre or part thereof (Plan area to be measured). Suspended floors, roofs, landing, beams and balconies (Plan area to be measured)	174 67.0 0	Sq m		0.00	INR Zero Only
27	Providing and fixing in position Stainless steel Grade 304 plate- 1.0 mm thick as per design for expansion joints. 200 mm wide.	646. 00	me tre		0.00	INR Zero Only

28	Providing and fixing of expansion joint system related with floor location as per drawings and direction of Engineer-In-Charge. The joints system will be of extruded aluminum base members, self aligning / self centering arrangement and support plates etc. as per ASTM B221-02. The system shall be such that it provides floor to floor /floor to wall expansion control system for various vertical localtion in load application areas that accommodates multi directional seismic movement without stress to it's components. System shall consist of metal profiles with a universal aluminum base member designed to accommodate various project conditions and finish floor treatments. The cover plate shall be designed of width and thickness required to satisfy projects movement and loading requirements and secured to base members by utilizing manufacturer's pre-engineered self- centering arrangement that freely rotates / moves in all directions. The Self - centering arrangement shall exhibit circular sphere ends that lock and slide inside the corresponding aluminum extrusion cavity to allow freedom of movement and flexure in all directions including vertical displacement. Provision of Moisture Barrier Membrane in the Joint System to have watertight joint is mandatory requirement all as per the manufactures design and as approved by Engineer -in- Charge. (Material shall confirm to ASTM 6063). Floor Joint of 100 mm gap	415.00	me tre		0.00	INR Zero Only
29	Providing and fixing of expansion joint system related with wall joint (internal/ external) location as per drawings and direction of Engineer-In- Charge. The joints shall be of extruded aluminum base members, self aligning / centering arrangement and support plates as per ASTM B221- 02. The material shall be such that it provides an Expansion Joints System suitable for vertical wall to wall/ wall to corner application, both new and existing construction in office Buildings & complexes with no slipping down tendency amongst the components of the Joint System. The Joint System shall utilize light weight aluminum profiles exhibiting minimal exposed aluminum surfaces mechanically snap locking the multicellular to facilitate movement. (Material shall confirm to ASTM 6063). Wall Joint of 100 mm gap	162.00	me tre		0.00	INR Zero Only

30	Providing and fixing of expansion joint system of approved make and manufactures for various roof locations as per approved drawings and direction of Engineer-In-Charge. The joints shall be of extruded aluminum base members with, self aligning and self centering arrangement support plates asper ASTM B221-02. The system shall be such that it provides watertight roof to roof/roof to corner joint cover expansion control system that is capable of accommodating multidirectional seismic movement without stress to its components. System shall consist of metal profile that incorporates a universal aluminum base member designed to accommodate various project conditions and roof treatments. The cover plate shall be designed of width and thickness required to satisfy movement and loading requirements and secured to base members by utilizing manufacturer's pre-engineered self-centering arrangement that freely rotates / moves in all directions. The Self centering arrangement shall exhibit circular sphere ends that lock and slide inside the corresponding aluminum extrusion cavity to allow freedom of movement				
31	and flexure in all directions including vertical displacement. The Joint System shall resists damage or deterioration from the impact of falling ice, exposure to UV, airborne contaminants and occasional foot traffic from maintenance personnel. Provision of Moisture Barrier Membrane in the Joint System to have water tight joint is mandatory requirement. (Material shall confirm to ASTM 6063). Roof Joint of 100 mm gap	70.0 0	me tre	0.00	INR Zero Only
32	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:6 (1 cement : 6 coarse sand)	8	Cu m	0.00	INR Zero Only
33	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor VII level in all shapes and sizes in : Cement mortar 1:6 (1 cement : 6 coarse sand)	200 1	Cu m	0.00	INR Zero Only
34	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundations and plinth in : a) Cement mortar 1:4 (1 cement : 4 coarse sand)	30	Sq m	0.00	INR Zero Only

35	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor VII level. Cement mortar 1:4 (1 cement :4 coarse sand)	836 2	Sq m		0.00	INR Zero Only
36	Extra for providing and placing in position 2 Nos 6mm dia. M.S. bars at every third course of half brick masonry.	839 2	Sq m		0.00	INR Zero Only
37	Providing and filling AAC blocks including proper watering and compaction in sunken areas all complete as per drawings and as directed by the Engineer-in-charge in-Charge.	328	Cu m		0.00	INR Zero Only
38	Extra for brick work / AAC block masonry / Tile brick masonry in superstructure above floor VII level, for each four floors or part thereof by mechanical means.	245 1	Cu m		0.00	INR Zero Only
39	Extra for half brick masonry in superstructure, above floor VII level for every four floors or part thereof by mechanical means.	248 7	Sq m		0.00	INR Zero Only
40	Brick work with common burnt clay machine moulded F.P.S. (non modular) bricks of class designation 12.5 in cement mortar 1:6 (1 cement : 6 coarse sand) in exposed brick work WITHOUT ANY MORTAR ON FACE OR FRONT EDGES OF BRICKS including making horizontal and vertical grooves 10 mm wide 12 mm deep RECESSED POINTING IN 1:3 Cement Mortar (1 cement:3 Fine sand mixed with water proofing compound) complete. THE BRICK WORK CAN BE IN FLEMISH BOND, RAT-TRAP BOND OR ENGLISH BOND AS PER DRAWINGS					
40.01	From ground level upto plinth level	7	cu m		0.00	INR Zero Only
40.02	Above plinth level upto floor VII level	158 1	cu m		0.00	INR Zero Only
41	Brick work with common burnt clay machine moulded F.P.S. (non modular) bricks of class designation 12.5 in cement mortar 1:6 (1 cement : 6 coarse sand) in exposed brick work WITHOUT ANY MORTAR ON FACE OR FRONT EDGES OF BRICKS including making horizontal and vertical grooves 10 mm wide 12 mm deep RECESSED POINTING IN 1:3 Cement Mortar (1 cement:3 Fine sand mixed with water proofing compound) complete. THE BRICK WORK CAN BE IN FLEMISH BOND, RAT-TRAP BOND OR ENGLISH BOND AS PER DRAWINGS- 75 MM THICK ONLY THICKNESS AS CLADDING ON FACE OF RCC MEMBERS	308 2	Sq m		0.00	INR Zero Only

42	Brick work with common burnt clay machine moulded F.P.S. (non modular) bricks of class designation 12.5 in cement mortar 1:6 (1 cement : 6 coarse sand) in exposed brick work WITHOUT ANY MORTAR ON FACE OR FRONT EDGES OF BRICKS including making horizontal and vertical grooves 10 mm wide 12 mm deep RECESSED POINTING IN 1:3 Cement Mortar (1 cement:3 Fine sand mixed with water proofing compound) complete. THE BRICK WORK CAN BE IN FLEMISH BOND, RAT-TRAP BOND OR ENGLISH BOND AS PER DRAWINGS--MAKING BRICK JALIS AS PER DRAWINGS . INDICATIVE SKETCH PROVIDED IN ATTACHED DRAWINGS.	740	Sq m		0.00	INR Zero Only
43	Providing and fixing 18 mm thick gang saw cut, mirror polished, premoulded and prepolished, machine cut for kitchen platforms, vanity counters, window sills, facias and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement : 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, moulding and polishing to edges to give high gloss finish etc. complete at all levels. Granite stone slab colour black, Cherry/Ruby red Area of slab over 0.50 sqm	75	Sq m		0.00	INR Zero Only
44	Providing and fixing 25 mm thick gang saw cut, mirror polished, premoulded and prepolished, machine cut for window sills, facias and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement : 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, moulding and polishing to edges to give high gloss finish etc. complete at all levels. Kota stone window Sill	644	Sq m		0.00	INR Zero Only
45	Extra for fixing marble /granite stone, over and above corresponding basic item, in facia and drops of width upto 150 mm with epoxy resin based adhesive, including cleaning etc. complete.	644	Me tre		0.00	INR Zero Only
46	Extra for providing opening of required size & shape for wash basin/ kitchen sink in kitchen platform, vanity counter and similar location in marble/ Granite/ stone work, including necessary holes for pillar taps etc. including moulding, rubbing and polishing of cut edges etc. complete.	130	Eac h		0.00	INR Zero Only

47	Providing and fixing stone slab with table rubbed, edges rounded and polished, of size 75x50 cm deep and 1.8 cm thick, fixed in urinal partitions by cutting a chase of appropriate width with chase cutter and embedding the stone in the chase with epoxy grout or with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 6 mm nominal size) as per direction of Engineer-in-charge and finished smooth. Granite Stone of approved shade	99	Sq m		0.00	INR Zero Only
48	Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately). Sal wood	15	Cu m		0.00	INR Zero Only
49	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters: 35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws	719	Sq m		0.00	INR Zero Only
50	Extra for providing lipping with 2nd class teak wood battens 25 mm minimum depth on all edges of flush door shutters (over all area of door shutter to be measured).	719	Sq m		0.00	INR Zero Only
51	Providing and fixing bright finished brass 100 mm mortice latch and lock, ISI marked, with six levers and a pair of anodised (anodic coating not less than grade AC 10 as per IS : 1868) aluminium lever handles of approved quality with necessary screws etc. complete.	333	Eac h		0.00	INR Zero Only
52	Providing & Fixing decorative high pressure laminated sheet of plain / wood grain in gloss / matt/ suede finish with high density protective surface layer and reverse side of adhesive bonding quality conforming to IS : 2046 Type S, including cost of adhesive of approved quality. 1.0 mm thick	1438	Sq m		0.00	INR Zero Only
53	Providing and fixing bright /matt finished Stainless Steel handles of approved quality & make with necessary screws etc all complete. 125 mm	662	Eac h		0.00	INR Zero Only
54	Providing 40x5 mm flat iron hold fast 400 mm long including fixing to frame with 10 mm diameter bolts, nuts and wooden plugs and embedding in cement concrete block 300x100x150 mm 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 20mm nominal size).	2874	eac h		0.00	INR Zero Only

55	Providing and fixing Stainless steel satin finish SS 304 grade Sliding Door bolts 250x16 mm for wooden doors of approved make and model all complete as per the directions of Engineer-in-charge 250x16 mm	504	Eac h		0.00	INR Zero Only
56	Providing and fixing Stainless steel satin finish SS 304 grade Tower Bolts SS screws for wooden doors of approved make and model all complete as per the directions of Engineer-in-charge					
56.01	300x10 mm	543	Eac h		0.00	INR Zero Only
56.02	200x10 mm	483	Eac h		0.00	INR Zero Only
57	Providing and fixing Door closer with link arm satin finish with SS screws for wooden doors of width upto 950mm of approved make and model all complete as per the directions of Engineer-in-charge	324	Eac h		0.00	INR Zero Only
58	Providing and fixing Stainless steel SS 304 grade satin finish wall mounted door stopper of 75mm length with SS screws of approved make and model all complete as per directions of Engineer-in-charge	324	Eac h		0.00	INR Zero Only
59	Providing and fixing factory made uPVC glazed/wire mesh windows/doors comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler (where ever required) extruded profiles having minimum wall thickness of 1.70 mm for Series R1 and R2 profiles and 2.10 mm for Series R3 and R4 profiles conforming to EN: 12608 in any shape, colour and design duly reinforced with galvanized mild steel section made of required shape & size as per CPWD Specification, uPVC extruded glazing beads, interlocks and Inline sash adaptor (where ever required) of appropriate dimension, EPDM gasket, hardware, SS 304 grade fasteners of minimum 8 mm dia with countersunk head, comprising of matching polyamide PA6 grade sleeve for fixing frame to finished wall as per IS 1367: Part 1 to 14, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame, sash & mullion (if required) shall be mitred cut and fusion welded/mechanically jointed duly sealed at all corners, including drilling of holes for fixing hardware and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of approved size and quality, all complete as per approved drawing conforming to CPWD specification & direction of Engineer-in-Charge. Section of steel reinforcement and cross sections of uPVC profiles to be as per design approved by Engineer-in-Charge. Wire mesh / Glazing of plain/ toughened/ laminated/ double glass unit with/ without high performance coatings as per design requirements and conforming to IS: 3548 & IS: 16231 shall be paid separately. Note:- Structural design proof checked from a Government Engineering Institute, to be provided by the manufacturer for (i) Sites with basic wind speed > 45 m/sec as per IS 875 - Part 3 (ii) Sites with structure height more than 20m for all wind speeds					

60	Two track two panels sliding door with Aluminium channel for roller track, wool pile, zinc alloy (zamak) powder coated handle on every panel along with multi-point locking system, adjustable nylon rollers with SS 304 body. Using R3 series with frame (55 mm & above) x (40 mm & above) & sash (30 mm & above) x (74 mm & above). (Height upto 2.5 metre).	52	Sq m		0.00	INR Zero Only
61	Fixed window / ventilator with mullion / transom Using R1 series with frame (33 mm & above) x (35 mm & above) & mullion (33 mm & above) x (50 mm & above). (Height upto 0.90 metre)	700	Sq m		0.00	INR Zero Only
62	Using R3 series with frame (55 mm & above) x (45 mm & above) & mullion (55 mm & above) x (65 mm & above). (Height upto 2.5 metre)	55	Sq m		0.00	INR Zero Only
63	Casement window double panels with fixed mullion with S.S. 304 friction hinges as per size and weight of sash, multi-point locking system, zinc alloy (zamak) powder coated handles. Using R2 series with frame (39 mm & above) x (39 mm & above) & sash (39 mm & above) x (60 mm & above) & mullion (39 mm & above) x (60 mm & above). (Height upto 1.2 metre).	493	Sq m		0.00	INR Zero Only
64	Casement cum fixed panel window having one single casement panel & fixed panel with S.S 304 friction hinges as per size and weight of sash, multi-point locking system, zinc alloy (zamak) powder coated handles. Using R2 series with frame (39 mm & above) x (39 mm & above) & sash (39 mm & above) x (60 mm & above) & mullion (39 mm & above) x (60 mm & above). (Height upto 1.2 metre; each openable shutter upto 0.8m width)	70	Sq m		0.00	INR Zero Only
65	Using R3 series with frame (55 mm & above) x (45 mm & above) & sash (55 mm & above) x (65 mm & above) & mullion (55 mm & above) x (65 mm & above). (Height upto 1.8 metre; each openable shutter upto 0.8m width)	26	Sq m		0.00	INR Zero Only
66	Casement cum fixed panel window having single casement panel at both ends & middle fixed panel with S.S 304 friction hinges as per size and weight of sash, multi-point locking system, zinc alloy (zamak) powder coated handles. Using R2 series with frame (39 mm & above) x (39 mm & above) & sash (39 mm & above) x (60 mm & above) & mullion (39 mm & above) (60 mm & above). (Height upto 1.2 metre; each openable shutter upto 0.8m width)	72	Sq m		0.00	INR Zero Only

67	Providing and fixing fire resistant door frame of section 50 x 60 mm on horizontal side & 35 x 60 mm on vertical sides having built in rebate made out of 1.6 mm thick GI sheet (Zinc coating not less than 120gm/ sqm) suitable for mounting 120 minutes Fire Rated Glazed Door Shutters. The frame shall be filled with mineral wool Insulation having density minimum 96Kg/cum. The frame will have a provision of G.I. anchor fastners 14 nos (5 each on vertical style & 4 on horizontal style of size M10 x 80) suitable for fixing in the opening along with factory made template for SS ball bearing hinges of Size 100x89x3mm for fixing of fire rated glazed shutter . The frame shall be finished with a approved fire resistant primer or powder coating of not less than 30 micron in desired shade as per the directions of Engineer - in- Charge . (Cost of SS ball bearing hinges is excluded).	480	me tre		0.00	INR Zero Only
68	Providing and fixing 60 mm thick glazed fire resistant door shutters of 120 minutes fire rating confirming to IS:3614 (Part II) or EN1634-1:1999, tested and certified as per laboratory approved by Engineer-in-Charge, with suitable mounting on door frame, consisting of vertical styles, top rail & side rail 60 mm x 60 mm wide and bottom rail of 110 mm x 60 mm made out of 1.6mm thick G.I. sheet (zinc coating not less than 120gm/sqm) duly filled mineral wool insulation having density minimum 96 kg/cum and fixing with necessary stainless steel ball bearing hinges of size 100x89x3mm of approved make, including applying a coat of approved fire resistant primer or powder coating not less than 30 micron etc all complete as per direction of Engineer-in-Charge (panelling to be paid for seperately).	141	Sq m		0.00	INR Zero Only

69	Providing and fixing glazing in fire resistant door shutters, fixed panels & partitions etc., with G.I. beading made out of 1.6 mm thick G.I. sheet (zinc coating not less than 120 gm/m ²) of size 20 x 33 mm screwed with M4 x 38 mm SS screws at distance 75 mm from the edges and 150 mm c/c, including applying a coat of approved fire resistant primer/ powder coating of not less than 30 micron on G.I. beading, & special ceramic tape of 5 x 20 mm size etc complete in all respect as per NBC 2016, IS 16231 (Part 3):2016 and as per direction of Engineer-in-charge with glass of required thickness having 120 minutes of fire resistance both integrity & radiation control (EW120) and minimum 20 minutes of insulation (EI20). The manufacturer have to give test report/certification of fire glass and the glass should have the stamp showing the value of E, EW & EI. The glass shall be tested in approved NABL accredited lab or by any other accreditation body which operates in accordance with ISO/IEC 17011 and accredits labs as per ISO/IEC 17025 for testing and calibration scopes shall be eligible. The maximum glazing size shall not be more than 1100x2200 mm (w x h) or 2.42 sqm.	212	Sq m		0.00	INR Zero Only
70	Providing and fixing panic bar / latch (Double point) fitted with a single body, Trim Latch & Lock on back side of the Panic Latch of reputed brand and manufacture to be approved by the Engineer- in- charge, all complete.	148	Eac h		0.00	INR Zero Only

71	Providing and fixing in position aluminum door fully panelled with 12mm thk. Novapan BSL and made up of extruded and anodised aluminium sections of approved make and of size 63.5 mm x 38.10 mm x 2.0 mm thk (wt. 1.054 kg/Rm) for outer frame, 47.62 mm x 10.16 mm x 1.74 mm thk (wt. 0.881kg/Rm) for top rail, 95.25 mm x 25.40 mm x 2.0 mm thk(wt. 1.519 kg/Rm) for bottom rail, 25.0 mm x 44.45 mm x 2.40 mm thk (wt. 0.918 kg/Rm) for lock rail, 47.62 mm x 44.45 mm x 1.8 mm thk (wt. 0.943kg/Rm) for shutter vertical hinges side, 47.62 mm x 44.45 mm x 1.95 mm thk (wt. 0.936 kg/Rm) shutter vertical latch side, clip weighing 0.097 kg/Rm including neoprene gasket, fixtures, fastenings and accesories like hinges, locking arrangement, door closer, tower bolts, handle etc. complete as directed by Engineer In Charge. (Note: anodic film must not be less than 15 microns i.e. AC-15 as per IS, the anodising must be scaleted by keeping the anodized section in boiling deanodized water for a period of one hour)					
71.01	Door (1100x2100)	26	Eac h		0.00	INR Zero Only
71.02	Door (750x2100)	180	Eac h		0.00	INR Zero Only
72	Providing and fixing carbon steel galvanised (minimum coating 5 micron) dash fastener of 10 mm dia double threaded 6.8 grade (yield strength 480 N/mm2), counter sunk head, comprising of 10 mm dia polyamide PA 6 grade sleeve, including drilling of hole in frame , concrete/ masonry, etc. as per direction of Engineer-in-charge.					
72.01	10 x 80 mm	569	No s		0.00	INR Zero Only
72.02	10 x 120 mm	119 1	No s		0.00	INR Zero Only
73	Providing and fixing stainless steel (Grade 304) railing made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement as per approval of Engineer-incharge, (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.).	360 8	Kg		0.00	INR Zero Only

74	Steel work welded in built up sections/ framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required. In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	740	kg		0.00	INR Zero Only
75	Structural steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	688 3	kg		0.00	INR Zero Only
76	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc., including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete. Hot finished seamless type tubes	240 20	kg		0.00	INR Zero Only
77	Providing and fixing precoated Galvalume (PPGL) profile sheets (size, shape and pitch of corrugation as approved by Engineer-in-charge) 0.50 mm (+ 0.05 %) total coated thickness with zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns. Sheet should have protective guard film of 25 microns minimum to avoid scratches during transportation and should be supplied in single length upto 12 metre or as desired by Engineer-in-charge. The sheet shall be fixed using self drilling /self tapping screws of size (5.5x 55 mm) with EPDM seal, complete upto any pitch in horizontal/ vertical or curved surfaces, excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required.	110 7	Sq m		0.00	INR Zero Only
78	Providing and fixing Bug screen for external door and window	566	Sq m		0.00	INR Zero Only
79	Providing and fixing precoated galvanised steel sheet roofing accessories of total coated thickness 0.50 mm (base metal of minimum 0.45 mm thickness with total coating thickness of 0.05 mm) with Zinc coating 120 gram per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns using self drilling/ self tapping screws complete :					
79.01	Gutter (600 mm over all girth)	297	me tre		0.00	INR Zero Only

79.02	Flashings/ Aprons.(Upto 600 mm)	112	me tre		0.00	INR Zero Only
79.03	North light curves metre	297	me tre		0.00	INR Zero Only
79.04	Barge board (Upto 300 mm)	122	me tre		0.00	INR Zero Only
79.05	Crimp curve sqm	297	me tre		0.00	INR Zero Only
80	Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joints with white cement and matching pigments etc., complete. Size of Tile 600x600 mm	331 7	Sq m		0.00	INR Zero Only
81	Providing and laying Vitrified tiles in different sizes (thickness to be specified by manufacturer), with water absorption less than 0.08 % and conforming to I.S. 15622, of approved make, in all colours & shade, in skirting, dado, riser of steps, over 12 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joint with white cement & matching pigments etc. complete. Size of Tile 600x600 mm	486	Sq m		0.00	INR Zero Only
82	Kota stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) : 25 mm thick	297 8	Sq m		0.00	INR Zero Only
83	Kota stone slabs 20 mm thick in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete.	151	Sq m		0.00	INR Zero Only
84	Extra for pre finished nosing in treads of steps of Kota stone/ sand stone slab.	148 6	me tre		0.00	INR Zero Only
85	Extra above item 11.26 for Providing and fixing kota stone with rubbing and mirror polishing on Top of Parapets, Top of cills including, vertical face of tops and cills including making bird beak/ offset joint and providing weather groove/ drip course on the stone edge, stone area to be measured on actual plan or elevation measurements only without any rounding off.	450	Sq m		0.00	INR Zero Only

86	Providing weather groove/ drip course on the edge of Kota stone as per any design.	300	me tre		0.00	INR Zero Only
87	Extra for Kota stone/ sand stone in treads of steps and risers using single length up to 2.00 metre.	446	Sq m		0.00	INR Zero Only
88	Providing and laying rectified Glazed Ceramic floor tiles of size 600x600 mm or more (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in colours White, Ivory, Grey, Fume Red Brown, laid on 20 mm thick cement mortar 1:4 (1 Cement: 4 Coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joints with white cement and matching pigments etc., complete.	984	Sq m		0.00	INR Zero Only
89	Providing and fixing 1st quality Ceramic Glazed wall tiles size 600x1200mm conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	325 8	Sq m		0.00	INR Zero Only
90	Extra for fixing tiles in any BOQ item with 4 mm wide groove using spacers on vertical or horizontal surfaces, complete with white cement, pigment and specified Grout.	625 0	Sq m		0.00	INR Zero Only
91	Providing and laying Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge. Polished Granite stone slab colour of Black, Cherry/Ruby Red or equivalent	316 2	Sq m		0.00	INR Zero Only
92	Providing and fixing 18 mm thick polished granite stone in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement : 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including rubbing and polishing complete.	268	Sq m		0.00	INR Zero Only

93	Providing and laying Lapato finish Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.	623 3	Sq m		0.00	INR Zero Only
94	Providing and fixing 18 mm thick Lapato finish granite stone in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement : 3 coarse sand) and jointed with white cement slurry mixed with pigment to match the shade of the slab, including rubbing and polishing complete.	490	Sq m		0.00	INR Zero Only
95	Providing and fixing Delhi quartz stone cladding fixed on 20 mm (average) thick cement mortar 1:3 (1 cement : 3 coarse sand) laid and jointed with grey cement slurry @ 3.3 kg/sqm including pointing with grey cement slurry admixed with pigment of matching shade including pointing with 1:3 Cement sand mortar etc. all complete in approved pattern as per drawings, and as directed by the Engineer-in-Charge.	380 1	Sq m		0.00	INR Zero Only
96	Extra above item 8.11 for Providing and fixing 18 mm th. Granite stone with rubbing and mirror polishing on Top of Parapets, Top of cills including, vertical face of tops and cills including making bird beak/ offset joint and providing weather groove/ drip course on the stone edge, stone area to be measured on actual plan or elevation measurements only without any rounding off.	450	Sq m		0.00	INR Zero Only
97	Providing weather groove/ drip course on the edge of 18 mm th. Granite stone as per any design.	350	me tre		0.00	INR Zero Only
98	Providing and laying tactile tile (for vision impaired persons as per standards) of size 300x300x9.8 mm having with water absorption less than 0.5% and conforming to IS:15622 of approved make in all colours and shades in for outdoor floors such as footpath, court yard, multi modals location etc., laid on 20 mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. complete as per direction of Engineer-in-Charge.	94	Sq m		0.00	INR Zero Only

99	Providing gola 75x75 mm in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 10 mm and down gauge), including finishing with cement mortar 1:3 (1 cement : 3 fine sand) as per standard design : In 75x75 mm deep chase	110 4	Me tre		0.00	INR Zero Only
100	Making khurras 45x45 cm with average minimum thickness of 5 cm cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) over P.V.C. sheet 1 m x1 m x 400 micron, finished with 12 mm cement plaster 1:3 (1 cement : 3 coarse sand) and a coat of neat cement, rounding the edges and making and finishing the outlet complete.	72	Eac h		0.00	INR Zero Only
101	Providing and applying 12 mm thick (average) premixed formulated one coat gypsum lightweight plaster having additives and light weight aggregates as vermiculite/ perlite respectively conforming to IS: 2547 (Part - 1 & II) 1976, applied on hacked / uneven background such as bare brick/ block/ RCC work on walls & ceiling at all floors and locations, finished in smooth line and level etc. complete. 1:4 (1 cement: 4 coarse sand)	338 95	Sq m		0.00	INR Zero Only
102	18 mm cement plaster in two coats under layer 12 mm thick cement plaster 1:5 (1 cement : 5 coarse sand) finished with a top layer 6 mm thick cement plaster 1:6 (1 cement : 6 fine sand).	250	Sq m		0.00	INR Zero Only
103	Finishing interior and specified exterior wall/ RCC surfaces with Apex ultima water based paint of Asianpaint brand- 2coats on one coat of trucare acrylic wall putty Asian paint brand - complete as per manufacturer's specifications, applying additional coats wherever required, to achieve even shade and colour. Two or more coats on new work	502 25	Sq m		0.00	INR Zero Only
104	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade : Two or more coats on new work	172 2	Sq m		0.00	INR Zero Only
105	Providing and applying plaster of paris putty of 2 mm thickness over plastered surface to prepare the surface even and smooth complete.	502 25	Sq m		0.00	INR Zero Only
106	Finishing interior and specified exterior wall/ RCC surfaces with Apex ultima water based paint of Asianpaint brand- 2 coats on one coat of trucare exterior wall primer Asian paint brand - complete as per manufacturer's specifications New work (Two or more coats applied @ 3.28 ltr/10 sqm) over and including priming coat of exterior primer applied @ 2.20kg/10 sqm	250	Sq m		0.00	INR Zero Only

107	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	250	Sq m		0.00	INR Zero Only
108	Polishing wooden surface with melamine polish after sanding with sand paper no.180 , then 320, then applying 2coats of wood tech epoxy insulator then dent filling with wood tech filler then staining wood tech wood stains interiors by spraying and application of Melamyne. Then applying wood tech PU luxury wood finish coating of Asian paints brand	180 0	Sq m		0.00	INR Zero Only
109	Providing and fixing double scaffolding system (cup lock type) on the exterior side, up to seven story height made with 40 mm dia M.S. tube 1.5 m centre to centre, horizontal & vertical tubes joining with cup & lock system with M.S. tubes, M.S. tube challies, M.S. clamps and M.S. staircase system in the scaffolding for working platform etc. and maintaining it in a serviceable condition for the required duration as approved and removing it there after .The scaffolding system shall be stiffened with bracings, runners, connection with the building etc wherever required for inspection of work at required locations with essential safety features for the workmen etc. complete as per directions and approval of Engineerin- charge .The elevational area of the scaffolding shall be measured for payment purpose .The payment will be made once irrespective of duration of scaffolding. Note: - This item to be used for maintenance work judicially, necessary deduction for scaffolding in the existing item to be done.	280 0	Sq m		0.00	INR Zero Only
110	Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / paneling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, paneling and dash fasteners to be paid for separately) :					
110.01	For fixed portion Powder coated aluminium (minimum thickness of powder coating 50 micron)	120	kg		0.00	INR Zero Only

110.02	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately) Powder coated aluminium (minimum thickness of powder coating 50 micron)	70	kg		0.00	INR Zero Only
111	Providing and fixing 12 mm thick prelaminated particle board flat pressed three layer or graded wood particle board conforming to IS: 12823 Grade I Type II, in panelling fixed in aluminum doors, windows shutters and partition frames with C.P. brass / stainless steel screws etc. complete as per architectural drawings and directions of engineer-in-charge. Pre-laminated particle board with decorative lamination on both sides	30	Sq m		0.00	INR Zero Only
112	Providing and fixing 6mm thick toughened glass in Doors, windows and Ventilators including sealing with EPDM / Neoprene gasket all complete as per the architectural drawings and the directions of engineer-in-charge	120	Sq m		0.00	INR Zero Only
113	Providing and fixing 8mm thick toughened glass in Doors, windows and Ventilators including sealing with EPDM / Neoprene gasket all complete as per the architectural drawings and the directions of engineer-in-charge	190	Sq m		0.00	INR Zero Only
114	Providing and fixing Louver with 6mm thick frosted glass in windows and Ventilators including sealing with EPDM / Neoprene gasket all complete as per the architectural drawings and the directions of engineer-in-charge	50	Sq m		0.00	INR Zero Only
115	Providing and fixing pre sealed Double glass panes 8mm glass +25 mm argon filled+8 mm glass (Insulated Glass units) as per ASTM E2190-19 Standard Specification for Insulating Glass Unit Performance and Evaluation	25	Sq m		0.00	INR Zero Only
116	Filling the gap in between aluminium frame & adjacent RCC/ Brick/ Stone work by providing weather silicon sealant over backer rod of approved quality as per architectural drawings and direction of Engineer-in-charge complete. Upto 5mm depth and 5 mm width	400	me tre		0.00	INR Zero Only

117	Providing and fixing 12 mm thick frameless toughened glass door shutter of approved brand and manufacture, including providing and fixing top & bottom pivot & double acting hydraulic floor spring type fixing arrangement and making necessary holes etc. for fixing required door fittings, all complete as per direction of Engineer-in-charge (Door handle, lock and stopper etc.to be paid separately).	1	Sq m		0.00	INR Zero Only
118	Providing and fixing aluminium tubular handle bar 32 mm outer dia, 3.0 mm thick & 2100 mm long with SS screws etc .complete as per direction of Engineer-in-Charge. Powder coated minimum thickness 50 micron aluminium tubular handle bar	25	Eac h		0.00	INR Zero Only
119	Providing and fixing aluminium casement windows fastener of required length for aluminium windows with necessary screws etc. complete. Powder coated minimum thickness 50 micron aluminium	35	Eac h		0.00	INR Zero Only
120	Providing and fixing aluminium round shape handle of outer dia 100 mm with SS screws etc. complete as per direction of Engineer-incharge Powder coated minimum thickness 50 micron aluminium	35	Eac h		0.00	INR Zero Only
121	Providing and laying water proofing treatment to vertical and horizontal surfaces of depressed portions of W.C., kitchen and the like consisting of: (i) Ist course of applying cement slurry @ 4.4 kg/sqm mixed with water proofing compound conforming to IS 2645 in recommended proportions including rounding off junction of vertical and horizontal surface. (ii) IInd course of 20 mm cement plaster 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound in recommended proportion including rounding off junction of vertical and horizontal surface. (iii) IIIrd course of applying blown or residual bitumen applied hot at 1.7 kg. per sqm of area. (iv) IVth course of 400 micron thick PVC sheet. (Overlaps at joints of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 kg/sqm).	1838	Sq m		0.00	INR Zero Only

121.01	Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc consisting of following operations: (a) Applying a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls upto 300 mm height including cleaning the surface before treatment.					
121.02	b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement: 5 coarse sand) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs. (c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/sqm of cement admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge. (d) Finishing the surface with 20 mm thick jointless cement mortar of mix 1:4 (1 cement :4 coarse sand) admixed with water proofing compound conforming to IS: 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep. (e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. "All above operations to be done in order and as directed and specified by the Engineer-in-Charge : :					
121.03	With average thickness of 120 mm and minimum thickness at khurra as 65 mm.	3017	Sq m		0.00	INR Zero Only
121.04	Providing and fixing Metal sheet on terrace lvl	3017	Sq m		0.00	INR Zero Only

122	Providing and supplying aluminium extruded tubular and other aluminium sections as per the architectural drawings and approved shop drawings , the aluminium quality as per grade 6063 T5 or T6 as per BS 1474,including super durable powder coating of 60-80 microns conforming to AAMA 2604 of required colour and shade as approved by the Engineer-in-Charge. (The item includes cost of material such as cleats, sleeves, screws etc. necessary for fabrication of extruded aluminium frame work. Nothing extra shall be paid on this account). The weight of aluminium extruded section shall be taken for purpose of payment.	2	kg		0.00	INR Zero Only
123	Designing, fabricating, testing, protection, installing and fixing in position semi (grid) unitized system of structural glazing (with open joints) for linear as well as curvilinear portions of the building for all heights and all levels, including:					
124	Structural analysis & design and preparation of shop drawings for the specified design loads conforming to IS 875 part III (the system must passed the proof test at 1.5 times design wind pressure without any failure), including functional design of the aluminum sections for fixing glazing panels of various thicknesses, aluminium cleats, sleeves and splice plates etc. gaskets, screws, toggles, nuts, bolts, clamps etc., structural and weather silicone sealants, flashings, fire stop (barrier)-cum-smoke seals, microwave cured EPDM gaskets for water tightness, pressure equalisation & drainage and protection against fire hazard including:					
125	Fabricating and supplying serrated M.S. hot dip galvanised / Aluminium alloy of 6005 T5 brackets of required sizes, sections and profiles etc. to accommodate 3 Dimentional movement for achieving perfect verticality and fixing structural glazing system rigidly to the RCC/ masonry/structural steel framework of building structure using stainless steel anchor fasteners/ bolts, nylon seperator to prevent bimetallic contacts with nuts and washers etc. of stainless steel grade 316, of the required capacity and in required numbers.					

126	Providing and filling, two part pump filled, structural silicone sealant and one part weather silicone sealant compatible with the structural silicone sealant of required bite size in a clean and controlled factory / work shop environment, including double sided spacer tape, setting blocks and backer rod, all of approved grade, brand and manufacture, as per the approved sealant design, within and all around the perimeter for holding glass.				
127	Providing and fixing in position flashings of solid aluminium sheet 1 mm thick and of sizes, shapes and profiles, as required as per the site conditions, to seal the gap between the building structure and all its interfaces with curtain glazing to make it watertight.				
128	Making provision for drainage of moisture/ water that enters the curtain glazing system to make it watertight, by incorporating principles of pressure equalization, providing suitable gutter profiles at bottom (if required), making necessary holes of required sizes and of required numbers etc. complete. This item includes cost of all inputs of designing, labour for fabricating and installation of aluminium grid, installation of glazed units, T&P, scaffolding and other incidental charges including wastages etc., enabling temporary structures and services, cranes or cradles etc. as described above and as specified. The item includes the cost of getting all the structural and functional design including shop drawings checked by a structural designer, dully approved by Engineer-in-charge. The item also includes the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working structural glazing as specified, cleaning and protection till the handing over of the building for occupation. In the end, the Contractor shall provide a water tight structural glazing having all the performance characteristics etc. all complete as required, as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer- in-Charge.				

129	Note:- 1. The cost of providing extruded aluminium frames, shadow boxes, extruded aluminium section capping for fixing in the grooves of the curtain glazing and vermin proof stainless steel wire mesh shall be paid for separately under relevant items under this sub- head. However, for the purpose of payment, only the actual area of structural glazing (including width of grooves) on the external face shall be measured in sqm. up to two decimal places. Note:-2. The following performance test are to be conducted on structural glazing system if area of structural glazing exceeds 2500 Sqm from the certified laboratories accredited by NABL(National Accreditation Board for Testing and Calibration Laboratories), Department of Science & Technologies, India. Cost of testing is payable separately				
130	The NIT approving authority will decide the necessity of testing on the basis of cost of the work, cost of the test and importance of the work. Performance Testing of Structural glazing system Tests to be conducted in the NABL accredited lab or any other accreditation body which operates in accordance with ISO/ IEC 17011 and accredits labs as per ISO/IEC 17025				
131	1. Performance Laboratory Test for Air Leakage Test (-50pa to - 300pa) & (+50pa to +300pa) as per ASTM E-283-04 testing method for a range of testing limit 1 to 200 mVhr 2. Static Water Penetration Test. (50pa to 1500pa) as per ASTM E- 331- 09 testing method for a range up to 2000 ml. 3. Dynamic Water Penetration (50pa to 1500pa) as per AAMA 501.01- 05 testing method for a range upto 2000 ml 4. Structural Performance Deflection and deformation by static air pressure test (1.5 times design wind pressure without any failure) as per ASTM E-330-10 testing method for a range upto 50 mm 5. Seismic Movement Test (upto 30 mm) as per AAMA 501.4-09 testing method for Qualitative test, Tests to be conducted on site. 6. Onsite Test for Water Leakage for a pressure range 50 kpa to 240 kpa (35psi) upto 2000 ml	2	sq m	0.00	INR Zero Only

132	Providing, assembling and supplying vision glass panels (IGUs) comprising of hermetically-sealed 6-12- 6 mm insulated glass (double glazed) vision panel units of size and shape as required and specified, comprising of an outer heat strengthened float glass 6mm thick, of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade, an inner Heat strengthened clear float glass 6mm thick, spacer tube 12mm wide, dessicants, including primary seal and secondary seal (structural silicone sealant) etc. all complete for the required performances, as per the Architectural drawings, as per the approved shop drawings, as specified and as directed by the Engineer-in-Charge. The IGUs shall be assembled in the factory/ workshop of the glass processor. (Payment for fixing of IGU Panels in the curtain glazing is included in cost of item No.25.2) For payment, only the actual area of glass on face # 1 of the glass panels (excluding the areas of the grooves and weather silicone sealant) provided and fixed in position, shall be measured in sqm. (i) Coloured tinted float glass 6mm thick substrate with reflective soft coating on face # 2, + 12mm Airgap + 6mm Heat Strengthened clear Glass of approved make having properties as visible Light transmittance (VLT) of 25 to 35 %, Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28) and U value of 3.0 to 3.3 W/ m2 degree K etc. The properties of performance glass shall be decided by technical sanctioning authority as per the site requirement	2	sq m		0.00	INR Zero Only
133	Extra for openable side / top hung vision glass panels (IGUs) including providing and supplying at site all accessories and hardwares for the openable panels as specified and of the approved make such as heavy duty stainless steel friction hinges, min 4 -point cremone locking sets with stainless steel plates, handles, buffers etc. including necessary stainless steel screws/ fasteners, nuts, bolts, washers etc. all complete as per the Architectural drawings, as per the approved shop drawings, as specified and as directed by the Engineer-inCharge.	2	sq m		0.00	INR Zero Only

134	Providing, fabricating and supplying shadow box of required size and shape, for fixing in the spandrel portion of the structural glazing, in linear as well as curvilinear portions of the building by providing semi-rigid, inorganic, non-combustible fibre glass wool insulation 50 mm thick, conforming to IS: 8183 and BS: 3958 Part 5. The insulation layer shall have facing (factory bonded on surface # 1 of the fibre glass insulation layer), of black non-woven fibre glass tissue of nominal thickness 0.5 mm and nominal mass not less than 60 gm /sqm, made of randomly oriented glass fibres distributed in a binder by a wet-lay process including fixing 1.5 mm thick solid aluminum sheet backing using, 6 mm thick cement board including SS rivets, nuts, bolts, washers etc complete.	2	sq m		0.00	INR Zero Only
135	Providing and supplying Spandrel Glass Panels comprising of 6 mm thick heat strengthened monolithic float glass of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade so as to match the colour and shade of the IGUs in the vision panels etc. ,all complete for the required performances as specified, as per the Architectural drawings, as per the approved shop drawings, as specified, and as directed by the Engineer-inCharge. For payment, only the actual area of glass on face # 1 of the glass panels (but excluding the area of grooves and weather silicone sealant) provided and fixed in position, shall be measured in sqm. (Payment for fixing of Spandrel Glass Panels in the curtain glazing is included in cost of relevant Item*).“(i) Coloured tinted float glass 6mm thick substrate with reflective soft coating on face # 2, having properties as visible Light transmittance (VLT) of 25 to 35 %, Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28) and U value of 3.0 to 3.3 W/m2 K etc. . The properties of performance glass shall be decided by technical sanctioning authority as per the site requirement.	2	sq m		0.00	INR Zero Only
136	Extra for compaction of earth work in embankment under optimum moisture conditions to give at least 95% of the maximum dry density (proctor density).	22	Cu m		0.00	INR Zero Only

137	Construction of granular sub-base by providing close graded Material conforming to specifications, mixing in a mechanical mix plant at OMC, carriage of mixed material by tipplers to work site, for all leads & lifts, spreading in uniform layers of specified thickness with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per specifications and directions of Engineer-in- Charge. With material conforming to Grade-I (size range 75 mm to 0.075 mm) having CBR Value-30	22	Cu m		0.00	INR Zero Only
138	Providing and fixing HDPE Sheet 500 micron	30	Sq m		0.00	INR Zero Only
139	Providing and laying C.C. pavement of mix M-25 with ready mixed concrete from batching plant. The ready mixed concrete shall be laid and finished with screed board vibrator , vacuum dewatering process and finally finished by floating, brooming with wire brush etc. complete as per specifications and directions of Engineer-in-charge. (The panel shuttering work shall be paid for separately). (Note:- Cement content considered in this item is @ 350 kg/cum. Excess/ less cement used as per design mix is payable/ recoverable separately).	72	Cu m		0.00	INR Zero Only
140	Providing and fixing pre-moulded joint filler in expansion joints of RCC roads / CC pavements after making the joints dust free with high pressure air jet cleaners, all complete as per direction of the Engineer-in-Charge. (Pre-moulded joint fillers shall be made of bitumen hot sealing compound impregnated fibre board having impregnation more than 35%, conforming to IS:1838 for fibre board and IS: 1834 for hot sealing bitumen compound grade A.)	33	per cm de pth per cm wi dth per me tre len gth		0.00	INR Zero Only
141	62 mm thick cement concrete flooring with concrete hardener topping, under layer 50 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) and top layer 12mm thick cement hardener consisting of mix 1:2 (1 cement hardener mix : 2 graded stone aggregate, 6mm nominal size) by volume, hardening compound mixed @ 2 litre per 50 kg of cement or as per manufacture's specifications. This includes cost of cement slurry, but excluding the cost of nosing of steps etc. complete.	100	Sq m		0.00	INR Zero Only

142	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5 mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured to calculate volume for payment). (Precast C.C. kerb stone shall be approved by Engineer-in-charge).	20	Cu m		0.00	INR Zero Only
143	Part B Sewerage Work					
143.01	Part B Sewerage work Excavating trenches of required width for pipe, cables etc including excavation for sockets ,& dressing of sides ,ramming of bottoms ,for all depth including getting out the excavated soil,& then returning the soil as required, in layers not exceeding 20 cm in depth including consolidating each deposited layer by ramming ,watering, etc and disposing of surplus excavated soil as directed, within lead of 50m. All kinds of soil. pipes cables etc. exceeding 80 mm dia. But not exceeding 300 mm dia	213	me ter		0.00	INR Zero Only
144	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size).	32	cu. mt.		0.00	INR Zero Only
145	Providing and placing on terrace (at all floor levels) polyethylene water storage tank, IS:12701 marked, with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank. Circular tank	265 50	Lit ers		0.00	INR Zero Only
146	Providing and fixing square-mouth S.W. gully trap class SP1 complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design : 150 x 100 mm size P type. With sewer bricks conforming to IS : 4885	3	no s		0.00	INR Zero Only

147	Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) with R.C.C. top slab with 1:1.5:3 mix (1 cement : 1.5 coarse sand (zone- III): 3 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 mix (1 cement: 4coarse sand (zone-III): 8graded stone aggregate 40mm nominal size), inside plastering 12mm thick with cement mortar 1:3 (1ement: 3coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement :2 coarse sand :4 Graded stone aggregate nominal size) finished with a floating coat of neat cement complete as per standard design inside size 90x80 cm and 45 cm deep including C.I. cover with frame (Light duty) 455x610 mm internal dimensions, total weight of cover and frame to be not less than 38 KG (weight of Cover 23 kg and weight of frame 15 Kg): With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	4	no s		0.00	INR Zero Only
148	Extra for depth of Manholes Size 90x80 cm With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	2	me ter		0.00	INR Zero Only
149	Constructing brick masonry road gully chamber 50x45x60 cm with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) including 500x450 mm pre-cast R.C.C. horizontal grating with frame complete as per standard design : bricks in cement mortar 1:4 (1 cement : 4 coarse sand) with precast R.C.C. vertical grating complete as per standard design : 19.28.1 With common burnt clay F.P.S. (non modular) bricks of class designation 7.5 With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	18	no s		0.00	INR Zero Only
150	P/L NP2 class R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of (1:2):					
150.01	250 mm dia RCC pipe	46	me ter		0.00	INR Zero Only
150.02	300 mm dia RCC Pipe	166	me ter		0.00	INR Zero Only
151	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS:13592 Type A, including jointing with seal ring conforming to IS:5382, leaving 10mm gap for thermal expansion, (i) Single socketed pipes. 160mm diameter	420	me ter		0.00	INR Zero Only
152	Providing and fixing on wall face unplasticised - PVC moulded fittings/ accessories for unplasticised Rigid PVC rain water pipes conforming to IS:13592 Type A, including jointing with seal ring conforming to IS:5382, leaving 10mm gap for thermal expansion.					
152.01	Single tee without door 160x160x160 mm	17	no s		0.00	INR Zero Only
152.02	Bend 87.5° 160 mm bend	17	no s		0.00	INR Zero Only
153	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings including unions and reducers with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge . concealed work including cutting chases and making good the walls etc.,					

153.01	20 mm nominal outer dia .Pipes.	512	me ter		0.00	INR Zero Only
153.02	25 mm nominal outer dia .Pipes.	74	me ter		0.00	INR Zero Only
153.03	32 mm nominal outer dia .Pipes.	78	me ter		0.00	INR Zero Only
153.04	50 mm nominal outer dia .Pipes.-From tank to shaft	80	me ter		0.00	INR Zero Only
154	SITC of Solar Geyser - 1000 LPD, no of tubes 54, total height after fitting 6'3", inner tank in SS304, tank insulation with PUF, back up electrical heater 8KW or 2 nos. 4 KW outer tank cover GI powder coated.Including 3 years warantee	2	No s		0.00	INR Zero Only
155	SITC of Solar Geyser - 100 LPD, no of tubes 8, maximum height after fitting 6'3", inner tank in SS304, tank insulation with PUF, back up electrical heater 2KW or 2 nos.14 KW outer tank cover GI powder coated.Including 3 years warantee	1	No s		0.00	INR Zero Only
156	Providing and fixing ball valve (brass) of approved quality, High or low pressure, with plastic floats complete :15 mm nominal bore	5	No s		0.00	INR Zero Only
157	P/F CPVC ball valve (gate valve) of approved make in CPVC pipes i/c cutting, chasing of, making it good and making all complete as per the directions of Engineer- in-charge.					
157.01	50 mm nominal bore	5	No s		0.00	INR Zero Only
157.02	32 mm nominal bore	6	No s		0.00	INR Zero Only
157.03	25 mm nominal bore	6	No s		0.00	INR Zero Only
157.04	20 mm nominal bore	10	No s		0.00	INR Zero Only
158	Providing and fixing water closets-Anglo Indian, S type, Essco -Jaquar brand ECS-WHT-355SNPP Size: 475x575x395 mm, S Trap . Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
159	Providing and fixing Hindware Dual flush cistern Catalogue no. 516366 Size 38.5 × 12.2 × 40.5 cm, Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
160	Providing and fixing with all sundries health faucet (hand shower) Jaquar brand Range :Allied Code :ALD-CHR-573 Description :Hand Shower (Health Faucet) with 8mm Dia 1.2 Meter Long Flexible Tube and Wall Hook.. Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
161	Providing and fixing Jaquar Wash Basin Aria ARS WHT 39903 Type:Table Top Colour:White Shape:Rectangle Dimensions:700 x 435 x 135 mm Item includes all accessories, piping, white cement, sundries , brackets etc. Complete	27	no s		0.00	INR Zero Only
162	Providing and fixing P.V.C. waste pipe for sink or wash basin including P.V.C. waste fittings complete. Flexible pipe 32 mm dia Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
163	Providing and fixing 600x450 mm beveled edge mirror of superior glass (of approved quality) complete with 6 mm thick hard board ground fixed to wooden cleats with C.P. brass screws and washers complete.	27	no s		0.00	INR Zero Only

164	Providing and fixing Jaquar Artize Soap Dish Holder Brass Chrome Plated Range :Kubix Prime Code :AKP-CHR-35731P Description :Soap Dish Holder . Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
165	Providing and fixing C.P. brass Bib Cock Jaquar brand Range :Aria Code :ARI-CHR-39037 Description :Bib Cock with Wall Flange. Item includes all accessories, all type of piping,white cement, sundries	93	no s		0.00	INR Zero Only
166	Providing and fixing Jaquar brand C.P. Long Body Bib Cock with Wall Flange, CODE : COP-CHR-107PM. Item includes all accessories, all type of piping,white cement, sundries	32	no s		0.00	INR Zero Only
167	Providing and fixing CP Grating Square Grating, Size: 5"X5" SS304 Brand Onida Shape Square Material Stainless Steel Size 5" x 5"/6" x 6" Cat No 60/3025 Model No 5120/5121 125 mm nominal dia with 25 mm waste hole/without hole. Item includes all accessories, all type of piping,white cement, sundries	93	no s		0.00	INR Zero Only
168	Providing and fixing Jaquar brand double Coat hook ACN-CHR-1161N Item includes all accessories, all type of piping,white cement, sundries	54	no s		0.00	INR Zero Only
169	Providing and fixing Jaquar brand ACN-1121N Towel Ring Square. Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
170	Providing and fixing Sink pillar taps with swivel output as per CAT no. SOL-6357 GE.. Item includes all accessories, all type of piping,white cement, sundries	2	no s		0.00	INR Zero Only
171	Angular stop cock Jaquar brand, Model No : Angular Stop Cock with Wall Flange, CQT-CHR-23059. Item includes all accessories, all type of piping,white cement, sundries	27	no s		0.00	INR Zero Only
172	Floor trap Brand Chilly model no. Chilly-CCTL-SMHC-150. Item includes all accessories, all type of piping,white cement, sundries	54	no s		0.00	INR Zero Only
173	Push Tap for urinal Jaquar, Model No : Pressmatic PRS077 G Urinal Valve with Auto Closing system with 65 mm Extension Body. Item includes all accessories, all type of piping,white cement, sundries	14	no s		0.00	INR Zero Only
174	white vitreous china large flat back / half stall urinal Jaquar-URS-WHT-0706) (Make For Push Tap for Urinal : Jaquar, Model No : Pressmatic PRS077 G Urinal Valve with Auto Closing system with 65 mm Extension Body. Item includes all accessories, all type of piping,white cement, sundries Floor drain Fixture included in PVC piping	27	no s		0.00	INR Zero Only
175	Overhead shower Brand Jaquar model no.OHS-CHR-1759 180 mm dia round overhead shower alongwith shower arm and flange etc. Item includes all accessories, all type of piping,white cement, sundries	27	No s		0.00	INR Zero Only
176	Concealed stop cock Jaquar Regular Concealed Stop Cock 20MM-089 ALD-CHR-089 and Jaquar exterior part Flr-chr-5083nk. Item includes all accessories, all type of piping,white cement, sundries	27	No s		0.00	INR Zero Only
177	P/F CPVC union approved make CPVC pipes i/c cutting and making all complete as per the directions of Engineer-in-charge.. Item includes all accessories, all type of piping,white cement, sundries					
177.01	50 mm nominal bore	4	No s		0.00	INR Zero Only

177.02	32 mm nominal bore	4	No s		0.00	INR Zero Only
178	Providing and fixing soil, waste and vent VERTICAL pipes in uPVC SWR pipings, working pressure 6.0 kg/ sq.cm. including all fittings, jointing (all types of traps, floor drains, bends, coupling, offsets, tees all of them with or without doors). Length shall be measured from GT, Manhole to Cowl or Horizontal termination point without any extra allowance for fittings. Item includes all types of chasing, core cutting, all accessories, all type of piping, white cement, sundries					
178.01	110 mm Outer dia	96	me ter		0.00	INR Zero Only
178.02	160 mm Outer dia	50	me ter		0.00	INR Zero Only
179	Providing and fixing soil, waste and vent HORIZONTAL SLUNG pipes in uPVC SWR pipings, working pressure 6.0 kg / sq.cm including all fittings, jointing (all types of traps, floor drains, bends, coupling, offsets, tees all of them with or without doors). The rates are inclusive of required Core cuttings in RCC members, chasing of all types, water proofing with 1:3 Cement sand Mortar with FOSROC water proofing Compund as / manufacturer's specifications of all thickness and dia. Length shall be measured from Start to End in a single horizontal line without any extra allowance for fittings. 110 mm Outer dia	324	me ter		0.00	INR Zero Only
180	Part C Electrical Work					
180.01	Main Panel (All Block) INCOMER 1 No. 300A 4P MCCB, 36 kA breaking capacity with thermal release and adjustable setting and with rotary handle with ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB METERING & INDICATION 1 set of R,Y,B phase indicating lamps 1 set of ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB BUS-BAR 1 Set of 450A TPN Aluminium Bus Bar with colour coded PVC Sleeves OUTGOINGS 1 Nos. 200A FP MCCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle 3 Nos. 160A FP MCCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle 6 Nos. 63A FP MCCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle NOTE :- All starters shall have ON & OFF push button & suitable rating of contractor and overload relays Supplying, Receiving, fixing, testing & commissioning of above described Panel	1	Set .		0.00	INR Zero Only

181	SUB Main Panel (Audi. Block) INCOMER 1 No. 200A 4P MCCB ,36 kA breaking capacity with thermal release and adjustable setting and with rotary handle.with ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB METERING & INDICATION 1 set of R,Y,B phase indicating lamps 1 set of ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB BUS-BAR 1 Set of 250A TPN Aluminium Bus Bar with colour coded PVC Sleeves OUTGOINGS 18 Nos.63A TPN MCCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle NOTE :- All starters shall have ON & OFF push button & suitable rating of contractor and overload relays Supplying,Receiving, fixing, testing & commissioning of above described Panel	1	Set		0.00	INR Zero Only
182	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class PVC conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable etc. as required. Group C	1300	Point		0.00	INR Zero Only
183	Wiring for group controlled (looped) light point/fan point/exhaust fan point/ call bell point (without independent switch etc.) with 1.5 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed PVC conduit, and earthing the point with 1.5 sq. mm FRLS PVC insulated copper conductor single core cable etc. as required.:Group A	77	Point		0.00	INR Zero Only
184	Wiring for twin control light point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed PVC conduit, 2 way modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm. FR PVC insulated copper conductor single core cable etc as required.	12	Point		0.00	INR Zero Only

185	Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 1 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	150 0	Mt r.		0.00	INR Zero Only
186	Wiring for light/ power plug with 4X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 2 Nos. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	530	Mt r.		0.00	INR Zero Only
187	Wiring for circuit/ submain wiring alongwith earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed PVC conduit as required					
187.01	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	250 0	Mt rs.		0.00	INR Zero Only
187.02	4x 10 sqmm+ 2x 6 sqmm earth wire	400	Mt rs.		0.00	INR Zero Only
188	Supply & fixing of following sizes of medium class PVC conduit along with accessories in surface / recessed including cutting the wall & making good the same in case of recessed conduit as required.					
188.01	25 mm dia.	50	Mt rs.		0.00	INR Zero Only
188.02	32 mm dia.	50	Mt rs.		0.00	INR Zero Only
189	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess including providing and fixing 6 pin 5/6 & 15/16 Amp modular socket outlet and 15/16 A modular switch, connection etc. as required.	153	Eac h		0.00	INR Zero Only

190	Providing and fixing circular/ Hexagonal cast iron or M.S. sheet box for ceiling fan clamp, of internal dia 140 mm, 73 mm height, top lid of 1.5 mm thick M.S. sheet with its top surface hacked for proper bonding, top lid shall be screwed into the cast iron/ M.S. sheet box by means of 3.3 mm dia round headed screws, one lock at the corners. Clamp shall be made of 12 mm dia M.S. bar bent to shape as per standard drawing.	245	Eac h		0.00	INR Zero Only
191	Supplying and fixing of following ways surface/ recess mounting, vertical type , 415 V, TPN MCB distribution board of sheet steel, dust protected, duly powder painted, inclusive of 200 A tinned copper bus bar, common neutral link, earth bar, din bar for mounting MCBs (but without MCBs and incomer) as required . (Note : Vertical type MCB TPDB is normally used where 3 phase outlets are required.) 4 way (4+12),Double door	4	Eac h		0.00	INR Zero Only
192	Supplying and fixing following way, horizontal type three pole and neutral, sheet steel, MCB distribution board, 415 V, onsurface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 8 way (4+24),Double door	15	Eac h		0.00	INR Zero Only
193	Supplying & fixing 6 amps to 32 amps rating 240/415 volts C curve Miniature Circuit Breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required. Single Pole	360	Eac h		0.00	INR Zero Only
194	Supply & fixing of single pole blanking plate in the existing MCB DB complete etc. as required	50	Eac h		0.00	INR Zero Only
195	Supplying and fixing following rating, double pole, 240 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.					
195.01	25 amps	15	Eac h		0.00	INR Zero Only
195.02	40 amps	2	Eac h		0.00	INR Zero Only
196	Supplying and fixing of following rating four pole 415 V MCCB in the existing MCCB DB complete with connections ,testing and commissioning etc as required.					

196.01	63 amps	10	Eac h		0.00	INR Zero Only
196.02	100 amps	5	Eac h		0.00	INR Zero Only
197	Earthing with G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. with charcoal/ coke and salt as required.	4	Eac h		0.00	INR Zero Only
198	Providing and fixing 25 mm x 5 mm G.I. strip in 40 mm dia G.I. pipe from earth electrode, as required.	75	Eac h		0.00	INR Zero Only
199	Providing and fixing 25 mm x 5 mm G.I. strip on surface or in recess for connections etc. as required.	100	Eac h		0.00	INR Zero Only
200	Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.	100	Eac h		0.00	INR Zero Only
201	Supply, Installation, Testing and Commissioning of 10 W LED Bulk head Light - Supply of 10W LED bulkhead Surface mounted IP65 bulkhead LED fixture made up of pressure die cast aluminum housing with integrated power supply unit, LED Used shall be SMD type and fixture should have minimum efficacy at System level (Not Chip Level) ≥90 lumens/watt with Minimum system Lumens 900, Life of LED : 50000 burning Hrs. @ L70B50 Lumen maintenance, cool white color temperature (SDCM<5), CRI >80, PF >0.95 & THD<10%, an operating Voltage Range of 150 - 260 VAC. Minimum Internal Surge Protection 2.5KV As Trilux Optima IND G3 900-857 ET or equivalent.	6	No s.		0.00	INR Zero Only

202	Supply, Installation, Testing and Commissioning of 12W Surface Mounted LED circular Downlighter - Supply of Surface Mounted LED Downlight with cylindrical construction, Housing Dia 160 mm, height 110 mm, Luminaire luminous flux 1320 Lm, Maximum system Power 12W, Luminous efficiency of 110 Lm/W. CRI >80. Life of fixture 50000 hrs@ L70 Lumen maintenance, CCT 5700K, CRI >80, PF >0.95, and suitable for 230V AC, 50Hz. supply, Internal Surge Protection ≥ 2.5KV. The fixture should comply with the parameters as per IS10322 and IEC60598, EMC / EMI compliance, and LED driver shall be SELV & BIS registered & luminair manufacture shall provide LM79report from NABL accredited lab & LM80 report issued by LED manufacturer as Trilux Ambliella D Plus G4 Surface.	80	No s.		0.00	INR Zero Only
203	Supply, installing, testing & commissioning of Decorative Wall Light with 2 LT Ivory Fabric shade with 3W LED mild steel & Brass with Chrome finish, Fixture Height 405mm, Size (LXWXH) 155 X 280 X 405 mm and E14 base 7w Bulb or Equivalent as per direction of E/I.	50	No s.		0.00	INR Zero Only
204	Supply installing, testing & commissioning of LED 4ft Batten with a nominal system lumen output of 4000 lumens and a minimum system efficacy of 110 lm/W. The luminaire shall have a rated system lifetime of 25,000 burning hours at L70B50. The luminaire should have a color temperature of 6500K/4000K and CRI>80. The luminaire shall meet IP20 rating with THD < 10% and PF > 0.95. It should have a surge protection of 2.5kV. The luminaire housing should made of Polycarbonate housing with a diffuser.	100 8	No s.		0.00	INR Zero Only

205	Supply, Installation, Testing and Commissioning of 1200 mm sweep, BEE 5 star rated, ceiling fan with Brush Less Direct Current (BLDC) Motor, class of insulation: B, 3 nos. blades, 30 cm long down rod, 2 nos. canopies, shackle kit, safety rope, copper winding, Power Factor not less than 0.9, Service Value (CMM/W) minimum 6.85, Air delivery minimum 215 CMM, 350 RPM (tolerance as per IS: 374-2019), THD less than 10%, remote or electronic regulator unit for speed control and all remaining accessories including safety pin, nut bolts, washers, temperature rise=75 degree C (max.), insulation resistance more than 2 mega ohm, suitable for 230 V, 50 Hz, single phase AC Supply, earthing etc. complete as required.	245	No s.		0.00	INR Zero Only
206	Providing and fixing of lightning conductor finial, made of 25 mm dia 300 mm long, G.I. tube, having single prong at top, with 85 mm dia 6 mm thick G.I. base plate including holes etc. complete as required.	4	Eac h		0.00	INR Zero Only
207	Jointing copper / G.I. tape (with another copper/ G I tape, base of the finial or any other metallic object) by riveting / nut bolting/ sweating and soldering etc as required.	150	Eac h		0.00	INR Zero Only
208	Providing and fixing G.I. tape 20 mm X 3 mm thick on parapet or surface of wall for lightning conductor complete as required.(For horizontal run)	175	Me tre		0.00	INR Zero Only
209	Providing and fixing G.I. tape 20 mm X 3 mm thick on parapet or surface of wall for lightning conductor complete as required.(For vertical run)	200	Me tre		0.00	INR Zero Only
210	Providing and fixing testing joint, made of 20 mm X 3 mm thick G.I. strip, 125 mm long, with 4 nos. of G.I. bolts, nuts, chuck nuts and spring washers etc. complete as required.	4	Eac h		0.00	INR Zero Only
211	Providing and laying G.I. tape 32 mm X 6 mm from earth electrode directly in ground as required.	120	Me tre		0.00	INR Zero Only

212	Supply, Installation, Testing & Commissioning of Indoor Access Point solution should have integrated dynamic packet capture, WIPS, detection of rouge and honeypot Access Point detection, able to create WxLAN policies and the cloud controller should be scalable to handle around 5000 APs or more in future. Should be able to extend API to integrate with other systems as well. AP indoor 4x4 with 802.11 a/b/g/n/ac support. The solution should be artificial intelligence based self healing solution. The solution should support Location Based services via Bluetooth low energy and should also support Asset Tracking if required in future without any change in Hardware. Should support upto 16 SSIDs per AP. Must be able to limit per SSID or per user based uplink or downlink bandwidth, as per detailed specification of management controller.	8	No s.		0.00	INR Zero Only
213	Supplying and drawing of UTP 4 pair CAT 6 LAN Cable in the existing surface/ recessed Steel/ PVC conduit as required (for Connectivity of Hub room to End Point)	600	Mtr		0.00	INR Zero Only
214	Supply, Installation, Testing and Commissioning of CAT6 information outlet (I/O) for camera at user end.	25	No s.		0.00	INR Zero Only
215	Supply, Installation, Testing and Commissioning of loaded 24 port CAT6 jack panel for CAT6 cable termination at rack end.	1	No s.		0.00	INR Zero Only
216	Supply, Installation, Testing and Commissioning of CAT6 patch cord 7 feet for information outlet (I/O) to end user device connectivity.	1	No s.		0.00	INR Zero Only
217	Supply, Installation, Testing and Commissioning of 1, 2 and 4 port face plate white for I/O fixing at user side.	30	No s.		0.00	INR Zero Only

218	Supply, Installation, Testing & Commissioning of 3 MP Bullet camera , ONVIF profile S ,G & T . UL , CE , FCC Certified ,1/2.8" Progressive Scan CMOS ,2.7 mm to 12 mm motorized varifocal lens , Quad stream with each stream support H.265+ compression simultaneously ,min illumination : 0.01 Lux @ (F1.2,AGC ON), 0 Lux with IR , Shutter speed : 1 / 5s ~ 1 / 100,000 s ,120 dB WDR , Compression : H.265+ ,H.265 ,H.264+ H.264 .SD card support , Alarm trigger - 1 input / 1 output , frame rate : Main stream should support 25 fps@5MP , Edge analytics : line crossing , perimeter intrusion ,Face detection (deep learning) , pedestrian detection ,cross counting , stationary object , In built IR LED , IR Distance upto 50 meters , IP 67 , IK 10 housing , POE	25	No s.		0.00	INR Zero Only
219	Supply, Installation, Testing & Commissioning of 32 channel NVR , ONVIF compliant , recording bandwidth 640 Mbps , output interface 1 HDMI (up to 4K), 1 VGA , Alarm in/out :16ch in / 4ch out , 1 X RJ45 Ethernet , iOS smartphone support , 8 HDD support , each HDD slot support upto 8 TB HDD , RAID support , 1x3.0 USB for backup /upgrade , 2x 2.0 USB for mouse , Artificial Intelligence Support having face recognition with compatible deep learning supported cameras, AI-Face registered quantity upto 10,000 ,AI maximum captured quantity 200,000. UL,CE,FCC certified	1	No s.		0.00	INR Zero Only
220	Supply, Installation, Testing and Commissioning of 6TB Surveillance Hard Disk.	1	No s.		0.00	INR Zero Only
221	Supply, Installation, Testing and Commissioning of Full HD 42" LED Professional Display Panel.	1	No s.		0.00	INR Zero Only
222	Supply, Installation, Testing & Commissioning of Access Switch 24 Port POE+ Access Switches with switching capacity of 56 Gbps, forwarding performance 10 Mpps, having 8 x 10/100/1000BASE-T PoE-plus(RJ45) with minimum PoE budget of 370W and 2x 1G SFP+ uplink ports	1	No s.		0.00	INR Zero Only
223	Supplying and fixing of following sizes of medium class PVC conduit along with accessories in surface/recess including cutting the wall and making good the same in case of recessed conduit as required. 25 mm dia.	350	Mt r		0.00	INR Zero Only

224	Supply, Installation, Testing and Commissioning of intelligent analog addressable photothermal detector complete with mounting base complete as required. Below False Ceiling	350	No s.		0.00	INR Zero Only
225	Supplying, installation, testing & commissioning of addressable manual call point complete as required.	10	No s.		0.00	INR Zero Only
226	Supplying, installation, testing & commissioning of addressable horn cum strobe complete as required.	10	No s.		0.00	INR Zero Only
227	Supplying, installation, testing & commissioning of micro processor based intelligent addressable main fire alarm panel, central processing unit with the following loop modules and capable of supporting not less than 240 devices (including detectors) and minimum 120 detectors per loop and loop length up to 2 km, network communication card, minimum 320 character graphics/ LCD display with touch screen or other keypad and minimum 4000 events history log in the non volatile memory (EPROM), power supply unit (230 ± 5% V, 50 hz), 48 hrs back-up with 24 volt sealed maintenance free batteries with automatic charger. The panel shall have facility to connect printer to printout log and facility to have seamless integration with analog/digital voice evacuation system (which is part of the schedule of work under SH: PA System) and shall be complete with all accessories . The panel shall be compatible for IBMS system with open protocol BACnet/ Modbus over IP complete as per specifications. Two Loop Panel.	1	No s.		0.00	INR Zero Only
228	Supplying, installation, testing & commissioning of repeater panel with 320 character/ Touch screen LCD display with inbuilt reset, acknowledge and silence switches complete as required.	40	No s.		0.00	INR Zero Only
229	Supplying & laying of 2x1.5 sqmm fire survival armoured cable, 600/1000V rated with annealed copper conductor having glass mica fire barrier tape covered by an extruded layer of Cross Linkable Ethylene Propylene Rubber (EPR) insulation and LSZH inner bedding, steel wire armouring & LSZH outer sheath complete as required.	200 0	RM		0.00	INR Zero Only

230	Supply of 1.5/3/6W metal box ceiling/wall speakers complete as required.	10	No s.		0.00	INR Zero Only
231	Supply of 1X500W Class-D Amplifier with 2 independent channels and can provide automatic re-settable overcurrent, overload, overheating, overvoltage, under-voltage and DC protection 250 Watts	1	No s.		0.00	INR Zero Only
232	Supply of cable Fire Retardant PVC insulated copper conductor cable in the existing surface / recessed steel conduit of following pairs, cores and size including connections and interconnections etc. as required.					
233	Speaker cable Two pair, 2-core, 1.5 sqmm	500	RM		0.00	INR Zero Only
234	Supplying, installation, testing & commissioning of. Speaker cable Two pair, 2-core, 1.5 sqmm	500	RM		0.00	INR Zero Only
235	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class PVC conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable etc. as required.(For Concealed Wiring) Group A	162	Point		0.00	INR Zero Only
236	Wiring for twin control light point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed PVC conduit, 2 way modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm. FR PVC insulated copper conductor single core cable etc as required.	12	Point		0.00	INR Zero Only
237	Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 1 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	10	Mtr.		0.00	INR Zero Only

238	Wiring for light/ power plug with 4X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 2 Nos. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	10	Mt r.		0.00	INR Zero Only
239	Wiring for circuit/ submain wiring alongwith earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed PVC conduit as required					
239.01	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	225	Mt rs.		0.00	INR Zero Only
239.02	2x 6 sqmm+ 1x 6 sqmm earth wire	50	Mt rs.		0.00	INR Zero Only
240	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess including providing and fixing 6 pin 5/6 & 15/16 Amp modular socket outlet and 15/16 A modular switch, connection etc. as required.	2	Eac h		0.00	INR Zero Only
241	Providing and fixing circular/ Hexagonal cast iron or M.S. sheet box for ceiling fan clamp, of internal dia 140 mm, 73 mm height, top lid of 1.5 mm thick M.S. sheet with its top surface hacked for proper bonding, top lid shall be screwed into the cast iron/ M.S. sheet box by means of 3.3 mm dia round headed screws, one lock at the corners. Clamp shall be made of 12 mm dia M.S. bar bent to shape as per standard drawing.	4	Eac h		0.00	INR Zero Only
242	Supplying and fixing following way, horizontal type three pole and neutral, sheet steel, MCB distribution board, 415 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 6 way (4+18),Double door	1	Eac h		0.00	INR Zero Only
243	Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess,complete with tinned copper bus bar, neutral bus bar, earth bar,din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 6 way, double door	5	Eac h		0.00	INR Zero Only

244	Supplying & fixing 6 amps to 32 amps rating 240/415 volts C curve Miniature Circuit Breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required. Single Pole	33	Eac h		0.00	INR Zero Only
245	Supply & fixing of single pole blanking plate in the existing MCB DB complete etc. as required	5	Eac h		0.00	INR Zero Only
246	Supplying and fixing following rating, double pole, 240 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.					
246.01	25 amps	5	Eac h		0.00	INR Zero Only
246.02	40 amps	2	Eac h		0.00	INR Zero Only
247	Supplying and fixing of following rating four pole 415 V MCCB in the existing MCCB DB complete with connections ,testing and commissioning etc as required.63 amps	1	Eac h		0.00	INR Zero Only
248	Supply, installing, testing & commissioning of Track light 24W LED.	34	No s.		0.00	INR Zero Only
249	Supply installing, testing & commissioning of LED 4ft Batten with a nominal system lumen output of 4000 lumens and a minimum system efficacy of 110 lm/W. The luminaire shall have a rated system lifetime of 25,000 burning hours at L70B50. The luminaire should have a color temperature of 6500K/4000K and CRI>80. The luminaire shall meet IP20 rating with THD < 10% and PF > 0.95. It should have a surge protection of 2.5kV. The luminaire housing should made of Polycarbonate housing with a diffuser.	112	No s.		0.00	INR Zero Only

250	Supply, Installation, Testing and Commissioning of 1200 mm sweep, BEE 5 star rated, ceiling fan with Brush Less Direct Current (BLDC) Motor, class of insulation: B, 3 nos. blades, 30 cm long down rod, 2 nos. canopies, shackle kit, safety rope, copper winding, Power Factor not less than 0.9, Service Value (CMM/W) minimum 6.85, Air delivery minimum 215 CMM, 350 RPM (tolerance as per IS: 374-2019), THD less than 10%, remote or electronic regulator unit for speed control and all remaining accessories including safety pin, nut bolts, washers, temperature rise=75 degree C (max.), insulation resistance more than 2 mega ohm, suitable for 230 V, 50 Hz, single phase AC Supply, earthing etc. complete as required.	4	No s.		0.00	INR Zero Only
251	Main Panel (Hostel Block) INCOMER 1 No. 160A 4P MCCB ,36 kA breaking capacity with thermal release and adjustable setting and with rotary handle.with ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB METERING & INDICATION 1 set of R,Y,B phase indicating lamps 1 set of ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB BUS-BAR 1 Set of 200A TPN Aluminium Bus Bar with colour coded PVC Sleeves OUTGOINGS 6 Nos.63A TPN MCCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle 1Nos.100A TPN MCCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle NOTE :- All starters shall have ON & OFF push button & suitable rating of contractor and overload relays Supplying,Receiving, fixing, testing & commissioning of above described Panel	3	Set .		0.00	INR Zero Only
252	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class PVC conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable etc. as required.(For Concealed Wiring) Group A (Hostels)	110 1	Poi nt		0.00	INR Zero Only

253	Wiring for twin control light point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed PVC conduit, 2 way modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm. FR PVC insulated copper conductor single core cable etc as required.	36	Poi nt		0.00	INR Zero Only
254	Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 1 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	450 0	Mt r.		0.00	INR Zero Only
255	Wiring for light/ power plug with 4X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 2 Nos. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	171 0	Mt r.		0.00	INR Zero Only
256	Wiring for circuit/ submain wiring alongwith earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed PVC conduit as required					
256.01	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	240 0	Mt rs.		0.00	INR Zero Only
256.02	2x 6 sqmm+ 1x 6 sqmm earth wire	207 0	Mt rs.		0.00	INR Zero Only
256.03	4x 10 sqmm+ 2x 6 sqmm earth wire	450	Mt rs.		0.00	INR Zero Only
257	Supply & fixing of following sizes of medium class PVC conduit along with accessories in surface / recessed including cutting the wall & making good the same in case of recessed conduit as required.					
257.01	25 mm dia.	30	Mt rs.		0.00	INR Zero Only
257.02	32 mm dia.	30	Mt rs.		0.00	INR Zero Only
258	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess including providing and fixing 6 pin 5/6 & 15/16 Amp modular socket outlet and 15/16 A modular switch, connection etc. as required.	447	Eac h		0.00	INR Zero Only

259	Providing and fixing circular/ Hexagonal cast iron or M.S. sheet box for ceiling fan clamp, of internal dia 140 mm, 73 mm height, top lid of 1.5 mm thick M.S. sheet with its top surface hacked for proper bonding, top lid shall be screwed into the cast iron/ M.S. sheet box by means of 3.3 mm dia round headed screws, one lock at the corners. Clamp shall be made of 12 mm dia M.S. bar bent to shape as per standard drawing.	306	Eac h		0.00	INR Zero Only
260	Supplying & fixing of 1 OR 2 modular(75mm x 75mm) GI box along with modular base and cover plate including supplying and fixing 25 Amp. modular switch in recess etc. as required. <u>(FOR MASTER SWITCH OF LIGHT & POWER CIRCUITS-ALL ROOMS)</u>	207	Eac h		0.00	INR Zero Only
261	Supplying & fixing Single Phase Digital Multi-Function Electrical Energy meter with GI box along with modular base and cover plate complete all respect.	207	Eac h		0.00	INR Zero Only
262	Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess,complete with tinned copper bus bar, neutral bus bar, earth bar,din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 6 way, double door	210	Eac h		0.00	INR Zero Only
263	Supplying and fixing following way, horizontal type three pole and neutral, sheet steel, MCB distribution board, 415 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 8 way (4+24),Double door	15	Eac h		0.00	INR Zero Only
264	Supplying & fixing 6 amps to 32 amps rating 240/415 volts C curve Miniature Circuit Breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required. Single Pole	105 0	Eac h		0.00	INR Zero Only
265	Supply & fixing of single pole blanking plate in the existing MCB DB complete etc. as required	150	Eac h		0.00	INR Zero Only
266	Supplying and fixing following rating, double pole, 240 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.					

266.01	25 amps	210	Eac h		0.00	INR Zero Only
266.02	40 amps	2	Eac h		0.00	INR Zero Only
267	Supplying and fixing of following rating four pole 415 V MCCB in the existing MCCB DB complete with connections ,testing and commissioning etc as required. 63 amps	15	Eac h		0.00	INR Zero Only
268	Earthing with G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. with charcoal/ coke and salt as required.	12	Eac h		0.00	INR Zero Only
269	Providing and fixing 25 mm x 5 mm G.I. strip in 40 mm dia G.I. pipe from earth electrode, as required.	225	Eac h		0.00	INR Zero Only
270	Providing and fixing 25 mm x 5 mm G.I. strip on surface or in recess for connections etc. as required.	300	Eac h		0.00	INR Zero Only
271	Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.	300	Eac h		0.00	INR Zero Only
272	Supply, Installation, Testing and Commissioning of 10 W LED Bulk head Light - Supply of 10W LED bulkhead Surface mounted IP65 bulkhead LED fixture made up of pressure die cast aluminum housing with integrated power supply unit, LED Used shall be SMD type and fixture should have minimum efficacy at System level (Not Chip Level) ≥90 lumens/watt with Minimum system Lumens 900, Life of LED : 50000 burning Hrs. @ L70B50 Lumen maintenance, cool white color temperature (SDCM<5), CRI >80, PF >0.95 & THD<10%, an operating Voltage Range of 150 - 260 VAC.Minimum Internal Surge Protection 2.5KV As Trilux Optima IND G3 900-857 ET or equivalent.	18	No s.		0.00	INR Zero Only

273	Supply, Installation, Testing and Commissioning of 12W Surface Mounted LED circular Downlighter - Supply of Surface Mounted LED Downlight with cylindrical construction, Housing Dia 160 mm, height 110 mm, Luminaire luminous flux 1320 Lm, Maximum system Power 12W, Luminous efficiency of 110 Lm/W. CRI >80. Life of fixture 50000 hrs@ L70 Lumen maintenance, CCT 5700K, CRI >80, PF >0.95, and suitable for 230V AC, 50Hz. supply, Internal Surge Protection $\geq 2.5\text{KV}$. The fixture should comply with the parameters as per IS10322 and IEC60598, EMC / EMI compliance, and LED driver shall be SELV & BIS registered & luminair manufacture shall provide LM79report from NABL accredited lab & LM80 report issued by LED manufacturer as Trilux Ambliella D Plus G4 Surface.	90	No s.		0.00	INR Zero Only
274	Supply, installing, testing & commissioning of Decorative Wall Light with 2 LT Ivory Fabric shade with 3W LED mild steel & Brass with Chrome finish, Fixture Height 405mm, Size (LXWXH) 155 X 280 X 405 mm and E14 base 7w Bulb or Equivalent as per direction of E/I.	3	No s.		0.00	INR Zero Only
275	Supply installing, testing & commissioning of LED 4ft Batten with a nominal system lumen output of 4000 lumens and a minimum system efficacy of 110 lm/W. The luminaire shall have a rated system lifetime of 25,000 burning hours at L70B50. The luminaire should have a color temperature of 6500K/4000K and CRI>80. The luminaire shall meet IP20 rating with THD < 10% and PF > 0.95. It should have a surge protection of 2.5kV. The luminaire housing should made of Polycarbonate housing with a diffuser.	678	No s.		0.00	INR Zero Only

276	Supply, Installation, Testing and Commissioning of 1200 mm sweep, BEE 5 star rated, ceiling fan with Brush Less Direct Current (BLDC) Motor, class of insulation: B, 3 nos. blades, 30 cm long down rod, 2 nos. canopies, shackle kit, safety rope, copper winding, Power Factor not less than 0.9, Service Value (CMM/W) minimum 6.85, Air delivery minimum 215 CMM, 350 RPM (tolerance as per IS: 374-2019), THD less than 10%, remote or electronic regulator unit for speed control and all remaining accessories including safety pin, nut bolts, washers, temperature rise=75 degree C (max.), insulation resistance more than 2 mega ohm, suitable for 230 V, 50 Hz, single phase AC Supply, earthing etc. complete as required.	306	No s.		0.00	INR Zero Only
277	Supply, Installation, Testing and Commissioning of 300 mm dia Domestic Exhaust Fan	15	No s.		0.00	INR Zero Only
278	Providing and fixing of lightning conductor finial, made of 25 mm dia 300 mm long, G.I. tube, having single prong at top, with 85 mm dia 6 mm thick G.I. base plate including holes etc. complete as required.	12	Eac h		0.00	INR Zero Only
279	Jointing copper / G.I. tape (with another copper/ G I tape, base of the finial or any other metallic object) by riveting / nut bolting/ sweating and soldering etc as required.	300	Eac h		0.00	INR Zero Only
280	Providing and fixing G.I. tape 20 mm X 3 mm thick on parapet or surface of wall for lightning conductor complete as required.(For horizontal run)	450	Me tre		0.00	INR Zero Only
281	Providing and fixing G.I. tape 20 mm X 3 mm thick on parapet or surface of wall for lightning conductor complete as required.(For vertical run)	450	Me tre		0.00	INR Zero Only
282	Providing and fixing testing joint, made of 20 mm X 3 mm thick G.I. strip, 125 mm long, with 4 nos. of G.I. bolts, nuts, chuck nuts and spring washers etc. complete as required.	18	Eac h		0.00	INR Zero Only
283	Providing and laying G.I. tape 32 mm X 6 mm from earth electrode directly in ground as required.	300	Me tre		0.00	INR Zero Only

284	Supply, Installation, Testing & Commissioning of Indoor Access Point solution should have integrated dynamic packet capture, WIPS, detection of rouge and honeypot Access Point detection, able to create WxLAN policies and the cloud controller should be scalable to handle around 5000 APs or more in future. Should be able to extend API to integrate with other systems as well. AP indoor 4x4 with 802.11 a/b/g/n/ac support. The solution should be artificial intelligence based self healing solution. The solution should support Location Based services via Bluetooth low energy and should also support Asset Tracking if required in future without any change in Hardware. Should support upto 16 SSIDs per AP. Must be able to limit per SSID or per user based uplink or downlink bandwidth, as per detailed specification of management controller.	3	No s.		0.00	INR Zero Only
285	Supplying and drawing of UTP 4 pair CAT 6 LAN Cable in the existing surface/ recessed Steel/ PVC conduit as required (for Connectivity of Hub room to End Point)	1800	Mtr		0.00	INR Zero Only
286	Supply, Installation, Testing and Commissioning of CAT6 information outlet (I/O) for camera at user end.	15	No s.		0.00	INR Zero Only
287	Supply, Installation, Testing and Commissioning of loaded 24 port CAT6 jack panel for CAT6 cable termination at rack end.	3	No s.		0.00	INR Zero Only
288	Supply, Installation, Testing and Commissioning of CAT6 patch cord 7 feet for information outlet (I/O) to end user device connectivity.	3	No s.		0.00	INR Zero Only
289	Supply, Installation, Testing and Commissioning of 1, 2 and 4 port face plate white for I/O fixing at user side.	90	No s.		0.00	INR Zero Only

290	Supply, Installation, Testing & Commissioning of 3 MP Bullet camera , ONVIF profile S ,G & T . UL , CE , FCC Certified ,1/2.8" Progressive Scan CMOS ,2.7 mm to 12 mm motorized varifocal lens , Quad stream with each stream support H.265+ compression simultaneously ,min illumination : 0.01 Lux @ (F1.2,AGC ON), 0 Lux with IR , Shutter speed : 1 / 5s ~ 1 / 100,000 s ,120 dB WDR , Compression : H.265+ ,H.265 ,H.264+ H.264 .SD card support , Alarm trigger - 1 input / 1 output , frame rate : Main stream should support 25 fps@5MP , Edge analytics : line crossing , perimeter intrusion ,Face detection (deep learning) , pedestrian detection ,cross counting , stationary object , In built IR LED , IR Distance upto 50 meters , IP 67 , IK 10 housing , POE	15	No s.		0.00	INR Zero Only
291	Supply, Installation, Testing & Commissioning of 32 channel NVR , ONVIF compliant , recording bandwidth 640 Mbps , output interface 1 HDMI (up to 4K), 1 VGA , Alarm in/out :16ch in / 4ch out , 1 X RJ45 Ethernet , iOS smartphone support , 8 HDD support , each HDD slot support upto 8 TB HDD , RAID support , 1x3.0 USB for backup /upgrade , 2x 2.0 USB for mouse , Artificial Intelligence Support having face recognition with compatible deep learning supported cameras, AI-Face registered quantity upto 10,000 ,AI maximum captured quantity 200,000. UL,CE,FCC certified	3	No s.		0.00	INR Zero Only
292	Supply, Installation, Testing and Commissioning of 6TB Surveillance Hard Disk.	3	No s.		0.00	INR Zero Only
293	Supply, Installation, Testing and Commissioning of Full HD 42" LED Professional Display Panel.	3	No s.		0.00	INR Zero Only
294	Supply, Installation, Testing & Commissioning of Access Switch 24 Port POE+ Access Switches with switching capacity of 56 Gbps, forwarding performance 10 Mpps, having 8 x 10/100/1000BASE-T PoE-plus(RJ45) with minimum PoE budget of 370W and 2x 1G SFP+ uplink ports	3	No s.		0.00	INR Zero Only
295	Supplying and fixing of following sizes of medium class PVC conduit along with accessories in surface/recess including cutting the wall and making good the same in case of recessed conduit as required. 25 mm dia.	600	Mt r		0.00	INR Zero Only

296	Supply, Installation, Testing and Commissioning of intelligent analog addressable photothermal detector complete with mounting base complete as required. Below False Ceiling	438	No s.		0.00	INR Zero Only
297	Supplying, installation, testing & commissioning of addressable manual call point complete as required.	15	No s.		0.00	INR Zero Only
298	Supplying, installation, testing & commissioning of addressable horn cum strobe complete as required.	15	No s.		0.00	INR Zero Only
299	Supplying, installation, testing & commissioning of micro processor based intelligent addressable main fire alarm panel, central processing unit with the following loop modules and capable of supporting not less than 240 devices (including detectors) and minimum 120 detectors per loop and loop length up to 2 km, network communication card, minimum 320 character graphics/ LCD display with touch screen or other keypad and minimum 4000 events history log in the non volatile memory (EPROM), power supply unit (230 ± 5% V, 50 hz), 48 hrs back-up with 24 volt sealed maintenance free batteries with automatic charger. The panel shall have facility to connect printer to printout log and facility to have seamless integration with analog/digital voice evacuation system (which is part of the schedule of work under SH: PA System) and shall be complete with all accessories . The panel shall be compatible for IBMS system with open protocol BACnet/ Modbus over IP complete as per specifications. Two Loop Panel.	3	No s.		0.00	INR Zero Only
300	Supplying, installation, testing & commissioning of repeater panel with 320 character/ Touch screen LCD display with inbuilt reset, acknowledge and silence switches complete as required.	60	No s.		0.00	INR Zero Only
301	Supplying & laying of 2x1.5 sqmm fire survival armoured cable, 600/1000V rated with annealed copper conductor having glass mica fire barrier tape covered by an extruded layer of Cross Linkable Ethylene Propylene Rubber (EPR) insulation and LSZH inner bedding, steel wire armouring & LSZH outer sheath complete as required.	3000	RM		0.00	INR Zero Only

302	Supply of 1.5/3/6W metal box ceiling/wall speakers complete as required.	30	No s.		0.00	INR Zero Only
303	Supply of 1X500W Class-D Amplifier with 2 independent channels and can provide automatic re-settable overcurrent, overload, overheating, overvoltage, under-voltage and DC protection 250 Watts	3	No s.		0.00	INR Zero Only
304	Supply of cable Fire Retardant PVC insulated copper conductor cable in the existing surface / recessed steel conduit of following pairs, cores and size including connections and interconnections etc. as required. Speaker cable Two pair, 2-core, 1.5 sqmm	1500	RM		0.00	INR Zero Only
305	Main Panel INCOMER 1 No. 63A DP MCB ,25 kA breaking capacity with thermal release and adjustable setting and with rotary handle.with ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB METERING & INDICATION 1 set of R,Y,B phase indicating lamps 1 set of ON/OFF/TRIP indication Lamps, MFM with Communication Facility along with control SP MCB BUS-BAR 1 Set of 100A TPN Aluminium Bus Bar with colour coded PVC Sleeves OUTGOINGS 6 Nos.32A DP MCB, 25 kA breaking capacity with thermal release and adjustable setting and with rotary handle NOTE :- All starters shall have ON & OFF push button & suitable rating of contractor and overload relays Supplying,Receiving, fixing, testing & commissioning of above described Panel	2	Set .		0.00	INR Zero Only
306	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class PVC conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable etc. as required.(For Concealed Wiring) Group A	534	Poi nt		0.00	INR Zero Only

307	Wiring for twin control light point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed PVC conduit, 2 way modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm. FR PVC insulated copper conductor single core cable etc as required.	24	Poi nt		0.00	INR Zero Only
308	Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 1 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	300	Mt r.		0.00	INR Zero Only
309	Wiring for light/ power plug with 4X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed medium class PVC conduit alongwith 2 Nos. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required.	150	Mt r.		0.00	INR Zero Only
310	Wiring for circuit/ submain wiring alongwith earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed PVC conduit as required					
310.01	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	136 0	Mt rs.		0.00	INR Zero Only
310.02	2x 6 sqmm+ 1x 6 sqmm earth wire	300	Mt rs.		0.00	INR Zero Only
310.03	4x 10 sqmm+ 2x 6 sqmm earth wire	100	Mt rs.		0.00	INR Zero Only
311	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess including providing and fixing 6 pin 5/6 & 15/16 Amp modular socket outlet and 15/16 A modular switch, connection etc. as required.	30	Eac h		0.00	INR Zero Only

312	Providing and fixing circular/ Hexagonal cast iron or M.S. sheet box for ceiling fan clamp, of internal dia 140 mm, 73 mm height, top lid of 1.5 mm thick M.S. sheet with its top surface hacked for proper bonding, top lid shall be screwed into the cast iron/ M.S. sheet box by means of 3.3 mm dia round headed screws, one lock at the corners. Clamp shall be made of 12 mm dia M.S. bar bent to shape as per standard drawing.	42	Eac h		0.00	INR Zero Only
313	Supplying and fixing following way, horizontal type three pole and neutral, sheet steel, MCB distribution board, 415 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 4 way (4+12), Double door	8	Eac h		0.00	INR Zero Only
314	Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 6 way, double door	10	Eac h		0.00	INR Zero Only
315	Supplying & fixing 6 amps to 32 amps rating 240/415 volts C curve Miniature Circuit Breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required. Single Pole	66	Eac h		0.00	INR Zero Only
316	Supply & fixing of single pole blanking plate in the existing MCB DB complete etc. as required	10	Eac h		0.00	INR Zero Only
317	Supplying and fixing following rating, double pole, 240 volts, isolator in the existing MCB DB complete with connections, testing and commissioning etc. as required.					
317.01	25 amps	10	Eac h		0.00	INR Zero Only
317.02	40 amps	2	Eac h		0.00	INR Zero Only
318	Supplying and fixing of following rating four pole 415 V MCCB in the existing MCCB DB complete with connections, testing and commissioning etc as required. 63 amps	2	Eac h		0.00	INR Zero Only

319	Earthing with G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. with charcoal/ coke and salt as required.	8	Eac h		0.00	INR Zero Only
320	Providing and fixing 25 mm x 5 mm G.I. strip in 40 mm dia G.I. pipe from earth electrode, as required.	100	Eac h		0.00	INR Zero Only
321	Providing and fixing 25 mm x 5 mm G.I. strip on surface or in recess for connections etc. as required.	100	Mt r.		0.00	INR Zero Only
322	Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.	150	Mt r.		0.00	INR Zero Only
323	Supply, Installation, Testing and Commissioning of 10 W LED Bulk head Light - Supply of 10W LED bulkhead Surface mounted IP65 bulkhead LED fixture made up of pressure die cast aluminum housing with integrated power supply unit, LED Used shall be SMD type and fixture should have minimum efficacy at System level (Not Chip Level) ≥90 lumens/watt with Minimum system Lumens 900, Life of LED : 50000 burning Hrs. @ L70B50 Lumen maintenance, cool white color temperature (SDCM<5), CRI >80, PF >0.95 & THD<10%, an operating Voltage Range of 150 - 260 VAC. Minimum Internal Surge Protection 2.5KV As Trilux Optima IND G3 900-857 ET or equivalent.	12	No s.		0.00	INR Zero Only
324	Supply, Installation, Testing and Commissioning of 12W Surface Mounted LED circular Downlighter - Supply of Surface Mounted LED Downlight with cylindrical construction, Housing Dia 160 mm, height 110 mm, Luminaire luminous flux 1320 Lm, Maximum system Power 12W, Luminous efficiency of 110 Lm/W. CRI >80. Life of fixture 50000 hrs@ L70 Lumen maintenance, CCT 5700K, CRI >80, PF >0.95, and suitable for 230V AC, 50Hz. supply, Internal Surge Protection ≥ 2.5KV. The fixture should comply with the parameters as per IS10322 and IEC60598, EMC / EMI compliance, and LED driver shall be SELV & BIS registered & luminair manufacture shall provide LM79report from NABL accredited lab & LM80 report issued by LED manufacturer as Trilux Ambilla D Plus G4 Surface.	248	No s.		0.00	INR Zero Only

325	Supply, installing, testing & commissioning of Decorative Wall Light with 2 LT Ivory Fabric shade with 3W LED mild steel & Brass with Chrome finish, Fixture Height 405mm, Size (LXWXH) 155 X 280 X 405 mm and E14 base 7w Bulb or Equivalent as per direction of E/I.	220	No s.		0.00	INR Zero Only
326	Supply installing, testing & commissioning of LED 4ft Batten with a nominal system lumen output of 4000 lumens and a minimum system efficacy of 110 lm/W. The luminaire shall have a rated system lifetime of 25,000 burning hours at L70B50. The luminaire should have a color temperature of 6500K/4000K and CRI>80. The luminaire shall meet IP20 rating with THD < 10% and PF > 0.95. It should have a surge protection of 2.5kV. The luminaire housing should made of Polycarbonate housing with a diffuser.	24	No s.		0.00	INR Zero Only
327	Supply, Installation, Testing and Commissioning of 1200 mm sweep, BEE 5 star rated, ceiling fan with Brush Less Direct Current (BLDC) Motor, class of insulation: B, 3 nos. blades, 30 cm long down rod, 2 nos. canopies, shackle kit, safety rope, copper winding, Power Factor not less than 0.9, Service Value (CMM/W) minimum 6.85, Air delivery minimum 215 CMM, 350 RPM (tolerance as per IS: 374-2019), THD less than 10%, remote or electronic regulator unit for speed control and all remaining accessories including safety pin, nut bolts, washers, temperature rise=75 degree C (max.), insulation resistance more than 2 mega ohm, suitable for 230 V, 50 Hz, single phase AC Supply, earthing etc. complete as required.	42	No s.		0.00	INR Zero Only
328	Supply, Installation, Testing and Commissioning of 300 mm dia Domestic Exhaust Fan	38	No s.		0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only
Quoted Rate in Words	INR Zero Only					

