



**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**

**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED  
AVIATION FUELLING STATION  
SHAHBHAD MOHAMMADPUR  
IGI AIRPORT  
NEW DELHI-110061**



**TENDER NO: DAFFPL/MOD/FF/2020-21/05**

**INVITING TENDER FOR CONSTRUCTION OF NEW  
ADMINISTRATIVE BUILDING  
(Civil, Interior & MEP Service Works)**

**BID DUE DATE & TIME: 1500 Hrs. IST on 13<sup>th</sup> August 2020**

**OPENING OF TECHNICAL BIDS: 1100 Hrs. IST on 14<sup>th</sup> August 2020**



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FINANCIAL BID FORMAT

NOTE: BIDDERS ARE REQUESTED TO SIGN AND STAMP ALL THE PAGES OF THE TENDER DOCUMENT AND SEND THE SAME BACK IN THEIR OFFER AS A TOKEN OF UNCONDITIONAL ACCEPTANCE OF TENDER FIRMS.

THE DEVIATIONS, IF ANY, SHOULD BE MENTIONED SEPARATELY ON BIDDER’S LETTER HEAD IN TECHNICAL BID. THE DEVIATIONS MENTIONED ANYWHERE ELSE SHALL NOT BE CONSIDERED. IN ABSENCE OF DEVIATION SHEET IT WOULD BE CONCLUDED THAT BIDDER HAS ACCEPTED THE TENDER TERMS WITHOUT ANY DEVIATIONS. CORRECTIONS IN TENDER DOCUMENT WILL NOT BE ACCEPTED.



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## TENDER NOTICE DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

### INVITING TENDER FOR CONSTRUCTION OF NEW ADMINISTRATIVE BUILDING WORKS AS PER DESIGN & SPECIFICATIONS AS REQUIRED

**TENDER NO: DAFFPL/MOD/FF/2020-21/05**

**Delhi Aviation Fuel Facility (P) Ltd (DAFFPL)** invites sealed bids under single stage two bid system from eligible bidders for construction of New Admin Building Works.

**Brief Scope of work:**

We intend to construct a new administrative building as per Design and Specification provided. Scope of work includes Civil, Interior & MEP Services.

Bid Security (EMD):	As mentioned in the Tender document
Date, Time & Venue for Voluntary Pre-bid Meeting:	27 <sup>th</sup> July 2020; 1500 HRS (IST) at DAFFPL, Aviation Fuelling Station, Shahabad Mohammadpur, New Delhi-110061
Bid Due Date, Time & Place of Submission:	Upto 15:00 HRS (IST) on 13 <sup>th</sup> August 2020 at office of Chief Executive Officer, DAFFPL, Aviation Fuelling Station, Shahabad Mohammadpur,

Detailed Invitation for Bids (IFB) along with Pre-qualification Criteria, Bid Document Corrigenda can be viewed and downloaded from DAFFPL's website: <http://www.daffpl.in>

**Chief Executive Officer**  
DAFFPL, New Delhi  
9810081078



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## CHAPTER 1: INTRODUCTION (COVERING NOTE)

**Delhi Aviation Fuel Facility Private Limited (DAFFPL)** is a Joint Venture comprising Indian Oil Corporation Ltd. (IOCL), Bharat Petroleum Corporation Ltd. (BPCL), and Delhi International Airport (P.) Ltd. (DIAL). We provide the infrastructure aimed at ensuring an uninterrupted flow of Aviation Turbine Fuel (ATF) to all type of aircrafts at the Indira Gandhi International Airport, New Delhi (IGI Airport) as per international benchmarking.

The bidder/ contractor shall refer to various sections of this tender document for detailed scope of work. It is contractor's responsibility to execute the job in all respects as per detailed drawings, documents / specification furnished by consultant / owner and as per applicable codes, standards & in line of statutory requirements.

The field circumstances shall also be taken into consideration and methods suitable to the site conditions shall be adopted with concurrence of the Engineer-in-charge and in line with manuals, instructions of respective equipment and specified codes and standards. The successful accomplishment of the project is greatly influenced by the teamwork, workmanship of the workers and supervisors.

The Contractor shall employ only such workers and supervisors who have considerable experience of similar work and who can work, temperamentally in good harmony and co-operation.

**Delhi Aviation Fuel Facility Private Limited (DAFFPL)** invites sealed tenders in prescribed tender form under two-bid system. For viewing details including EMD, BID QUALIFICATION CRITERIA etc. please visit our web site [www.daffpl.in](http://www.daffpl.in) and go to tender section by clicking the link "Tenders". Tender documents are available on our website.

The bid documents can also be collected from our office and the bids are to be submitted in Physical form in the Tender Box kept at the office of the **Delhi Aviation Fuel Facility Private Limited (DAFFPL)** at Shahabad Mohammadpur, New Delhi-110061, India.



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1. The Tender is floated in Two Bid system consisting of Technical Bids (Bid Qualification Criteria - BQC, Technical plus Commercial) and Price Bids.

Part-I : Bid Security / EMD in accordance with tender document.  
Part-II : BQC (Bid qualification criteria), Technical & commercial Bid, duly filled in & along with all supporting as requested to be submitted in Physical form in the Tender Box.  
Part -III : Price Bid.

2. The bidder should be able to construct the entire size/type/quantity bid by them. Bidders cannot bid for part items or part quantity.
3. Firstly, the Technical bid (BQC & Techno commercial bids) shall be opened. The Bids shall be initially scrutinized by a team as per tender requirements of BQC (Bid qualification criteria). The price bids of only technically qualified bidders will be opened, evaluated and shortlisted for Placement of Work Order.
4. Each page of bid documents is to be duly signed & stamped by the bidder before submitting the Tender.
5. The bids submitted should be valid for **four months** from the due date of bid submission for Owners acceptance. Once accepted it will remain firm till completion of contracts/orders.
6. We request the bidder to carefully go through all tender documents before submitting the offer. Please note that any exceptions or deviations to the tender document are necessarily to be recorded in the attached deviation statement only. Any exceptions/deviations brought out elsewhere in the bid shall not be considered.
7. The bidders may be invited for a presentation to DAFFPL during Techno-commercial evaluation before price bid opening.
8. The bidders to provide their bank details/ PAN / Sales Tax /WCT Registration numbers/Goods & Service Tax Registration No. / VAT registration No., as applicable for updating vendor master file. You are also requested to keep us informed of any change in address / status of your business / contact details including email address etc.
9. Party can quote with the deviations as referred in Point No.6 above. Please refer query end date / time in tender calendar after which no query posted by bidder shall be considered. However, DAFFPL reserves the right to respond the queries after cutoff date / time mentioned in tender calendar.
10. Please note that queries related to scope of job, tender specifications, terms & conditions etc., should be submitted by means of letter/E mail to reach the owner's office not later than one week before the meeting. It may not be practicable to



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answer queries received late, but queries and responses/clarifications will be posted in the form letter, E-mail within one week from the date of Pre Bid Meeting. Any modification in the bid document that may become necessary as a result of the Pre-Bid meeting shall be made by the owner exclusively through the issues of corrigendum/ addendum posted at web site and not through the minutes of the pre-bid meeting.

### 11. UNSOLICITED POST BID MODIFICATION

Bidders are advised to quote strictly as per terms and conditions of the Bidding Document. After tender submission due date & time/ extended due date & time (as the case may be) the bidders shall not make any subsequent price changes, whether resulting or arising out of any technical / commercial clarifications sought/allowed on any deviations or exceptions mentioned in the bid unless discussed and agreed by DAFFPL in writing.

12. EMD & Technical bid shall be opened on **14<sup>th</sup> August 2020 at 11:00 Hrs (IST)** in the presence of authorized representative of bidders (Restricted to one [1] person per bidder only) at the office of DAFFPL. Price Bid of only those bidders whose offer is found meeting BQC, shall be opened on a later date as per convenience of DAFFPL after intimation to the qualified bidders.

13. DAFFPL reserves the right to accept any tender in whole or in part or reject any or all tenders without assigning any reason. DAFFPL reserves right to accept any or more tenders in part. Decision of DAFFPL in this regard shall be final and binding on the bidder.

**QUERIES AND CLARIFICATIONS:** Any query or clarification about this tender may please be referred to below address & phone nos. on any working day during office working hours

Mr. M Vishnu Vardhan Assistant Manager - Projects <a href="mailto:Vishnu.vardhan@daffpl.in">Vishnu.vardhan@daffpl.in</a> , <a href="mailto:rakesh.arora@daffpl.in">rakesh.arora@daffpl.in</a> 8826000228	Mr. Amit Katyal Design Consultant <a href="mailto:ak@millenniumventures.in">ak@millenniumventures.in</a> 9873335880
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14. **GOVERNING LAWS:** The laws of Union of India shall govern all matters concerning the tender. Any issue arising related to the tender or the selection process shall be adjudged by the courts in Delhi alone.

15. A Pre-bid meeting is scheduled for **27<sup>th</sup> July 2020 at 1500 Hrs IST** at the office of DAFFPL, New Delhi. All prospective bidders can participate in the same.

- The purpose of the pre-bid meeting is to clarify any doubts of the BIDDER on the interpretation of the provisions of tender.
- Bidder(s) are requested to submit their queries, mentioning form name, clause no. & clause, by a letter / e-mail to our office as per schedule in order to have fruitful discussions during the meeting.
- All the Bidder(s) are requested to attend the pre-bid meeting to be held at DAFFPL Office as per schedule.



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16. **Tender document can be purchased from our office located at Shahabad Mohammadpur and can be downloaded from our website [www.daffpl.in](http://www.daffpl.in).**
- **A bidder who downloads the document from website must submit a separate DD for an amount of Rs.5000/- along with the EMD document.**
  - **Bidders who purchase the document from our office must submit a DD for an amount of Rs.5000/- at the time of purchase.**
17. **Earnest Money Deposit (EMD) (also referred to as Bid Security):** Bidder shall be required to submit the Earnest Money Deposit (EMD), either in the form of Bank guarantee as per format (provided as Annexure) or PAY ORDER or BANK DRAFT (in favour of Delhi Aviation Fuel Facility Private Limited, payable at New Delhi) at our office. The EMD in either form must be submitted on or before the due date & due time of bid submission of this tender with a covering note mentioning the tender no.
- a. The bidders not submitting EMD by due time & date shall be rejected & their bids shall not be evaluated further.
  - b. **The EMD amount shall be 2.5 Lakhs INR**
  - c. Firms registered with National Small Scale Industries (NSIC)/MSME of India are exempted from submission of bid security. Bidders registered with NSIC of India are also requested to submit self-declaration on their letter head to this effect along with a copy of their Valid Registration certificate, specifying limit of volume and other details which should be submitted.
18. **Site Restriction:** The job must be done in an area which is inside the premises of DAFFPL Fuel Facility. Successful bidder will have to follow all the security norms and procedures for entry and exit to the facility. The job timings will have to change as per the permissions obtained from Operation Dept. All the entry procedures for labours / machinery / raw materials as per the rules of the DAFFPL will have to be followed by the vendor. Contractor shall visit the site and ensure familiarity with the working condition / limitations at the site. Also, the entire works are to be carried out in an operating Location. The contractor may have to follow the timings of the facility and must work under restricted conditions. The normal working hours of facility is 0930 Hrs to 1800 Hrs on Monday to Saturday except holidays. Working beyond above normal working hours /holidays /Sundays are to be with prior permission of Engineer in charge and relevant facility officers. Contractor is required to plan his work within the normal working hours and days and accordingly he must mobilize the resources to complete the job within the scheduled time. However, all efforts will be made by DAFFPL to give extended working time beyond normal working time in order to help the contractor for early completion of the job. No additional payment / charges shall be payable for such works. Not getting permission for working on holidays/ Sundays or beyond normal working hours will not be considered as reason for delay in work. The contractor and his personnel must obey all rules and regulations of the plant. Trained and experienced supervisor/ engineer are required to be present at the work spot always.



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All hot work like welding, cutting, grinding etc. needs to be done in the closed booth of asbestos cloth. No extra claim on account of the same will be considered. Also the shutdown jobs may get delayed due to operational requirement. Any extra claims on account of the same will not be entertained.

19. **Completion Time:** Time is the essence of the contract. The time period of contract is **10 (Ten) months** from the date of Letter of Intent including monsoon period. **The time includes necessary time required for mobilizations and demobilizations after the execution of work and includes monsoon period.** Successful bidder is required to provide a bar chart /schedule showing the activities/events with time along with the Technical bid to be scheduled accordingly.
20. The work is required to be done in a working/operating location, the party has to get necessary Hot/cold work permits from the concerned officer in plant as per OISD standards and all workmen should be provided with necessary safety helmet, safety belts, safety shoes and other standard safety equipment's. Any delay on account of non-adherence to safety norms, rules and regulations of plant as well as obtaining work permits from the plant shall not be accounted for the delay in completion of job.
21. **Receipt & storage of material at Site:** Contractor is required to make his own arrangement for unloading and storage of materials at site. Contractor is required to inform us prior to dispatch of materials and his representative required to be available for receipt and unloading of materials at site.
22. The successful vendor if required must arrange and submit proper **POLICE VERIFICATION DOCUMENTS** of all the labours, site in charges, supervisors, and all associated workmen who will be coming inside the terminal for carrying out the job.
23. For arranging the electricity vendor to note that only Acoustic Proof, box type DG sets will be allowed inside the depot premises. Vendor to also note that proper GI plate type earthing system as per IS 3042 (LATEST) must be provided by the vendor for DG set and no extra payment will be done for the same. There should be two nos. earthing system connected in a grid at a location as instructed by DAFFPL site in-charge
24. All the debris, scrap, cut pieces, etc coming out of construction, excavated earth, area cleaning will have to be shifted by the vendor to a location inside or outside the terminal premises as per the instruction of DAFFPL site in-charge and no extra payment will be done for the same.





## CHAPTER 2: INSTRUCTIONS TO BIDDERS

1. The bidder shall bear all costs associated with the preparation and submission of the bid and Owner will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.
2. Vendor is requested to submit their bids taking full notice of all the technical specifications, terms and conditions, forms & attachments to this tender. Bids must be submitted in Physical form only.
3. Owner reserves the right to accept / reject any or all bid qualification documents at their sole discretion without assigning any reason whatsoever.
4. Owner is not responsible for any delays from bidder end.
5. Owner reserves the right to make any changes in terms and conditions of purchase before due date of bid submission and to reject any or all bids received incomplete.
6. Undertaking by the bidder:
  - a. I/we hereby undertake that the statements made herein/information given in the bids through Physical Tendering system/annexure/forms referred are true in all respects and that in the event of any such statement or information being found to be incorrect in any particular, the same may be construed to be a misrepresentation entitling DAFFPL to avoid any resultant contract.
  - b. I/we further undertake as and when called upon by DAFFPL to produce, for its inspection, original(s) of the document(s) of which copies have been annexed hereto.
7. Owner, at its discretion reserves the right to verify information submitted by the bidders.
8. Bidder to submit documents/information to satisfy the bid qualification criteria. Bidders should also be in a position to produce further information as and when required by DAFFPL with in a time limit of 15 days.
9. DAFFPL reserves their right to negotiate the quoted prices with lowest bidder.
10. Bidders would be qualified based on data and documents submitted by them.
11. Owner's decision on any matter regarding short listing of vendors shall be final and no corresponding in this regards will be entertained.
12. The vendors who are on IOCL/BPCL/DIAL holiday list or delisted will not be



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considered.

13. The bidder is expected to examine all instructions, forms, attachments, terms and specifications in the tender document. The entire tender document together with all its attachments thereto, shall be read, understood and accepted by the bidder, unless deviations are specifically stated seriatim by the bidder. Failure to furnish all information required in the tender document or submission of a bid not substantially responsive to the tender documents in every respect will be at bidder risk and may result in the rejection of his bid. The bidder scope of supplies as specified in the material requisition shall be in strict compliance with the scope detailed therein and in the bid document.
14. Bidders in their own interest shall ensure that they submit their bid, complete in all respects, well within the specified bid due date and time. No relaxation shall be given for delay due to any unforeseen event in submission of bid.
15. At any time prior to the bid due date, we may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bid document. The amendment will be notified through our portal [www.daffpl.in](http://www.daffpl.in) to all prospective bidders and will be binding on them. In order to afford prospective bidder, reasonable time in which to take the amendment into account in preparing their bids, we may, at our discretion, extend the bid due date.
16. The bid prepared by the bidder and all correspondence/ drawings and documents relating to the bid exchanged by bidder and the owner shall be written in ENGLISH language, provided that any printed literature furnished by the bidder may be written in another language so long as accompanied by an ENGLISH translation, in which case, for the purpose of interpretation of the bid, the ENGLISH translation shall govern.
17. Declaration with the bid qualification criteria that bidder has not been banned or delisted by any Government or quasi Government agencies or Public Sector Undertaking (PSU) as per declaration format (provided as annexure) of the tender document should be submitted along with the bid.
18. Bidders are advised to submit bids based strictly on the terms & conditions and specifications contained in the tender document and not to stipulate any deviations. Each Bidder shall submit only one bid. A Bidder who submits more than one bid will be rejected. Alternative bids will not be accepted.
19. The Owner may, at its discretion, extend the bid due date, in which case all rights and obligations of the Owner and the Bidders, previously subject to the bid due date, shall thereafter be subject to the new bid due date as extended. The same will be hosted in the web site.



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20. Bids shall be kept valid for 4 months from the bid due date. A bid valid for a shorter period shall be considered as non-responsive and rejected by the Owner. Notwithstanding above, the Owner may solicit the Bidder consent to an extension of the period of bid validity. The request and the responses thereto shall be made in writing. The EMD (bid security) shall also be accordingly extended.
21. Telex/ Telegraphic/ Telefax / E-mail offers will not be considered and shall be rejected.
22. No bid shall be modified after the due date & time or extension, if any, for submission of bids. Bidder(s) to note that Price changes after submission of bid shall not be allowed. In case any bidder gives revised prices/price implication, his bid shall be rejected. No bid shall be allowed to be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder. Withdrawal of a bid during this interval shall result in the forfeiture of Bidder s EMD.
23. Bids that do not meet the Bid qualification criteria as specified in the bid document shall be rejected. A bid with incomplete scope of work and/or which does not meet the technical requirements as specified in the bid document, shall be considered as non-responsive and rejected. Conditional bids will be liable for rejection.
24. The Owner will examine the bids to determine whether they are complete, whether any computational errors have been made, whether the documents have been properly signed and whether the bids are generally in order.
25. The bids without requisite EMD and/or not in the prescribed Performa and the time limit will not be considered and bids of such bidder(s) shall be rejected.
26. PRICE EVALUATION CRITERIA: As award is on overall landed lowest basis, part offers will be rejected.
27. Prior to the expiration of period of bid validity, the owner will notify the successful bidder in writing or by e-mail, that his bid has been accepted. The Notification of Award will constitute the formation of the Contract. Delivery Period shall be counted from the date of notification of award (Letter/Fax/e-mail of Intent).
28. Any efforts by a bidder to influence the owner/ in the owner bid evaluation, bid comparison or contract award decisions may result in the rejection of their bid.
29. ISSUE OF CONTRACT/ WORK ORDER: After the successful bidder has been notified that his bid has been accepted, DAFFPL will send to such bidder a detailed contract/purchase order incorporating all the terms and conditions agreed between the parties. Within 07 days of receipt of the detailed order, the bidder



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shall sign and return to the owner the duplicate copy of the order as a token of their acknowledgement.

30. Vigil Mechanism: DAFFPL has developed the Vigil Mechanism to deal with references/ grievances, if any, that is received from bidders who participated / intends to participate in the tender. The details of the same are available on our website [www.daffpl.in](http://www.daffpl.in)

31. VERIFICATION BY OWNER: All statements submitted by bidder regarding experience, manpower availability, equipment and machinery availability etc., are subject to verification by the owner either before placement of order or after placement of order. If any data submitted by the bidder at the bid stage is found to be incorrect, the offer is liable to be rejected or the contract/order is liable to be terminated.

### 32. SEALING & MARKING OF BIDS

A. Bids shall be submitted separately in THREE SECTIONS in sealed envelopes superscribed with the Bid Document number, bid due date and time, item and nature of bid as under:

- **SECTION - I (Envelope No. 1): Bid Security / EMD:**

Bid security in accordance with tender document.

- **SECTION - II (Envelope No. 2): Technical Bid:**

- a. Information and documentary evidence establishing bidder's claim for meeting qualification criteria as stipulated in IFB. This section/envelope should necessarily contain all the required back-up documents for Bid Qualification.
- b. Technical bid complete with all technical details, covering letter and un-priced copy of price Schedule with prices substituted with 'QUOTED' or 'NOT QUOTED' or 'NOT APPLICABLE'. **Deviation sheet duly filled with deviations, if any, shall form part of technical bid.**

- **SECTION - III (Envelope No. 3): Price Bid:**

- a. PRICE BID WITH FULL PRICE DETAILS. The price bid shall contain prices only in the prescribed price schedule formats, without any technical and commercial details. Technical specifications or commercial terms given in unpriced schedule will only be evaluated and the same will be binding on the Bidder. The bids shall be sealed and kept in a single envelope with marking as Section - III (Price Bid) / Envelope No. 3: "Original"
- b. The bidder shall quote the final prices (excluding taxes, Cess, duties



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and other levies etc) in the 'PRICE SCHEDULE FORMAT' of bid document ONLY. Prices quoted in any other format shall not be considered for evaluation.

- c. The Price bid shall be kept in a larger envelope duly sealed and shall bear the name and address of the bidder.
  
- B. The envelopes containing Section -I, Section -II, Section -III of bid shall be enclosed in a larger envelope duly sealed and pasted and shall bear the name and address of the bidder.
- C. Bidder to note that if bid security / EMD (in the Proforma attached with these documents) in original and/or bid document fee (if the bid document is downloaded) is kept in any other envelope and not found in envelope no. 1, the offer of the bidder(s) will be REJECTED during opening.
- D. Bidder to note that prices are to be quoted in the format provided in the price schedule formats provided along with the tender without any conditions. Price bids submitted in any other format and conditional price bids will be liable to be rejected. Price bids received in open condition (not in sealed envelope) or kept in any other Section of the bid (i. e, Section - I or II) will also be liable for rejection.
- E. If the outer envelope is not sealed and not marked as required, then DAFFPL will assume no responsibility for the bid's misplacement or premature opening.
- F. Bidders in their own interest shall ensure that they send their bid complete in all respects well in time to reach the specified office within the specified bid due date and time. No relaxation shall be given for delay due to any unforeseen event in submission of bid.
- G. Bid Security strictly in the Proforma attached with these documents shall be submitted in Original along with the Bid. Bids received without original bid security, shall not be opened for evaluation.
- H. Tender document complete in all respects must be submitted in the tender box provided at the DAFFPL office before due date and time

### 33. DOCUMENTS COMPRISING THE BIDS

The bid prepared by the Bidder shall comprise the following components:

- I. **ORIGINAL BID SECURITY (Section - I):** Bidders are advised to instruct their banks not to post Bid Security directly to Owner as the same has to accompany with the bid.
- II. **TECHNICAL BID (Section -II):**
  - Documentary evidence establishing Bidder's claim for meeting qualification criteria as stipulated in the Bid Document.
  - Notarized Audited Annual Report of previous three financial years.
  - Documentary evidence establishing Bidder's eligibility to bid



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- and that the offered Goods conform to the Bid Document.
- Price Schedule (with Price figures blanked) completed in accordance with the requirements specified in the bid document.
  - Agreed Terms & Conditions duly filled-in.
  - Deviation Sheet, if any.
  - Declaration with the bid qualification criteria that bidder has not been banned or delisted by any Government or quasi Government agencies or PSU's.
  - Any other information/details/documents/data required as per Bid Document.
  - Parent Company Guarantee, if applicable

### III. **PRICE BID (Section -III):** Bid Form and Price Schedule (Both given along with tender) duly filled in.

#### 34. BID FORM & PRICE SCHEDULE

The bidders shall complete the Bid Form and appropriate Price schedule furnished of Bid Document, indicating the required information for all quoted items.

#### 35. FORMAT AND SIGNING OF BID

- a. The bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to sign on behalf of the bidder on all pages of the bid. Such authorization shall be indicated by written Power of Attorney accompanying the bid. The name and position held by each person signing must be typed or printed below the signature. The person or persons signing the bid shall initial all pages of the bid, except for unamended printed literature.
- b. The complete bid shall be without alterations, interlineations or erasures, except as may be necessary to correct errors made by the Bidder, in which case such corrections shall be rewritten & initialed by the person or persons signing the bid.
- c. All the pages of the price bid shall be signed by the authorized signatory. In case all the pages of the price bid are not signed, the bid shall be rejected.

#### 36. OPENING OF BIDS

Bids will be opened by Owner at DAFFPL Office, New Delhi, in the presence of bidders/bidders authorized representatives available on the opening date and time (duly authorized by a competent person and having the letter of authority).

- a. **BID SECURITY / EMD (SECTION-I) AND TECHNICAL BID (SECTION-II):**
  - I. On the day and time of bid opening, Bid security (Envelope 1) and Technical Bid (Envelope 2) shall be opened in presence of bidders.
  - II. The Bidder's representatives, who are present, shall sign a



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register/attendance sheet evidencing their attendance.

- III. The Bidder(s) names, presence or absence of requisite bid security will be announced at the opening.
- IV. Bidder (s), whose bids are not opened for any reason, including non receipt of original bid security, will not be allowed to be present during bid opening.

### b. PRICE BID OPENING (SECTION -III):

- I. Only those bidders whose bids meet the qualification criteria and are technically acceptable shall be called for opening of Price bid (Envelope 3) at a later date, informed in advance.
- II. The Bidder's representatives, who are present, shall sign a register/attendance sheet evidencing their attendance.
- III. Bidder(s), whose bids are not opened for any reason, will not be allowed to be present during bid opening.

## 37. EVALUATION OF BIDS

- a. Qualification of Bidder: The experience details and financial & technical capabilities of the bidder(s) shall be examined to determine whether the bidder(s) meet the Bid Qualification Criteria mentioned in the INVITATION FOR BIDS (IFB).
- b. The Owner will examine the bids to determine whether they are complete, any computational errors have been made, whether the documents have been properly signed and whether the bids are generally in order.
- c. The bids without requisite Bid Security and/or not in the prescribed proforma will not be considered and bids of such bidder Bidder(s) shall be rejected.
- d. To assist in the examination, evaluation and comparison of technical bids, the owner/ may, at its discretion, ask the Bidder clarifications on the bid. The request for such clarifications and the response thereto shall be in writing.
- e. Prior to the evaluation and comparison of the bid, the owner will determine the substantial responsiveness of each bid to the bidding documents. For the purpose of this Article, a substantially responsive bid is one, which conforms to all the terms and conditions of the bidding document without material deviations or reservations. A material deviation or reservation is one which affects in any substantial way the scope, quality, or performance of the works or which limits in any substantial way, inconsistent with the bidding document, the DAFFPL's rights or Bidder's obligation under the contract and retention of which deviation or reservation would affect unfairly the competitive position of other bidders presenting substantially responsive bids. The owner's determination of bid responsiveness is to be based on the contents of the



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- bid itself without recourse to the extrinsic evidence.
- f. A bid determined as substantially non-responsive will be rejected by the Owner and shall not subsequently be allowed by the Owner to be made responsive by the Bidder by correction of the non-conformity.
- g. The Bidders qualifying the initial criteria as set out will be evaluated for the following criteria by scoring method based on details furnished by them.

Financial Strength (Form 'A' and 'B')	Maximum <b>20 Marks</b>
Experience in similar nature of work during last seven years (Form 'C')	Maximum <b>20 Marks</b>
Performance on works (Time over run Parameter) (Form 'D')	Maximum <b>20 Marks</b>
Performance on works (Quality) (Form 'D')	Maximum <b>40 Marks</b>
<b>Total</b>	<b>100 Marks</b>

To become eligible for short listing the bidder must secure at least fifty percent marks in each and sixty percent marks in aggregate in Part A, Part B & Part C individually as per Annexure III.

DAFFPL, however, reserves the right to restrict the list of such qualified contractors to any number deemed suitably by it.

**Note:**

- 1) The Bid Shall be submitted in English Language Only**
- 2) For any Document submitted in any language other than English, the translation copy in English language shall be submitted.**





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### CHAPTER 3: BID-QUALIFICATION CRITERIA:

Bidders need to meet following pre-qualification criteria to qualify for short-listing as a successful vendor, who would be considered for tendering process for the job.

➤ **Technical Criteria:**

**The bidder shall have satisfactorily executed either of the following during the last 7 years ending 31/03/2020:**

The Bidder should have completed at least **one similar work**, costing not less than **INR 400 lakhs**.

**OR**

The Bidder should have completed at least **two similar works**, each costing not less than **INR 300 lakhs**.

**OR**

The Bidder should have completed at least **three similar works**, each costing not less than **INR 200 lakhs**.

**Note:**

- Similar works mean “**Civil, Interior & MEP Service works in consolidated**”.
- In addition to above, bidder to submit a work completion certificate issued by competent authority for the work done not less than Stilt plus three floors.
- Bidder shall submit the Annexure III (Forms A, C, D & E) in support of full filling the above criteria.

➤ **Financial criteria for Job:**

- Bidder shall have minimum average annual turnover of Rs. 300 Lacs as per audited financial results in the preceding three financial/calendar years (2016-17, 2017-18 and 2018-19). “Turnover shall mean Consolidated Turnover in case of a Bidder having wholly owned subsidiaries”
- Should not have incurred any loss in more than two years during the last five years ending 31st March 2019.
- Should have a solvency of amount 200 Lacs (Original solvency to be submitted along with the bid).
- Bidder shall submit the attached Annexure III (Forms B) in support of full filling the above criteria.

Both the above criteria (Technical & Financial) to be met for acceptance of the bid.

OTHER INFORMATION OF PQC



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1. Parties who are affiliates of one another can decide which affiliate will make a bid. Only one affiliate may submit a bid. Two or more affiliates are not permitted to make separate bids directly or indirectly. If 2 or more affiliates submit a bid, then any one or all of them are liable for disqualification. However up to 3 affiliates may make a joint bid as a consortium, and in which case the conditions applicable to a consortium shall apply to them. "Affiliate" of a Party shall mean any company or legal entity which:
  - a. Controls either directly or indirectly a Party, or
  - b. Which is controlled directly or indirectly by a Party; or
  - c. Is directly or indirectly controlled by a company, legal entity or Partnership which directly or indirectly controls a Party. "Control" means actual control or ownership of at least a 50% voting or other controlling interest that gives the power to direct, or cause the direction of, the management and material business decisions of the controlled entity.
2. Bids may be submitted by:
  - a. A single person/ entity (called sole bidder);
  - b. A newly formed incorporated joint venture (JV) which has not completed 3 financial years from the date of commencement of business;
  - c. A consortium (including an unincorporated JV) having a maximum of 3 (three) members;
  - d. An Indian arm of a foreign company.
3. Fulfillment of Eligibility criteria and certain additional conditions in respect of each of the above 4 types of bidders are stated below, respectively:
  - a. The sole bidder (including an incorporated JV which has completed 3 financial years after date of commencement of business) shall fulfill each eligibility criteria.
  - b. In case the bidder is a newly formed and incorporated joint venture and which has not completed three financial years from the date of commencement of business, then either the said JV shall fulfill each eligibility criteria or any one constituent member/ promoter of such a JV shall fulfill each eligibility criteria. If the bid is received with the proposal that one constituent member/ promoter fulfils each eligibility criteria, then this member/promoter shall be clearly identified and he/it shall assume all obligations under the contract and provide such comfort letter/guarantees as may be required by Owner. The guarantees shall cover inter alia the commitment of the member/ promoter to complete the entire work in all respects and in a timely fashion, being bound by all the obligations under the contract, an undertaking to provide all necessary technical and financial support to the JV to ensure completion of the contract when awarded, an undertaking not to withdraw from the JV till completion of the work, etc.
  - c. In case the bidder(s) is/are a consortium (including an unincorporated JV), then the following conditions shall apply:
    - I. Each member in a consortium may only be a legal entity and not an



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- individual person;
- II. The Bid shall specifically identify and describe each member of the consortium;
  - III. the consortium member descriptions shall indicate what type of legal entity the member is and its jurisdiction of incorporation (or of establishment as a legal entity other than as a corporation) and provide evidence by a copy of the articles of incorporation (or equivalent documents);
  - IV. One participant member of the consortium shall be identified as the “Prime member” and contracting entity for the consortium;
  - V. This prime member shall be solely responsible for all aspects of the Bid/ Proposal including the execution of all tasks and performance of all consortium obligations;
  - VI. The prime member shall fulfill each eligibility criteria;
  - VII. a commitment shall be given from each of the consortium members in the form of a letter signed by a duly authorized officer clearly identifying the role of the member in the Bid and the member’s commitment to perform all relevant tasks and obligations in support of the
  - VIII. Prime/lead member of the Consortium and a commitment not to withdraw from the consortium;
  - IX. No change shall be permitted in the number, nature or share holding pattern of the Consortium members after pre-qualification, without the prior written permission of the Owner.
  - X. No change in project plans, timetables or pricing will be permitted as a consequence of any withdrawal or failure to perform by a consortium member;
  - XI. No consortium member shall hold less than 25% stake in a consortium;
  - XII. Entities which are affiliates of one another are allowed to bid either as a sole bidder or as a consortium only;
  - XIII. Any person or entity can bid either singly or as a member of only one consortium.
- d. In case the bidder is an Indian arm (subsidiary, authorized agent, branch office or affiliate) of a foreign bidder, then the foreign bidder shall have to full fill each eligibility criteria. If such foreign company desires that the contract be entered into with the Indian arm, then a proper back to back continuing (parent company) guarantee shall be provided by the foreign company clearly stating that in case of any failure of any supply or performance of the equipment, machinery, material or plant or completion of the work in all respects and as per the warranties/ guarantees that may have been given, then the foreign company shall assume all obligations under the contract. Towards this purpose, it shall provide such comfort



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letter/guarantees as may be required by Owner. The guarantees shall cover inter alia the commitment of the foreign company to complete the entire work in all respects and in a timely fashion, being bound by all the obligations under the contract, an undertaking to provide all necessary technical and financial support to the Indian arm or to render the same themselves so as to ensure completion of the contract when awarded, an undertaking not to withdraw from the contract till completion of the work, etc.



## CHAPTER 4: PERFORMANCE OF WORK

### 1. EXECUTION OF WORKS:

- a. All the works shall be executed in strict conformity with the provisions of the contract documents and with such explanatory detailed drawings, specifications, and instructions as may be furnished from time to time to the contractor by the Engineer-in-Charge whether mentioned in the contract or not. The contractor shall be responsible for ensuring that works throughout are executed in the most substantial, proper and workman like manner with the quality of material and workmanship in strict accordance with the specifications following all safety requirements of DAFFPL and as stipulated in work permits as per the directions and to the entire satisfaction of the Engineer-in-Charge.
- b. Wherever it is mentioned in the specifications that the Contractor shall perform certain work or provide certain facilities/materials, it is understood that the contractor shall do, so at his cost unless otherwise specified.
- c. The materials, design and workmanship shall satisfy the relevant Indian Standards, the Job specification contained herein and codes referred to. Where the job specification stipulate requirements in addition to those contained in the standards codes and specifications, these additional requirements shall also be satisfied.

### 2. COORDINATION AND INSPECTION OF WORK:

The coordination and inspection of the day-to-day work under the contract shall be the responsibility of the Engineer-in-Charge. The written instructions regarding any particular job will be normally be passed by the Engineer-in-Charge or his authorized representative. A work order book / logbook will be maintained by the Contractor for each job in which the aforesaid written instructions will be entered. These will be signed by the contractor or his authorized representative by way of acknowledgment within 12 hours. The non-maintaining of the order book or non-signing by the contractor shall not preclude the contractor from complying with the instructions.

### 3. WORK IN MONSOON AND DEWATERING:

- a. The completion of the work may entail working in the monsoon also. The contractor must maintain a minimum labour force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered for such work in monsoon.
- b. During monsoon and other period, it shall be the responsibility of the contractor to keep the construction work site free from water at his own cost.



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### **4. WORK ON SUNDAYS AND HOLIDAYS:**

For carrying out work on Sundays and Holidays if needed, the contractor will approach the Engineer-in-Charge or his representative at least two days in advance and obtain permission in writing. No special compensation on this account will be payable.

### **5. DRAWINGS TO BE SUPPLIED BY THE OWNER:**

- a. Where drawings are attached with tender, these shall be for the general guidance of the contractor to enable him to visualize the type of work contemplated and scope of work involved. The contractor will be deemed to have studied the drawings and formed an idea about the work involved.
- b. Detailed working drawings on the basis of which actual execution of the work is to proceed will be furnished from time to time during the progress of the work. The contractor shall be deemed to have gone through the drawings supplied to him thoroughly and carefully and in conjunction with all other connected drawings and bring to the notice of the Engineer-in-Charge, discrepancies, if any, therein before actually carrying out the work.
- c. Copies of all detailed working drawings relating to the works shall be kept at the contractor's office of the site and shall be made available to the Engineer-in-Charge at any time during the contract. The drawings and other documents issued by the Owner shall be returned to the Owner on completion of the works.

### **6. SETTING OUT WORKS:**

- a. The Engineer-in-Charge shall furnish the contractor with only the four corners of the work site and a level bench mark and the contractor shall set out the works and shall provide efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.
- b. The contractor shall provide, fix and be responsible for the maintenance of all stacks, templates, level marks, profiles and other similar things and shall take all necessary precaution to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the contractor. The work shall be set out to the satisfaction of the Engineer-in-Charge. The approval thereof or joining in setting out the work shall not relieve the contractor of any of his responsibilities.
- c. Before beginning the works, the contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboos, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme, for bearing marks acceptable to the Engineer-in-Charge. The centre, longitudinal or face lines and cross lines shall be marked by means of



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small masonry pillars. Each pillar shall have distinct marks at the centre to enable theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-Charge in writing but such approval shall not relieve the contractor of any of his responsibilities. The contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction.

- d. Pillars bearing geodetic marks located at the site of work under construction should be protected and fenced by the contractor.
- e. On completion of works, the contractor must submit the geodetic documents according to which the work was carried out.

### **7. RESPONSIBILITY FOR LEVEL AND ALIGNMENT:**

The contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectually any errors or imperfections therein. Such rectifications shall be carried out by the contractor, at his own cost, when instructions are issued to that effect by the Engineer-in-Charge.

### **8. MATERIALS TO BE SUPPLIED BY CONTRACTOR:**

- a. The contractor shall procure and provide the whole of the materials required for construction including tools, tackles, construction plant and equipment for the completion and maintenance of the works except the materials which will be issued by Owner and shall make his own arrangement for procuring such materials and for the transport thereof. The materials procured by the contractor shall be DAFFPL approved/specified quality.
- b. All materials procured should meet the specifications given in the tender document. The Engineer-in-Charge may, at his discretion, ask for samples and test certificates for any batch of any material procured. Before procuring, the contractor should get the approval of Engineer-in-Charge for any material to be used for the works.
- c. Manufacturer's certificate shall be submitted for all materials supplied by the contractor. If, however, in the opinion of the Engineer-in-Charge any tests are required to be conducted on the materials supplied by the contractor, these will be arranged by the contractor promptly at his own cost.

### **9. MATERIALS SUPPLIED BY OWNER:**

- a. If the specifications of the work provides for the use of any materials of special description to be supplied from the Owner's stores, price for such material to be charged therefore as herein after mentioned being so far as practicable for the convenience of the contractor but not so as in any way to control the meaning or effect of the contract. The contractor shall be bound to purchase and shall be supplied such materials as are from time to time required to be used by him for the purpose of the contract only. The sums due



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from the contractor for the value of the actual materials supplied by the Owner will be recovered from the running account bill on the basis of the actual consumption of materials in the work covered and for which the running account bill has been prepared. After the completion of the works, however, the contractor has to account for the full quantity of materials supplied to him as per relevant clauses in this document.

- b. The value of the materials as may be supplied to the contractor by the Owner will be debited to the contractor's account at the rates shown in the schedule of chargeable materials and if they are not entered in the schedule, they will be debited at cost price, which for the purpose of the contract shall include the cost of carriage and all other expenses whatsoever such as normal storage supervision charges which shall have been incurred in obtaining the same at the Owner's stores. All materials so supplied to the contractor shall remain the absolute property of the Owner and shall not be removed on any account from the site of the work, and shall be at all times open for inspection to the Engineer-in-Charge. Any such materials remaining unused at the time of completion or termination of the contract shall be returned to the Owner's stores or at a place as directed by the Engineer-in- Charge in perfectly good condition, at contractor's cost.

### **10. CONDITIONS FOR ISSUE OF MATERIALS:**

- a. Materials specified to be issued by the Owner will be supplied to the contractor by the Owner from his stores/location. It shall be the responsibility of the contractor to take delivery of the materials and arrange for its loading, transport and unloading at the site of work at his own cost. The materials shall be issued between the working hours and as per the rules of the Owner framed from time to time.
- b. The contractor shall bear all incidental charges for the storage and safe custody of materials at site after these have been issued to him.
- c. Materials specified to be issued by the Owner shall be issued in standard sizes as obtained from the manufacturer.
- d. The contractor shall construct suitable godown at the site of work for storing the materials safe against damage by rain, dampness, fire, theft etc. He shall also employ necessary watch and ward establishment for the purpose.
- e. It shall be duty of the contractor to inspect the material supplied to him at the time of taking delivery and satisfy himself that they are in good condition. After the materials have been delivered by the Owner, it shall be the responsibility of the contractor to keep them in good condition and if the materials are damaged or lost, at any time, they shall be repaired and/ or replaced by him at his own cost, according to the directions of the Engineer-in-Charge.
- f. The Owner shall not be liable for delay in supply or non-supply of any materials which the Owner has undertaken to supply where such failure or delay is due to natural calamities, act of enemies, transport and procurement





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difficulties and any circumstances beyond the control of the Owner. In no case, the contractor shall be entitled to claim any compensation or loss suffered by him on this account.

- g. It shall be the responsibility of the contractor to arrange in time all materials required for the works other than those to be supplied by the Owner. If, however, in the opinion of the Engineer-in-Charge the execution of the work is likely to be delayed due to the contractor's inability to make arrangements for supply of materials which normally he has to arrange for, the Engineer-in-Charge shall have the right, at his own discretion, to Issue such materials If available with the Owner or procure the materials from the market or elsewhere and the contractor will be bound to take such materials at the rates decided by the Engineer-in-Charge. This, however, does not in any way absolve the contractor from responsibility of making arrangements for the supply of such materials in part or in full, should such a situation occur, nor shall this, constitute a reason for the delay in the execution of the work.
- h. None of the materials supplied to the contractor will be utilized by the contractor for manufacturing item, which can be obtained from standard manufacturer in finished form.
- i. The contractor shall, if desired by the Engineer-in-Charge, be required to execute an indemnity bond for safe custody and accounting of all materials issued by the Owner.
- j. The contractor shall furnish to the Engineer-in-Charge sufficiently in advance a statement showing his requirements of the quantities of the materials to be supplied by the Owner and the time when the same will be required by him for the works, so as to enable the Engineer-in-Charge to make necessary arrangement for procurement and supply of the material.
- k. A daily account of the materials issued by the Owner shall be maintained by the contractor indicating the daily receipt, consumption and balance in hand. This account shall be maintained in a manner prescribed by the Engineer-in-Charge along with all connected papers viz. requisition, issues etc. and shall be always available for inspection in the contractor's office at site.
- l. The contractor should see that only the required quantities of materials are got issued. The contractor shall not be entitled to cartage and incidental charges for returning the surplus materials, if any, to the stores/location where from they were issued or to the place as directed by the Engineer-in-Charge.
- m. Materials/ Equipment supplied by Owner shall not be utilized for any other purpose(s) than issued for.

### **11. MATERIALS PROCURED WITH ASSISTANCE OF OWNER:**

Notwithstanding anything contained to the contrary in any or all the clause of this document where any materials for the execution of the contract are procured with the assistance of Owner either by issue from Owner's stock or purchase made under orders or permits or licences issued by Government, the contractor shall hold the



said materials as trustee for the Owner and use such materials economically and solely for the purpose of the contract and not dispose them off without the permission of the owner and return, if required by the Engineer-in-Charge, all surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason, whatsoever on his being paid or credited such prices as the Engineer in-Charge shall determine having due regard to the condition of the materials. The price allowed to the contractor however, shall not exceed the amount charged to him excluding the storage charges if any. The decision of the Engineer-in- Charge shall be final and conclusive in such matters. In the event of breach of the aforesaid condition, the contractor shall in terms of the licenses or permits, and/or for criminal breach of trust, be liable to compensate the Owner a double rate or high rate, in the event of those materials at that time having higher rate or not being available in the market, then any other rate to be determined by the Engineer-in-Charge and his decision shall be final and conclusive.

**12. MATERIALS OBTAINED FROM DISMANTLING:**

If the contractor in the course of execution of the work is called upon to dismantle any part, the materials obtained in the work of dismantling etc. will be considered as the Owner's property and will be disposed off to the best advantage of the Owner.

**13. ARTICLES OF VALUE FOUND:**

All gold, silver and other materials, of any description and all precious stones, coins, treasure relics, antiquities and other similar things which shall be found in, under or upon the site, shall be property of the Owner and the contractor shall duly preserve the same to the satisfaction of the Engineer-in-Charge and shall from time to time deliver the same to such person or person indicated by the Owner.

**14. DISCREPANCIES BETWEEN INSTRUCTIONS:**

Should any discrepancy occur between the various instructions furnished to the contractor, his agents or staff or any doubt, arise as to the meaning of any such instructions or should there be any misunderstanding between the contractor's staff and the Engineer-in-Charge's staff, the contractor shall refer the matter immediately in writing to the Engineer-in-Charge whose decision thereon shall be final and conclusive and no claim for losses alleged to have been caused by such discrepancies between instructions, or doubts, or misunderstanding shall in any event be admissible.

**15. ACTION WHERE NO SPECIFICATIONS ISSUED:**

In case of any class of work for which there is no such specification given by the Owner in the tender documents, such work shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same the work should be carried out as per standard Engineering Practice subject to the approval of the Engineer-in-Charge.



**16. INSPECTION OF WORK:**

- a. The Engineer-in-Charge will have full power and authority to inspect the works at any time wherever in progress either on the Site or at the contractor's premises / workshop where situated premises /workshops of any person, firm or corporation where work in connect with the contract may be in hand or where materials are being or are to be supplied, and the contractor shall afford or procure for the Engineer-in-Charge every facility and assistance to carry out such Inspection. The contractor shall at all time during the usual working hours and at all other time for which reasonable notice of the intention of the Engineer in-Charge or his representative to visit the works have been given to the contractor, either himself be present to receive order and instructions or post a responsible agent duly accredited in writing for the 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. The contractor shall give not less than seven days, notice in writing to the Engineer-in-Charge before covering up or placing any work beyond reach of inspection and measurement any work in order that the same may be inspected and measured. In the event of breach of above the same shall be uncovered at contractor's expense carrying out such measurement or inspection.
- b. No materials shall be dispatched by the contractor before obtaining the approval of Engineer-in-Charge in writing. The contractor is to provide at all times during the progress of the work and the maintenance period, proper means of access with ladders, gangways, etc. and the necessary attendance to move and adopt as directed for inspection or measurement of the works by the Engine in-Charge.

**17. ASSISTANCE TO THE ENGINEERS:**

The contractor shall make available to the Engineer-in-Charge, free of cost necessary instruments and assistance in checking of setting out of works and taking measurement of work.

**18. TESTS FOR QUALITY OF WORKS:**

- a. All workmanship shall be of the respective kinds described in the contract documents and in accordance with the instructions of the Engineer-in-Charge and shall be subjected from time to time to such test at contractor's cost as the Engineer-in-Charge may direct at place of manufacture or fabrication or on the site or at all or any such places. The contractor shall provide assistance, instruments, labour and materials as are normally required for examining, measuring and testing any workmanship as may be selected and required the Engineer-in-Charge.
- b. All the tests necessary in connection with the execution of the work as decided by Engineer-in-Charge shall be carried out at the field testing laboratory of the Owner by paying the charges as decided by the Owner from



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time to time. In case of non-availability of test facility with the Owner, the required test shall be carried out at the cost of contractor at government or any other testing laboratory as directed by Engineer-in-Charge.

- c. If any tests are required to be carried out in connection with the work or materials workmanship not supplied by the contractor, such tests shall be carried out by the contractor as per the instructions of Engineer-in-Charge and cost of such tests shall be reimbursed by the Owner.

### **19. SAMPLES:**

The contractor shall furnish to the Engineer-in-Charge for approval when requested or if required by the specifications, adequate samples of all materials and finishes to be used in the work. Such samples shall be submitted before the work is commenced and in ample time to permit tests and examinations thereof. All materials furnished and finishing applied in actual work shall be fully identical to the approval samples.

### **20. ACTION AND COMPENSATION IN CASE OF BAD WORK:**

If it shall appear to the Engineer-in-Charge that any work has been executed with unsound, imperfect or unskilled workmanship or with materials of any inferior description, or that any materials or articles provided by the contractor for the execution of the work are unsound or of a quality inferior to that contracted for, or otherwise not in accordance with the contract, the contractor shall on demand in writing from the Engineer-in-Charge or his authorized representative, specifying the work, materials or articles complained of, notwithstanding that the same have been inadvertently passed, certified and paid for forthwith shall rectify or remove and reconstruct the works specified and provide other proper and suitable materials or articles at his own charge and cost, and in the event of failure to do so within a period to be specified by the Engineer-in-Charge in his demand aforesaid, the contractor shall be liable to pay compensation at the rate of 0.5% of the estimated cost of the whole work, for every week limited to a maximum of 10% of the estimated cost of the whole work, while his failure to do so shall continue and in the case of any such failure the Engineer-in-Charge may on expiry of notice period rectify or remove and re-execute the work or remove and replace with others, the materials or articles complained of as the case may be at the risk and expenses of the contractors in all respects. The decision of the Engineer-in-Charge as to any question arising under this clause shall be final and conclusive.

### **21. SUSPENSION OF WORKS:**

The contractor shall, if ordered in writing by the Engineer-in-Charge or his representative, temporarily suspend the works or any part thereof for such period and such time as so ordered and shall not, after receiving such written order, proceed with the work therein ordered to be suspended, until he shall have received a written order to proceed therewith. The contractor shall not be entitled to claim/compensation for any loss or damage sustained by him by reason of temporary suspension of the works aforesaid. An extension of time for completion,



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corresponding with the delay caused by any such suspension of the works as aforesaid will be granted to the contractor, should he apply for the same, provided that suspension was not consequent to any default or failure on the part of the contractor.

### **22. OWNER MAY DO PART OF WORK:**

Upon failure of the contractor to comply with any instructions given in accordance with the provisions of the contract, the owner has the alternative right, instead of assuming charge for entire work to place additional labour force, tools, equipments and materials on such parts of the work, as the owner may designate or also engage another contractor to carry out the work. In such cases, the owner shall deduct from the amount which otherwise might become due to the contractor, the cost of such work and materials with ten percent added to cover all departmental charges and should the total amount thereof exceed the amount due to the contractor, the contractor shall pay the difference to the owner.

### **23. POSSESSION PRIOR TO COMPLETION:**

The Engineer-in-Charge shall have the right to take possession of or use any completed or partially completed work or part of the work. Such possessions or use shall not be deemed to be an acceptance of any work completed in accordance with the contract agreement. If such prior possession or use by the Engineer-in-Charge delays the progress of work, suitable adjustment in the time of completion will made and contract agreement shall be deemed to be modified accordingly.

### **24. PERIOD OF LIABILITY FROM THE DATE OF COMPLETION OF WORK:**

- a. The contractor shall guarantee the installation/site work for a period of 12 (twelve) Months from the date of completion of work, unless otherwise specified. Any damage that may lie undiscovered at the time of issue of completion certificate, connected in any way with the equipment or materials supplied by him or in the workmanship shall be rectified or replaced by the contractor at his own expense as deemed necessary by the Engineer-in-Charge or in default, the Engineer-in-Charge may cause the same made good by other workmen and deduct expenses (for which the certificate of Engineer-in-Charge shall be final) from any sums that may be then or at any time thereafter, become due to the contractor or from his security deposit.
- b. If the contractor feels that any variation in work or in quality of materials or proportions would be beneficial or necessary to fulfill the guarantee called for, he shall bring this to the notice of the Engineer-in-Charge in writing. The work will not be considered as complete and taken over by the Owner until all the temporary works etc., constructed by the contractor is removed and work site cleaned to the satisfaction of Engineer-in-Charge.
- c. Care of Works:  
From the commencement to completion of works, the contractor shall take full responsibility for the care of all works including all temporary works, and



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in case any damage, loss or injury happens to the works or to any part thereof or to any temporary work, from any cause whatsoever, he shall at own cost repair and make good the same, so that at completion, the work shall be in good order and in conformity in every respect with the requirements of the contract and the Engineer-in-Charge's instructions.

- d. Effects prior to taking over: If at any time, before the work is taken over, the Engineer-in-Charge shall
- Decide that any work done or materials used by the contractor or any sub-contractor is defective or not in accordance with the contract or that the works or any portion thereof are defective or do not fulfill the requirements of contract (all such matters being herein after called 'Defects' in this clause) and
  - As soon as reasonably practicable, notice given to the contractor in writing of the said decisions specifying particulars of the defects alleged to exist or to have occurred, then the contractor shall at his own expenses and with all speed make good the defects so specified. In the case contractor shall fail to do so, the Owner may take, at the cost of the contractor, such steps as may in all circumstances, be reasonable to make good such defects. The expenditure, so incurred by the Owner shall be recovered from the amount due to the contractor. The decision of the Engineer-in-Charge with regard to the amount be recovered from the contractor will be final and binding on the contractor. As soon as the works have been completed in accordance with the contract and have passed the tests on completion, the Engineer-in-Charge shall issue a certificate (hereinafter called completion certificate) in which he shall certify the date on which the work have been so completed and have passed the said tests and the Owner shall be deemed to have taken over the works on the date so certified. If the works have been divided into various groups in the contract, the Owner shall be entitled to take over any group or groups before the other or others and thereupon the Engineer-in-Charge shall issue a completion certificate which will however, be for such group or groups as taken over only.
- e. Defects after taking over: In order that the contractor could obtain a completion certificate, he shall make good with all possible speed, any defect arising from the defective materials supplied by the Contractor or workmanship or any act of omission of the contract that may have been noticed or developed after the works or group of the works has been taken over. The period allowed for carrying out such work will be normally one month. If any defect be not remedied within a reasonable time, the Owner may proceed to do the work at the contractor's risk and expense and deduct from the final bill such amount as may be decided by the Owner. If by reason of any default on the part of the contractor a completion certificate has not been issued in respect of every portion of the work within one month after



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the date fixed by the contract for the completion of the works, the Owner shall be at his liberty to use the works or any portion thereof in respect of which a completion certificate has been issued provided that the works or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completing these works for the issue of completion certificate.

- f. The Security Deposit/retention money deducted / furnished shall be retained for the period of liability as given in clause above. This Retention amount or Bank Guarantee furnished against Security Deposit/retention money shall be released only on expiry of the period of liability and also based on the certification of the Engineer-in-charge that no defect/damage has been reported / observed during the stipulated period of liability for the contract.
- g. Performance of contractor shall be evaluated on each job by Engineer-in-Charge and recorded. Review of performance will be carried out at appropriate intervals by DAFFPL.



## CHAPTER 5: GENERAL TERMS & CONDITIONS:

### 1. Construction Program:

A detailed bar chart showing various activities shall be prepared by the tenderers. The work shall be executed strictly as per the agreed time schedule. The period of completion shall include, the time required for mobilization and testing as well as rectification, if any, testing & completion in all respects to the entire satisfaction of the consultant.

A joint programme of execution programme shall be prepared by the contractor.

Monthly / weekly construction programme shall be made by the contractor. The contractor shall scrupulously adhere to these targets / programme by deploying adequate personal and construction tools and tackles. He shall also supply all materials in his scope of supply in time to achieve the targets set out in the weekly and the monthly programme.

The contractor shall give every day, a report on labour and equipment deployed along with the progress of the work done on previous day, for each category of work.

The contractor, immediately on award of work shall submit details of his key personnel to be engaged for the work at site. In addition, he shall furnish the Engineer-in-charge detailed organogram involved with the work.

### 2. Construction Water and Power: Bidder to make their own arrangements.

### 3. Safety Rules and Regulations:

All Safety rules and regulations of the terminal operator must be followed by the contractor without fail. If any damage occurs due to negligence of safety, contractor will be held responsible for the same.

### 4. Tests and Inspection:

The contractor shall carry out the various tests as enumerated in the technical specifications of this tender document and the technical documents that will be furnished to him during the performance of the work. No separate payment shall be made.

The contractor shall carry out at his cost, all the tests either on the field or through external institutions / laboratories, concerning the execution of the work and supply of materials by the contractor.

Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at this own





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cost. Results of all inspection & tests shall be recorded in the inspection reports, test reports, etc., which will be approved by the Engineer-in-charge. These reports shall form part of the completion documents.

Inspection & Acceptance of works shall not relieve the contractor from any of his responsibilities under this contract.

**5. Site Cleaning:**

The contractor shall take care to clean the working site from time to time for easy access to work site and for safety. Working site should be always kept cleared to the entire satisfaction of DAFFPL.

Before handing over any work to the owner, the contractor in addition to other formalities to be observed as detailed in the document shall clear the site to the entire satisfaction of DAFFPL.

**6. Coordination with other Agencies:**

Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the contractor. Proper coordination with other agencies will be the responsibility of the contractor. In case of any dispute, the decision of Engineer-in-charge shall be final and binding on the contractor.

**7. Bidder to note that Special Packaging Requirement as in technical specifications of this tender. The materials should be properly packed so as to withstand all transit hazards (both ocean & inland transit).**

**8. TAXES & DUTIES:**

- a) It is for the Bidder to assess and ascertain the rates of applicable taxes on quoted items. It is clearly understood that Owner will not have any additional liability towards payment on Bidders wrong assessment / interpretation of applicability of such taxes.
- b) The statutory variation in applicable taxes and introduction of new tax, from bid due date till the contractual completion period shall be to owner account against submission of the documentary evidence. However, any increase in the rate of these taxes and duties beyond the contractual delivery period shall be to Seller account. Any decrease in the rate of these taxes and duties shall be passed on to the owner.
- c) Successful bidder shall carry out its obligations towards services at site as mentioned in technical specifications without any extra charges.
- d) Octroi/Entry tax, if any, in the any state of India shall be directly paid by the vendor, if applicable.
- e) DAFFPL shall not be liable, in case the tax authorities assess the tax elements in a different way on account of any reason, whatsoever.



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- f) Taxes and duties other than those specified in this document, if any, shall be included in the quoted prices and no separate reimbursement shall be made by DAFFPL.

### 9. Income Tax / Corporate Tax :

- a) As regards Income Tax, Surcharge on Income Tax or any other Corporate Tax payable by the Bidder for reason of the contract awarded, and / or on their expatriate personal, the Owner shall not bear any Tax liability whatsoever, irrespective of the mode of construction of contract / order. The Bidder shall be liable and responsible for payment of such tax, if attracted under the provision of Indian Income Tax Act.
- b) Bidder may note that if any tax is deductible at source as per Indian Income Tax Law, the same will be so deducted before releasing any payment to the Bidder and a TDS (Tax deducted at source) certificate will be furnished to the Bidder.
- c) Accordingly, Bidder shall have the responsibility to check and include such provision of taxes in the prices.
- d) In case of delay in delivery due to reasons attributable to Bidder, any new or additional taxes or duties levied by Statutory authorities during this period shall be borne by the Bidder.

### 10. EMD / BID SECURITY

- a) The bidder shall furnish, as part of his bid, a bid security in original for the amount specified in the tender document by way of pay order, bank guarantee on Rs.100/-value non-judicial stamp paper or demand draft.
- b) The bid security is required to protect the Owner against the risk of Bidders conduct, which would warrant the security forfeiture.
- c) If bid Security / EMD is in the form of bank guarantee, it shall be in the form of irrevocable bank guarantee (in the format attached) issued by any Indian Scheduled Bank (other than Co-operative Bank) will be accepted.
- d) Bid Security / EMD shall be issued in favour of M/s Delhi Aviation Fuel Facility (P) Limited, New Delhi. .
- e) Unsuccessful bidders bid security without any interest will be discharged/ returned as promptly as possible, but not later than 60 days after the expiry of the period of bid validity prescribed by the Owner.
- f) The successful bidder bid security without any interest will be discharged, upon the Bidder accepting the Contract/ Purchase Order and furnishing the Contract performance bank guarantee to DAFFPL.
- g) The bid security may be forfeited:
- i. If a bidder withdraws his bid during the period of bid validity or
  - ii. In the case of a successful bidder, if the bidder fails or refuses to:
    - Accept the Purchase Order in accordance with agreed terms and conditions.
    - Furnish Contract performance bank guarantee as per bid



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document/ Purchase Order.

- iii. Detection of submission of false / forged documents and fraud.
- h) Bid Security / EMD should be in favour of “Delhi Aviation Fuel Facility Private Limited”, payable at New Delhi and submitted to the relevant office of DAFFPL as mentioned in covering note of the tender document. Covering letter to bid Security / EMD must indicate the tender number. This is essential to have proper co-relation at a later date. The bid security / EMD shall be strictly in the form provided in the bid document before the due date & time of bid submission.
- i) Central Public Sector Undertaking of Govt. Of India are exempted from furnishing the bid security. Firms registered with NSIC/ MSME are also exempted from furnishing bid security, provided they are registered for the tendered items and up to the monetary limit they intend to quote. Provided further that they submit a copy of the current and valid registration certificate for the quoted item and monetary value along with their bid(s). Owner reserves right to verify the registration certificate provided, with relevant authorities.

### 11. CONTRACT PERFORMANCE BANK GUARANTEE [CPBG]

- a) As a Performance security, the successful Bidder, to whom the work is awarded by, shall be required to furnish within 30 days of notification of award of contract (Letter/ Fax/e-mail of Intent) a Performance Bank Guarantee on RS.100/- VALUE non-judicial stamp paper in favour of the Owner (M/S DAFFPL).
- b) The Bank Guarantee amount shall be equal to TEN PERCENT (10%) of the Total Order Value and it shall guarantee the faithful performance of the Order in accordance with the Terms and conditions specified in the documents and specifications.
- c) CPBG shall be in the form of an irrevocable Bank Guarantee (in the format attached) issued by any Indian Scheduled Bank (other than Co-operative Bank).
- d) The Bank Guarantee shall be valid for the entire period of the Contract, namely, till the end of the guarantee / warranty period. The guarantee amount shall be payable on demand to the Owner.
- e) In case, the Contract Performance Bank Guarantee stated above gets reduced/ deducted for reasons of non-fulfillment of any Contractual obligations upto the completion of guarantee period, the bidder shall immediately take action to increase the value of Bank Guarantee to TEN PERCENT (10%) of the Contract price, to cover his guarantee/warranty obligations.
- f) The Performance Guarantee will be returned to the bidder without any interest at the end of the warranty / guarantee period subject to fulfillment of all contractual obligations by the Bidder. The bank guarantee shall have a



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claim period of 3 months beyond the contractual guarantee period.

- g) The proceeds of performance security shall be appropriated by the owner as compensation for any loss resulting from vendor's failure to complete his obligations under the contract to the prejudice to any of the rights or remedies the owner may be entitled to as per terms and conditions of contract. The proceeds of this performance security shall also govern the successful performance of goods and services and vendors all obligations during the entire period of contractual warrantee / guarantee.

### 12. PRICE REDUCTION FOR DELAY IN DELIVERY:

- a) The inability of successful bidder to execute orders in accordance with the agreed completion schedule will entitle DAFFPL, at its options, to:
- b) Accept delayed delivery at prices reduced by a sum equivalent to half percent (0.5%) of the value of any goods/work not delivered for every week of delay or part thereof, limited to a maximum of 5% of the total order value. Date of completion of work shall be considered for calculation of price reduction
- c) The price reduction clause shall become applicable for works done beyond the schedule completion period.

### 13. INSURANCE

Supplier shall carry and maintain any and all statutory insurance(s) required under Indian Laws and Regulations, including Workmen compensation Act/ESI/Third party liabilities etc. and insurances for their personnel engaged in performance of the work at their own cost.

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 Client or Client appointed representative **all Risk Insurance Policy for an amount equivalent to the 1.1 times of contract value for this work, with Client as the first beneficiary.** The insurance shall be obtained in joint names of Chief Executive Officer, DAFFPL and the Contractor (who shall be second beneficiary).

Also, he shall indemnify the Company from any liability during the execution of the work. Further, **he shall obtain and submit to the Chief Executive Officer, DAFFPL, a third-party insurance policy for maximum Rs.10 lacs for each accident, with the Engineer-in-Charge as the first beneficiary.** The insurance shall be obtained in joint names of Engineer-in-Charge and the Contractor (who shall be second beneficiary). The Contractor shall, from time to time, provide documentary evidence as regards payment of premium for all the Insurance Policies for keeping them taken by his Sub-Contractors / specialized agencies. The Contractor shall however be responsible, to the Department, for any claim or loss resulting from the failure of his Sub Contractors / specialized agencies in obtaining



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such Insurance Policies. 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 Department giving details of the Insurance Policies along with Certificate of these insurance policies being valid, along with documentary evidences as required by the Engineer-in-Charge. 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.

## 14. PAYMENT TERMS:

- All the payments due to the bidder shall be made online and no Cheques / draft shall be issued
- In case Mobilization Advance (05% of Contract Value) is paid to the successful bidder, it shall be permissible for the bidder to furnish Bank Guarantee to cover Mobilization Advance, which shall be subject to the following conditions:
  - Bank Guarantee will be for a value equivalent to 05% (five percent) of the Total Contract Value and shall be kept valid till recovery of complete advance payment.
  - Recoveries will be effected from each Running Account Bill at the rate of 10% (ten percent) of the gross bill value, till the entire Mobilization Advance is fully recovered
- The contractor on submitting the bill thereof be entitled to receive payment approved and passed by the Engineer-in-Charge, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor. This payment will be made after making necessary deductions as stipulated elsewhere in the contract document for materials, security deposit or any moneys due to the Owner etc.

## STANDARD PAYMENT TERMS FOR WORKS CONTRACTS

S.No	Type of Work	Payment (%)
1	Foundation & 1 <sup>st</sup> Slab	20%
2	2 <sup>nd</sup> Slab & 3 <sup>rd</sup> Slab, Stilt (Ground Floor) Block work & 1 <sup>st</sup> Floor Block work	20%



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3	4 <sup>th</sup> Slab & 2 <sup>nd</sup> Floor Block work & 3 <sup>rd</sup> Floor Block work, Firefighting, Line Plumbing, Electrical Conduiting & Wiring, Façade work	20%
4	HVAC, Flooring, Interior Partitions, Wall/ Ceiling Finishes, Furniture, Fixtures/Fittings	20%
5	After final Completion of project & clearance of all snags	20%
<b>Note: Deduction of 10% will be done in every running bill against DLP if contractor fails to submit Performance Guarantee.</b>		

15. Only in the event of causes of Force Majeure occurring within the contractual delivery period and if they impede the performance of contract, the delivery dates shall be extended on receipt of application from the bidder / Owner without imposition of penalty. Only those causes which depend on natural calamities, civil wars, fire and national strikes which have duration of more than seven consecutive calendar days are considered the causes of force Majeure. The decision of Owner shall be final and binding on vendor.
16. The Vendor must advise the Owner by a registered letter duly certified by Local Chamber of Commerce or statutory authorities and Owner must advise the Vendor by a letter, the beginning and the end of the delay immediately, but in no case later than within 10 days of the beginning and end of such causes of Force Majeure condition as defined above. Provided further that if the performance in whole or part of any obligation under this contract is prevented or delayed by reason of any such event for period exceeding 60 days either party may at its option terminate the contract.
17. Any reference to the Govt. Acts /Regulations etc. in the Bid Document is only indicative, and it is entirely for the bidder to ascertain the applicable Acts/Regulations.
18. Rejected material lying in Owner premises must be replaced within 15 days from date of final report on rejection of material.
19. RECOVERY OF SUMS DUE: Whenever, any claim against bidder for payment of a sum of money arises out of or under the contract or in any other form, the owner shall be entitled to recover such sums from any sum then due or when at any time thereafter may become due from the vendor under this or any other form and should this sum be not sufficient to cover the recoverable amount of claim(s), the vendor shall pay to DAFFPL on demand the balance remaining due.
20. PATENTS & ROYALTIES: The vendor shall fully indemnify owner and users of materials specified herein/supplied at all times, against any action, claim or demand,



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costs and expenses, arising from or incurred by reasons of any infringement or alleged infringement of any patent, registered design, trademark or name, copy right or any other protected rights in respect of any materials supplied or any arrangement, system or method of using, fixing or working used by the vendor. In the event of any claim or demand being made or action sought against Owner in respect of any of the aforesaid matter, the vendor shall be notified thereof immediately and the vendor shall at his/its own expense with (if necessary) the assistance of Owner (whose all expense shall be reimbursed by the vendor) conduct all negotiations for the settlement of the same and/or litigation which may arise thereof.

21. **LIABILITY CLAUSE:** In case where it is necessary for employees or representatives of the Vendor to go upon the premises of owner, vendor agrees to assume the responsibility for the proper conduct of such employees/representatives while on said premises and to comply with all applicable Workmen s Compensation Law and other applicable Government Regulations and Ordinances and all plant rules and regulations particularly in regard to safety precautions and fire hazards. If this order requires vendor to furnish labour at site, such vendors workmen or employees shall under NO circumstances be deemed to be in owner s employment and vendor shall hold himself responsible for any claim or claims which they or their heirs, dependent or personal representatives, may have or make, for damages or compensation for anything done or committed to be done, in the course of carrying out the work covered by the purchase order, whether arising at owner s premises or elsewhere and agrees to indemnify the owner against any such claims, if made against the owner and all costs of proceedings, suit or actions which owner may incur or sustain in respect of the same.
22. **COMPLIANCE OF REGULATIONS:** Vendor warrants that all goods/Materials covered by this order have been produced, sold, dispatched, delivered and furnished in strict compliance with all applicable laws, regulations, labour agreement, working condition and technical codes and statutory requirements as applicable from time to time. The vendor shall ensure compliance with the above and shall indemnify owner against any actions, damages, costs and expenses of any failure to comply as aforesaid.
23. **REJECTION, REMOVAL OF REJECTED GOODS AND REPLACEMENT:** In case the testing and inspection at any stage by inspectors reveal that the equipment, materials and workmanship do not comply with specification and requirements, the same shall be removed by the vendor at his/its own expense and risk, within the time allowed by the owner. The owner shall be at liberty to dispose off such rejected goods in such manner as he may think appropriate. In the event the vendor fails to remove the rejected goods within the period as aforesaid, all expenses incurred by the owner for such disposal shall be to the account of the vendor. The freight paid by the owner, if any, on the inward journey of the rejected materials shall be reimbursed by the



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vendor to the owner before the rejected materials are removed by the vendor. The vendor will have to proceed with the replacement of the equipment or part of equipment without claiming any extra payment if so required by the owner. The time taken for replacement in such event will not be added to the contractual delivery period.

24. **NON-WAIVER** : Failure of the Owner to insist upon any of the terms or conditions incorporated in the Purchase Order or failure or delay to exercise any rights or remedies herein, or by law or failure to properly notify Vendor in the event of breach, or the acceptance of or payment of any goods hereunder or approval of design shall not release the Vendor and shall not be deemed a waiver of any right of the Owner to insist upon the strict performance thereof or of any of its or their rights or remedies as to any such goods regardless of when such goods are shipped, received or accepted nor shall any purported oral modification or revision of the order by DAFFPL act as waiver of the terms hereof. Any waiver to be effective must be in writing. Any lone incident of waiver of the any condition of this agreement by DAFFPL shall not be considered as a continuous waiver or waiver for other condition by DAFFPL.
25. **NEW & UNUSED MATERIAL**: All the material supplied by the vendor shall be branded new, unused and of recent manufacture.
26. **CANCELLATION**:
- a) DAFFPL reserves the right to cancel the contract/purchase order or any part thereof through a written notice to the vendor if –
    - i. The vendor fails to comply with the terms of this purchase order/contract.
    - ii. The vendor becomes bankrupt or goes into liquidation.
    - iii. The vendor fails to deliver the goods on time and/or replace the rejected goods promptly.
    - iv. The vendor makes a general assignment for the benefit of creditors.
    - v. A receiver is appointed for any of the property owned by the vendor.
    - vi. Any other conditions where owners commercial interest get affected.
  - b) Upon receipt of the said cancellation notice, the vendor shall discontinue all work on the purchase order matters connected with it. DAFFPL in that event will be entitled to procure the requirement in the open market and recover excess payment over the vendor s agreed price if any, from the vendor and also reserving to itself the right to forfeit the security deposit if any, made by the vendor against the contract. The vendor is aware that the said goods are required by DAFFPL for the ultimate purpose of materials production and that non-delivery may cause loss of production and consequently loss of profit to the DAFFPL. In this-event of DAFFPL exercising the option to claim damages for non delivery other than by way of difference between the market price and the contract price, the vendor shall pay to DAFFPL, fair compensation to be agreed upon between DAFFPL and the vendor. The provision of this clause shall not





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prejudice the right of DAFFPL from invoking the provisions of price reduction clause mentioned aforesaid.

27. **ANTI –COMPETITIVE AGREEMENTS/ABUSE OF DOMINANT POSITION** : The Competition Act, 2002 as amended by the Competition (Amendment) Act, 2007 (the Act), prohibits anti- competitive laws and aims at fostering competition and at protecting Indian markets against anti- competitive practices by enterprises. The Act prohibits anti- competitive agreements, abuse of dominant position by enterprises, and regulates combinations (consisting of acquisition, acquiring of control and M&A) wherever such agreements, abuse or combination causes, or is likely to cause, appreciable adverse effect on competition in markets in India. DAFFPL reserves the right to approach the Competition Commission established under the Act of Parliament and file information relating to anti-competitive agreements and abuse of dominant position. If such a situation arises, then Vendors are bound by the decision of the Competitive Commission and also subject to penalty and other provisions of the Competition Act.
28. **ASSIGNMENT**: The Vendor can / does not have any right to assign his rights and obligations under these general purchase conditions without the prior written approval of DAFFPL.
29. **GOVERNING LAW**: These General Purchase Conditions shall be governed by the Laws of India.
30. **AMENDMENT**: Any amendment to these General Purchase Conditions can be made only in writing and with the mutual consent of the parties to these conditions.
31. The following expressions used in these terms and conditions and in the purchase order shall have the meaning indicated against each of these:
- OWNER**, Client, Purchaser, buyer : means DAFFPL
  - VENDOR**, tenderer, Bidder, Contractor, Seller, Supplier, manufacturer stated anywhere in the tender document carry the same meaning: It means the person, firm or the Company / Corporation to bidding and shall include its successors and assigns.
  - INSPECTOR/ TPIA**: Person/agency deputed by Owner for carrying out inspection, checking/testing of items ordered and for certifying the items conforming to the purchase order specifications..
  - GOODS / MATERIALS**: means any of the articles, materials, machinery, equipments, supplies, drawing, data and other property and all services including but not limited to design, delivery, installation, inspection, testing and commissioning specified or required to complete the order.
  - SITE / LOCATION**: means any Site where DAFFPL desires to receive materials anywhere in India as mentioned in tender
  - CONTRACT**, Order or Purchase Order/CALL-OFF means the agreement for



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supply of goods/ materials for required quantity between Owner and Vendor, for a fixed period of time on mutually agreed terms and conditions.

- g) The term MR means Material Requisition containing technical requirements and scope of work (technical), GPC means General Purchase Conditions containing commercial terms & conditions, PO means Purchase order issued after award of contract incorporating agreed deviations in MR, ATC means Agreed Terms & Conditions , RFQ means Request For Quotation.
- h) For the purpose of contract, the trade terms FOB, CFR and CIF, DAP shall have the meanings as assigned to them by INCOTERMS 2010 published by ICC, Paris.

### **32. REFERENCE FOR DOCUMENTATION:**

The number and date of Collective Request for Quotation (CRFQ) must appear on all correspondence before finalization of Contract / Purchase Order.

After finalization of Contract / Purchase Order: The number and date of Contract /Purchase Order must appear on all correspondence, drawings, invoices, dispatch advices, (including shipping documents if applicable) packing list and on any documents or papers connected with this order.

### **33. ARBITRATION**

- a) Any 'dispute or difference of any nature whatsoever, any claim, cross-claim, counterclaim or set off of the Owner against the Consultant or regarding any right, liability, act, omission or account of any of the parties hereto arising out of or in relation to this agreement shall be referred to the Sole Arbitration of the nominated Director of the Owner or of some Officer of the Owner who may be nominated by the nominated Director. The consultant will not be entitled to raise any objection to any such arbitrator on the ground that the arbitrator is an officer of the Owner or that he has dealt with the matters to which the contract relates or that in the course of his duties as an Officer of the Owner, he had expressed view on all or any other matters in dispute or difference. In the event of the arbitrator to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason, the nominated Director as aforesaid at the time of such transfer, vacation of office or inability to act may in the discretion of the nominated Director designate another person to act as arbitrator in accordance with the terms of the agreement to the end and intent that the original Arbitrator shall be entitled to continue the arbitration proceedings notwithstanding his transfer or vacation of office as an officer of the Owner if the nominated Director does not designate another person to act as arbitrator on such transfer, vacation of office or inability of original arbitrator. Such person shall be entitled to proceed with the reference from the point at which it was left



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by his predecessor. It is also a term of this contract that no person other than the nominated Director of the Owner or a person nominated by such nominated Director as aforesaid shall act as arbitrator hereunder. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to the agreement subject to the provisions of the Arbitration & Conciliation Act, 1996 or any statutory modification or reenactment thereof and the rules made there under for the time being in force shall apply to the arbitration proceedings under this clause.

- b) The arbitrator shall have power to order and direct either of the parties to abide by, observe and perform all such directions as the arbitrator may think fit having regard to the matters in difference i.e. dispute, before him. The arbitrator shall have all summary powers and may take such evidence oral and/or documentary, as the arbitrator in his absolute discretion thinks fit and shall be entitled to exercise all powers under the Indian Arbitration & Conciliation Act 1996 including admission of any affidavit as evidence concerning the matter in difference i.e. dispute before him.
- c) The parties against whom the arbitration proceedings have been initiated, that is to say, the Respondents in the proceeding, shall be entitled to prefer a cross claim, counter claim or set off before the Arbitrator in respect of any matter in issue arising out of or in relation to the Agreement without seeking a formal reference of arbitration to the nominated Director/officer for such counter-claim, or set off and the Arbitrator shall be entitled to consider and deal with the same as if the matters arising therefore has been referred to him originally and deemed to form part of the reference made by the nominated Director/officer.
- d) The arbitrator shall be at liberty to appoint, if necessary, any accountant or engineering or other technical person to assist him, and to act by the opinion so taken.
- e) The arbitrator shall have power to make one or more awards whether interim or otherwise in respect of the dispute and difference and will be entitled to make separate awards in respect of claims of cross claims of the parties.
- f) The arbitrator shall be entitled to direct any one of parties to pay the costs to the other party in such manner and to such extent as the arbitrator may in his discretion determine and shall also be entitled to require one or both the parties to deposit funds in such proportion to meet the arbitrators expenses whenever called upon to do so.
- g) The parties hereby agree that the courts in the city of Delhi alone shall have jurisdiction to entertain any application or other proceedings in respect of anything arising under this agreement and any award or awards made by the Sole Arbitration hereunder shall be filed (if so required) in the concerned courts in the city of Delhi only.



**BRIEF PARTICULARS OF THE WORK**

The brief scope of work shall generally comprise of but not be limited to the following:

1. Site will be handed over as where it is basis and complete clearing of Site including shifting of material and debris.
2. Proper temporary barricading by fencing with Powder coated G.I. sheets, shall be carried out by the Contractor at the start of work to physically define the boundaries of the plot for restricted entry to only those involved in the work and also to prevent any accidents, at the same time without causing any inconvenience to the traffic and the users of the buildings in the adjacent plots. It shall be done by providing, erecting, maintaining temporary protective barricading of minimum 12.0 metres in height, made in panels, with each panel having MS frames / MS hollow sections of suitable size and stiffness, with thick GI corrugated sheet or suitably stiffened plain GI sheet fixed on frames. Such panels shall be suitably connected to each other for stability with nuts and bolts, hooks, clamps etc. and fixed firmly to the ground as shown in the drawings, for the entire duration till completion of the work.
3. Name Boards for safety and site development display.
4. Excavation and Topsoil preservation.
5. Shallow/Strip/Raft Foundation.
6. Anti-termite Treatment.
7. PCC and soiling.
8. Backfilling and Compaction.
9. RCC Substructure and Superstructure including staircase.
10. Plinth beam and plinth area construction.
11. Masonry in AAC Blocks.
12. Internal and External plaster.
13. Water supply including water meters, sewage disposal system, plumbing fittings and sanitary fixtures.
14. Waterproofing of toilets, terrace, chajjas, balconies, refuge area, and other sunk areas etc.
15. Flooring, Toilets and kitchen/Pantry tiling.
16. Anodized Aluminum Doors, Anodized Aluminum windows/glazing, ventilators including locks and associated accessories.
17. Storm water drainage. (to be connected to existing drainage system in facility)
18. Rainwater harvesting.
19. Internal and external painting.
20. Electrical Conduiting, Wiring, switchboards, Electrical Fittings & fixtures.



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21. Firefighting wet riser, sprinkler, smoke detection system, Fire extinguishers, exit signage, Sand Buckets etc. as per Fire department NOC.
22. HVAC VRV system and Ducting etc.
23. Lifts with Machine room as per local municipality (NMC) norms.
24. Roof top grid connected solar panel system. (Provisions to be made for connections)
25. Overhead tanks including fire water tanks with associated plumbing works. Tap-off point provided by DAFFPL existing facility infrastructure.
26. Telephone, DTH Cabling, PA, CCTV, Access control and data cabling works
27. Fire Fighting & Water Supply. Tap-off point provided by DAFFPL existing facility infrastructure.
28. Meter room, feeder pillar, main cabling, Earth pits, and Lightning arrester etc.
29. Stilt lighting, External lighting and electrical works.
30. MS works for duct areas and external part elevation
31. Gypsum Partition, Sliding folding partitions, SS Hardware fittings & fixtures, Acoustical wall paneling, etc.
32. Modular & loose furniture including workstations, storages, tables, chairs, sofas etc. including preparation of shop drawing & its approval from the Engineer-in-Charge.
33. Site office, site laboratory, temporary storeroom, Construction Machineries, first aid box, safety material, sanitary facilities for labor, temporary lighting for site area while executing works, water supply arrangements.
34. Obtaining all statutory NOC/approvals as applicable in the Delhi State.

Above items are only indicative and for guidance & brief description of jobs but should not be considered limited to this list. Tenderer should refer to the detailed tender documents, technical specifications and drawings for detailed items and scope of work included in this project. Any discrepancy in the above shall be brought to the notice of DAFFPL in the pre-bid meeting.

Defects liability period shall be 1 (one year) from the date of competition of the work certified by Engineer-in-Charge.

### **Other Terms and Conditions**

- All ancillary and incidental facilities required for execution of the work i.e. labor camps, stores, offices for contractors, work shop facilities, watch and ward, temporary structure for plants and machinery, well equipped site laboratory as mentioned in the tender document, water storage structure, tube wells, electric /telephone installation and charges, liaison work, protection work during execution and not included in the main items, any other item /activity contained elsewhere in



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the tender documents which is necessary for execution of work in the opinion of the Chief Executive Officer, DAFFPL.

- During construction/Upgradation of drains necessary arrangements for diverting the water by means of bypassing the drains for maintaining undisturbed flow, pumping out water in bypass drain and any other arrangement required at site for free flow of drain water shall be made by the contractor and nothing shall be payable on this account.
- In case of flooding of site on account of rain or any other cause, or any other damage whatsoever, no claim financially or otherwise shall be entertained, notwithstanding any other provisions elsewhere in the tender documents.
- The contractor shall submit a detailed program for execution of work showing activities distinctly along with Bar-Chart/ PERT within one weeks from the date of award of work. The contractor shall submit monthly progress report along with bar chart indicating status of work. The contractor shall also submit monthly Program in advance indicating resources to be deployed like material, labour, T&P etc.
- If required, the contractor shall have to work during nights also. He shall make the necessary arrangements for lights etc. for nights or even if lights are required in day due to any other reason. Nothing extra shall be paid on this account. The rates shall include the above elements.
- The Contractor shall make necessary arrangements for medical aid to all his workers including availability of first aid box all the time at the site of work.
- Cement bags shall be stored in two separate godowns, one for tested cement and the other for fresh cement (under testing). These godowns shall be constructed by the contractor at his own cost. The actual size of godown shall be as per site requirements and nothing extra shall be paid for the same. The decision of the Client or Client appointed representative regarding the capacity needed will be final. The account of daily receipt and issue of cement shall be maintained in a register in the prescribed Performa and signed daily by the contractor or his authorized agent in token of its correctness.
- Material shall be kept in joint custody of the contractor and the representative of the Chief Executive Officer, DAFFPL. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Chief Executive Officer, DAFFPL.
- The area shall be kept dry when the work is in progress even below water table. Nothing extra shall be paid for bailing out water due to sub-soil condition, rains, spring etc.



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- Proper labour hutments with all the required civic amenities shall be constructed by the contractor at site of work.
- Material received from the site after dismantling and demolishing the existing structures shall be stacked and measured properly in the presence of the Site Engineer.
- The contractor shall also provide and erect temporary protective barricades within the plot, if required, to prevent any accident. Temporary protective roofing near the Entrance to the building, under construction, shall be made to protect the visiting officials from getting hurt by falling debris etc. Also, one or more coat of enamel paint of shade as approved and directed by the Engineer-in-Charge shall be applied on the panels and Warning signs shall be painted over that in suitable sizes, shapes and numbers as directed by the Engineer-in-Charge. It shall be dismantled and taken away by the Contractor after the completion of work at his own cost with the approval of the Engineer-in- Charge. Nothing extra shall be payable on this account.
- **PREVENTION OF NUISANCE AND POLLUTION CONTROL:**  
The Contractor shall take all precautions to abide by the environmental related restrictions imposed by any statutory body having jurisdiction in Delhi. 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 during 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 Engineer-in-Charge, 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 Engineer-in-Charge and disposed at designated places only

The contractor shall follow the guidelines of Statutory government offices such as Pollution Control Board, National Green Tribunal and all other concerned government departments and statutory bodies.

Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the nearby occupants/users of building(s), if any.



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- **SECURITY AND TRAFFIC ARRANGEMENTS**

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 labor/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.

- **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. The contractor shall prepare detailed drawing for all temporary works like scaffolding, centering and shuttering and get it vetted from the third party consultant approved by the Engineer-In-Charge Nothing extra shall be paid on this account.



## **TECHINICAL SPECIFICATIONS – CIVIL & INTERIOR**

### **1.0 GENERAL**

1.1 The mode of measurement shall be as per the details mentioned in this Annexure. The mode of measurement shall be as mentioned in relevant standard specification incorporated in the Bidding Document. Any other mode of measurements not covered in above specifications shall be followed in accordance with relevant BIS codes /Schedule of Rates/Specifications etc. and/or as decided by Engineer-in-Charge. Only the relevant mode(s) of measurement as detailed in this Section shall be applicable for the items covered in the scope of work / Schedule of Rates of the Bidding Document.

1.2 In case of discrepancy between measurement of work specified in this Annexure, Standard Specification/ Job Specification, Schedule of Price/Rates etc., precedence shall be given in following order:

- a) Measurement of works as per this Annexure of SCC.
- b) Measurement of works as mentioned in Standard Specification / Job Specification.
- c) Measurement of works in accordance with item description of relevant item mentioned in Schedule of Rates.

1.3 In case the clarity is not in the above documents, then it shall be as per CPWD specifications and manuals and relevant BIS/IS standards. Where ever the mode of measurement is not covered by the foregoing; BIS codes are to be referred and if it does not exist in BIS also, then Measurement of works shall be as decided by Engineer-in-Charge. Also refer clause 6.1.0.0 of GCC in this regard.

1.4 The measurements of works are to be recorded by the Engineer of the Contractor and to be checked by the Owner on submission by the contractor. No overwriting, white fluid or cutting in the MB will be acceptable.

1.5 Payment will be made on the basis of measurements jointly checked and certified by Engineer-in-Charge. Measurement shall be based on "Approved for Construction" drawings, to the extent that the work conforms to the drawings and details are adequate.

1.6 Wherever work is executed based on instructions of Engineer-in-Charge or details are not adequate in the drawings, Contractor shall take physical measurements in the presence of Engineer-in-Charge.

1.7 Wherever the unit of items has been indicated as lumpsum, the payment shall be made on lumpsum basis on completion & no mode of measurement shall be applicable.

1.8 Measurements of weights shall be in metric tonnes corrected to the nearest Kilogram. Linear measurements shall be in meters corrected to the nearest centimetres.

1.9 The weights mentioned in the drawing or shipping list shall be the basis for payment. If mountings for panels etc. are packed separately, their erection weights shall include all mountings.

1.10 No other payment either for temporary works connected with this Contract or for any other item such as weld, shims, packing plates etc. shall be made. Such items shall be deemed to have been included for in the rates quoted.

1.11 Measurements will be made for various items under schedule of rates on the following basis as indicated in the unit column

- |      |         |           |
|------|---------|-----------|
| i.   | Weights | MT or Kg  |
| ii.  | Length  | M (Meter) |
| iii. | Number  | No.       |
| iv.  | Volume  | Cu.M      |
| v.   | Area    | Sq.M      |

1.12 The measurement for cable laying shall be made on the basis of length actually laid from lug to lug including length of loops provided.

## **2.0 GENERAL CIVIL, STRUCTURAL AND ARCHITECTURAL WORKS**

2.1 The measurement of works as mentioned in the relevant Technical/Standard Specification shall be followed.

### **Pricing**

The rate for each item of work shall, unless expressly stated otherwise, include the following (but not limited to the list given below) for the completion of works in all respects as per conditions of Contract, technical specifications, drawing etc.

All taxes/GST, Royalties, Transportation, Freights, Packing and forwarding charges Insurance etc.

All requirements and expenses for completion of work as per Rules and Regulations of Local Bodies, State Government and Central Government of India.

All materials, equipments, accessories, consumable, controls and instruments, tools, tackles, plants, scaffolding/ double scaffolding labour, maintenance, fixing, cleaning, making good hauling, hoisting etc., Waste on material and labour. Loading, Unloading, handling/double handling, setting out protection from weather, temporary supports, platforms etc., and the maintenance, of the same, dismantling of temporary works, disposal of debris and all other labour necessary for the execution of works. Testing the installation as often as necessary, Contractors to arrange for all special instruments and tools required for such testing.

Painting of all equipment, pipes, supports etc., as per colour codes to be decided for various systems.

Apportion of costs for general facilities to be used by the Contractor's staff such as lifts, electricity, telephones etc. during execution if such facilities are provided by other contractors and who arrange for such facilities in the first instance. Fees for testing the materials, equipment or overall installation by appropriate authorities. Supervising Civil/ Masonry / Carpentry Works done by other agencies on behalf of the Bank for Interior contractor. All requirements of specification and drawings. Description of work given in the schedule of quantities is a brief description and shall be read in conjunction with specifications and drawings. Removal of POP covering and carting away all unwanted material including POP. The rates quoted by the Tenderer will be deemed to be for the finished work complete in all respects with accessories, fitting, mounting arrangements normally provided with such equipment and/or needed for execution, completion, safe operation of equipment as required

through they may not have been specifically mentioned in technical specifications, drawings and/or schedule of equipment.

All minor Masonry, Carpentry and Civil works such as cutting opening in Masonry Walls, Internal Partitions, chasing on walls, etc. and making good the same to match existing works shall be provided by the contractor, whenever asked for by the owner.

### **SCHEDULE OF QUANTITIES**

All items of work contracted for shall be executed strictly in accordance with the description of the item in the Schedule of Quantities, relevant drawings and specifications read in conjunction with the appropriate Indian Standard specifications and conditions of the contract and established Engineering practices.

The rate for each item of work included in the schedule of quantities shall unless expressly stated otherwise include cost of: All materials, fixing materials, accessories sequence of operations, appliances, tools, plant equipment, transport labour and incidentals required and completion of the work called for in the item and as per specifications and drawings completely. Wastage on materials and labour Loading transporting, unloading, handling as necessary, hoisting to all levels, and setting, fitting and fixing the position, protecting, disposal of debris as directed and all other labour necessary and to fully complete the job in accordance with contract documents, good practice and recognized principles of trade laid down in codes of practice. Liabilities, obligations and risks arising out of conditions of contract.

All requirements of specifications, whether such requirements are mentioned in the item or not shall be provided for the specifications and drawings where available are to be read as complimentary to any part of the schedule of quantities and any work called for in one shall be taken as required for all similar items. In the event of conflict between Schedule of Quantities and other documents including the specifications the most stringent among them shall apply and the interpretations of the consultants/owner shall be final and binding.

The Contractor shall be paid for the actual quantity of work executed by him in accordance with the drawings at the accepted rates.

This schedule shall be fully priced and the extensions and totals duly checked. The rates for all items shall be filled in INK. The entries under amount column shall be rounded off to the nearest Rupee.

No alterations whatsoever is to be made either to the description of items in the Schedule of quantities or specifications unless such alterations, is clarified in writing by the consultant/owner. Any such alterations, notes or additions shall unless clarified in writing be disregarded when tender documents are considered. Any observation in BOQ should be made in the letter accompanying technical bid for proper consideration and on disfiguring or overwriting in the documents is permitted.

In event of an error occurring in the amount column of the schedule, as a result of wrong extension of unit rate and quantity, the unit rate quoted by the Tenderer shall be regarded as firm and the extensions shall be amended on the basis of rates.

All errors in totalling in the amount column and in carrying forward totals shall be corrected.

Standard for building of Measurements IS 1200 latest revision effective on the date of measurement for interior items as applicable. Any errors in quantity of items from the contract schedule shall not vitiate this contract but shall be corrected and deemed to be a variation by the Architect/ PMC/Owner.

### **DRAWINGS AND DATA**

Within two weeks of placement of order/letter of intent contractor shall furnish the following data in triplicate for approval by Architect/ PMC/Owner. General arrangement drawing of the equipment on orders showing plan, elevations, and sectional views, mounting details.

### **BILL OF MATERIALS**

Descriptive catalogues, characteristic curves, duty point efficiency factor and technical particulars of all the various equipments offered.

### **SPARE PARTS AND MAINTENANCE FOR MATERIALS SUPPLIED**

Tenderer shall offer along with the bid, duly recommended by manufacturer set of spare parts required for a period of 1 year's continuous operation. Itemized unit prices with exact quantities recommended for these spares shall be separately indicated for consideration of the Owner/Consultant.

### **DOCUMENTS MUTUALLY COMPLIMENTARY**

The several documents forming the contract are to be read as mutually complementary to each other and in case of ambiguities/ discrepancies, the same shall be explained and clarified by the Consultant/Owner to the Contractor in what manner the work is expected to be carried out to meet the end requirements.

### **INSTRUCTIONS DURING EXECUTION**

On the advice of the Owner, the consultants may issue further drawings and written instructions, details, directions and explanations collectively referred to as "Site instruction" in regard to:

Variations for modification of the design, quality or quantity of works as addition or omission or substitution of any works therein. Any discrepancies in the drawings or between the schedule of quantities and/or specifications and/or drawings. Removal from the site any material brought by the contractor and substitution of any other materials therefore. The dismissal or removal from work of any person employed there upon.

Removal/re-examination of any works executed in case of doubt of any nature.

Opening up for inspection of any work covered up without proper tests by the Architect/ PMC.

Oversight on the part of the Architect/ PMC/his assistant to disapprove any defective work or material shall not prejudice the Owner/Consultant, thereafter to disapprove such work or materials and to order pulling down, replacement, removal breaking up or reconstruction. The Contractor shall make his own arrangement for the engagement of all labour and shall be responsible for regulating their service conditions, work conditions in conformity with all Acts, Regulations, Rules or order of competent authority under relevant laws in force during the pendency of the contract.

Contractor shall indemnify the Owner from all claims relating to the workers/ staff/ sub-contractors, Salaries Wages, Overtime, Leave, Provident Fund, Medical facilities, gratuity, Bonus or any other claim as applicable and stipulated in any statutory provisions, rules order of competent authority.

All materials so far as procurable shall be of the reputed make in the category of manufacture and bear the stamp of quality of the Bureau Standards wherever applicable. The contractor shall furnish documentary proof, test certificates and guarantees as relevant to such materials from manufacturers, which shall match with the date of procurement.

**MASONRY:** Rate shall include for provision of

Work at all heights, depth and in all situations and to all shapes and profile and all necessary works like staging, ladders, platforms, double staging etc. all are required for proper execution of works. Hacking and roughening of concrete or other surfaces coming in contact with masonry for bondage, cutting bricks/blocks, wastage etc.

Raking out joints to specified depth either for plaster or pointing or finishing the joints flushes as the work proceeds, all as directed.

Bedding and pointing wall-plaster, lintels, sills etc. in or on walls, bedding and pointing doors, windows and like in cement mortar.

Making openings for pipes, conduits, ducts etc. and closing the same after completion of such works and finishing as directed.

Providing at exact locations and to exact sizes pre-designated openings.

Forming chases for edges for concrete floors or other units, for scaling in of waterproofing layers, etc. Providing cement concrete blocks (1:2:4) at door jambs where required to receive expansion bolts/holdfasts etc. Building in holdfasts and or inserts, supplied by the engineer. Keeping the work well wetted for 10 days. Bricks/blocks to be wetted before use.

Bailing out, pumping out or otherwise removing all water, which may accumulate from all causes. Sampling and testing of any other material during the course of work as and when directed.

Plaster Rates shall include for provision of:

Work at all levels, heights and to all situations and profiles. Double scaffolding, working platforms etc.

A coat of neeru plaster soon after the curing period is over.

Work in narrow widths and small quantities unless special provision is made to the contrary.

Preparation to the surfaces by raking out joints in brick or by hacking the concrete surface and wetting the surface before plastering wherever required.

Thickness of plaster exclusive of the thickness of key i.e. grooves and open joints in brickwork, blockwork, stone work etc.

Chamfers of any width, internal and external rounded angles and chases and forming sharp and clean edges as shown.

Curing, protection and cleaning of all surfaces.

Keeping all plastered surfaces well wetted for at least 7 days.

## **PAINTING AND POLISHING**

The rates shall include for provision of:

Works at all heights and use of all scaffolding quantities, ladders, cradles etc. necessary for execution work and for inspection.

Preparing surfaces to receive finishing coats, such as brushing to remove all extraneous materials and fungus growth, if any, preparing, scraping, washing and rubbing etc

Puttying, sand papering and dusting of surfaces in between coats where applicable.

Work on cornices, narrow bands and widths, recesses grooves etc. Finishing to approved matt texture and/or stipple finish etc. complete as directed. Spreading and removing, covering to doors window. Floors, fittings, ducts, pipes etc. to protect them from splashes Washing floors, cleaning glass, joinery, electrical fittings, ducts. Pipes etc. of drops and splashes and leaving premises clean and tidy.

## **FLOORING, DADO, SKIRTING AND WALL FINISHES**

The rates shall include for provision of:

Use and waste of all temporary fillets, side-forms, templates, moulds, straight edges etc. Washing of coarse and fine aggregates, wherever required by the consultants.

Final preparation of the base, sub-grade or sub-floor including minor trimming of the base to remove slight undulations if necessary. Cleaning and watering the surfaces immediately before laying the floor. Providing bedding layer of mortar as specified, in case of slabs, tiles etc. to correct levels of slopes as called for. Cutting, rubbing and polishing surfaces and edges where applicable. Rounding off corners, edges and junctions of floors with skirting or dado and also cutting recesses where required to accommodate recessed skirting. Forming rounded recess in floor where called for. Providing grooves where shown on drawings. Work in narrow widths, bands, cornices, and strips and to profiles shown at all heights, levels, and locations and in small quantities, unless otherwise mentioned.

Curing, protecting and cleaning all finished surfaces as specified. Work on any surface such as bricks, blocks, concrete, stone etc. Providing grooves at the junction of plaster with other finishes as called for.

Scoring surfaces of plaster for key where the surface is not required to be finished fair. All samples of finishing materials shall be got approved prior to use. Keeping the work well wet for at least 7 days. Cutting tiles/slabs to require size/shapes providing holes etc. before laying.

Hand polishing, machine polishing, cleaning tiles with acid. All marble work e.g. flooring, cladding, skirting, dado etc. shall have white cement-based mortar in bedding and grouts.

All ceramic tiles shall be of 1st quality. All stone flooring to be protected by POP covering with plastic base.

## **CARPENTARY AND JOINERY**

Rate shall include for provision of:

Unless otherwise specified, the quoted rates shall be for all joinery work with approved Indian Teakwood, Steam beech wood free from all defects and kiln seasoned and preservatives treated and shall be got tested in laboratory and approved before placing or applying primer coat. The rate shall also include for applying two coats of Solignum paint to the face of frames in contact with masonry or concrete and the like.

The rate quoted shall include for fixing on masonry/RCC members and for 300 x 40 mm x 6 mm finished MS holdfasts embedded in PCC (1:2:4) blocks of 230 x 150 mm size and of width to suit the thickness of masonry wall or for anchor fasteners, coach screws etc. of adequate size for fixing to RCC members, as Care shall be taken to thoroughly clean the hardware, fittings, glass panes, doors, etc. of the waste cement marks, left over paint marks etc.

The rate shall include for providing temporary supports etc., for fixing of frames and shutters at all levels.

The sizes mentioned are for finished items. Also, the rate quoted shall include for: Planning and finishing smooth all faces of various faces as required.

All screws, nails, pins, key and such other fixing accessories.

Cutting rebates, Grooves etc. in frames/shutters as required or as directed. Approved glue or adhesive for all joinery work.

Providing seasoned Burma T.W., beech wood best quality, beading, trimmings, beads, weather bars etc. as called for. Providing rough grounds as per drawings.

Providing as per schedule/drawings all hardware, fittings and fixture like, latches, hinges, tower bolts etc. locks and other items as indicated for fixing such items supplied by the Engineer-in-charge at no extra cost.

Solignum treatment to all hidden wooden members and all board or ply faces coming in contact with masonry or concrete faces where retarding treatment is not called for.

Providing and applying pink primer to all wooden surfaces till the same are painted/polished.

Filling and finishing neat gaps around frames, doors, windows etc. with approved mastic. Work at all heights and locations.

Wherever painting is specified it includes painting the surfaces with three coats of first quality synthetic enamel paint of approved shade and make over a coat of wood pink primer.

Wherever polishing is specified it include polishing the surfaces with two or more layers of French spirit polish, with approved additives, strainers to get even shade over a coat of primer of approved chemicals.

All plywood and blackboard edges where exposed shall be finished with teakwood Lipping.

Unless otherwise specified, all door shutters specified are to be solid core flush door shutters, with topping bonded with phenol formaldehyde and confirming to relevant Indian Standards.

## **METAL WORK**

The rates shall include for provision of:

All steelwork shall confirm to IS-800 and rolled steel to IS-226 and IS-1977. All pressed steel sections shall be heavy duty.

Supplying all materials, fabricating, hoisting and fixing in position complete with expansion fasteners, coach screws, hold fasts, screws etc. and for RCC (1:2:4) blocks of adequate size as directed.

Glazing of windows, ventilators, doors should be as approved by Architect/ PMC.

Supplying and fixing all hardware of specified and approved type and make, confirming to standard practices followed by approved manufacturer.

Door, windows, rolling shutters, fire doors shall be fabricated by approved manufacturer.

Member's joints shall be mechanically cut to length mitered and electrically welded with true corners. Providing Silicon sealant in gaps between frames and masonry/concrete faces after erection.

Painting with a coat of zinc chromate's primer and three coats of synthetic enamel paint of approved make including supplying putty to obtain even and smooth finish.

Before fabrication, the contractor must take approval of the Architect/ PMC for type of sections, hardware, glass etc. to be utilized. He should take actual measurements at site and fabrication shall be done accordingly.

Providing necessary coupling, transoms and mullions wherever required as per relevant I.S. code (I.S. 1038). SPECIFICATIONS GENERAL

These specifications are for work to be done, items to be supplied and materials to be used in the works as shown and defined on the drawings and described herein all under supervision and to the entire satisfaction of the Architect/ PMC & owner.



The workmanship is to be the best available and of a very high standard, use must be made of specialist tradesmen in all types of work and necessary allowance must be made for the same in the rates quoted.

The materials and items to be provided by the contractor shall be the best of their respective kinds as specified in the tender and in accordance with the samples approved, where materials or products are specified in these specifications and/or Bill of Quantities by the name of the manufacturer of the brand name, trade name or catalogue reference, the contractor will require to obtain prior approval of the Architect/ PMC and owner for using substitute material or product. The contractor shall produce all invoices, vouchers or receipted accounts for any materials if called upon to do so by the Architect/ Consultant and owner.

Samples of all materials are to be submitted to the Architect/ PMC/owner for his approval before the contractor orders or delivers in bulk in the site. Samples together with their packing are to be provided by the Contractor free of charge and approved samples will be retained by the owner and designer for comparison with the materials which will be delivered to the site.

Should any materials be rejected by the Architect/ PMC/owner, they will be removed from the site at the Contractor's expense. Also, the contractor will be required to submit specimen finishes of colours, fabrics, etc. for approval of Architect/ PMCs/ owner before proceeding with the works. Should it be necessary to prepare shop drawings, and then four copies of such drawings shall be submitted for approval of the Architect/ PMC who will retain two copies, all at the Contractor's expenses.

Timber generally is to be the best of its kind, well and properly seasoned, of natural growth, free from work holes, large loose or dead knots or other defects and sawn die square and not to suffer from warping, splitting or other defects through handling.

The hardwood is to be Hollock or red Marandi with moisture contents not more than 20%. Teak is to be the best quality from Dandily free from soft heart, worm and bee holes, and weighing not less than 50 lbs. per cubic foot with maximum moisture contents of 12%. Teak veneers and flitches shall match each other throughout and, where possible, shall match existing flitches in the building. The particleboard shall be of high density, equal or superior quality to that laid in the I.S. 3478 and as approved by the Architect/ PMC. The blackboard shall be of the following I.S. Specification or such approved adhesives shall be used: -I.S. 851 - 1957: Synthetic Resin adhesive for construction work in wood.

I.S. 849 - 1957: Cold setting case in glue for wood. where glued joinery and carpentry work is likely to come into contact with moisture, the glue shall be waterproof. The use of animal glues will not be permitted.

Flush doors of hollow framed core insulated construction shall be constructed with 4" wide stiles, top and bottom rail, one 4" wide horizontal intermediate rail and two 4" wide diagonal braces, filled in solid with approved rigid type polyurethane doors shall be constructed with one 3" wide and one 5" wide stile, 4" wide top and bottom rail, one 4" wide horizontal intermediate rail and 2" wide diagonal braces; filled in as described before.

Flush doors of hollow framed core construction shall be constructed with 3" wide stiles and top rails, 5" wide bottom rail, two 6" wide horizontal intermediate rails with beehive core of

1" wide filling pieces at 4" centres both ways and blocked out as necessary for lock and hinges. All horizontal members shall have 1/4 dia. borings.

All doors shall consist of selected hardwood properly jointed together and they shall be covered on both sides with 3/16" teak veneered plywood or as specified. Each door is to be lipped all around with 1/2" teak twice-rebated edging tongued to the stiles and rails and metered. The doors are to be the full thickness as specified. The lipping on the meeting stiles of folding doors shall be increased to take the rebate as specified.

Frames to doors, windows etc. shall be of hardwood or teak as specified and to the required sizes with all necessary mouldings with mortised and tenoned joint, lead and teak pins and secured in position as specified.

Shelves generally shall be constructed of plywood with edgings of 1" teak tongued on.

Timber is to be cut to the required sizes and length as soon as practicable after the works are begun and stored under cover so that the air will circulate freely around it. Joinery is to be prepared immediately after the finalisation of the contract, framed up (but not boned) and stored until required for fixing in position, when it is to be bonded and wedged up. Any portion that warps or develop shakes or other defects are to be replaced before wedging up. The whole work is to be framed and finished in a proper workman like manner, in accordance with the detailed drawings, and fitted with all necessary metal ties, straps, bolts, screws, etc. Turning bonded joints are to be cross-tongued with teak tongues and where over 1/2" thick, to be double cross tongued. Joiner's work generally is to be finished with fine sand papered surfaces unless otherwise specified.

Templates, boxes and moulds shall be accurately set out and rigidly constructed so as to remain accurate during the time they are in use.

Grounds are to be clean sawn, free from large knots, splayed as required and plugged and fixed to walls, etc. at 1'-6" centres unless otherwise specified.

Wood plugs are to be cut on the twist. Patent wall plugs or plastic fillings may be used in lieu of wood plugs with the prior approval of the Architect/ PMC.

All unexpected surfaces of timber, e.g. false ceilings, backing fillets, backs of doorframes, cupboard framing, grounds, etc. are to be treated with two coats of Atlas `A' or other equal and approved timber preservative before fixing or bedding.

The service stations, bar counters, shelving, etc. shall be generally constructed of plywood as described and specified properly housed, grooved tongued, glued, blocked and screwed together and entirely to the satisfaction of the Architect/ PMC.

The chairs, tables, etc. shall be generally constructed of teak, foam rubber and fabric as described and specified, properly housed, grooved, tenoned, tongued, glued, blocked and screwed together in the manner of good quality furniture and entirely to the satisfaction of the Architect/ PMC & owner. A prototype sample of all custom-made pieces must be prepared and submitted to the Architect/ PMC for his owner's approval before proceeding with the work in quantity.

## **HARDWARE & METAL:**

The hardware throughout shall be of approved manufacture and supply, well made and equal in every respect to the approved samples to be deposited with the owner and Architect/ PMC. For the purpose of approval of samples, the contractor may be required to produce and provide to the Architect/ PMC, samples from many different sources and should allow in his rates for the same.

Fittings generally shall have satin chrome or anodised finish unless otherwise stated and shall be suitable for their intended purpose of use.

Screws are to match the finish of the article to be fixed and to be round or flat headed or counter sunk as required.

The bronze and brass surfaces shall be covered with thick grease or other suitable protective material renew as necessary and subsequently clean off and clear away on completion.

Aluminium and stainless steel shall be of approved manufacture and suitable for its particular application. Generally, the surfaces of all aluminium shall have an anodized finish and the quality and finish both shall comply with the samples approved by the Architect/ PMC & owner.

All steel, brass, bronze, aluminium and stainless-steel articles shall be submitted for test for strength, if so, required by the Architect/ PMC & owner, at the contractor's expenses.

All brazing and welds are to be executed in a clean and smooth manner, rubbed down and left in the flattest and tidiest way, particularly where exposed.

Chromium plating shall be in accordance with B.S. 1224 or as per approved specifications for "normal outdoor conditions", and shall be on a base material of copper or brass.

## **GLAZING**

All glass to be approved manufacture complying with BS 3548-1966, or as per approved quality and sample, to be of the quality specified and free from bubbles, smoke wanes, air holes and other defects.

The compound for glazing to metal is to be a special non-hardening compound manufactured for the purpose and of a brand and quality approved by the Architect/PMC & owner.

In cutting glass, proper allowance shall be made for expansion each square of glazing to be in whole sheet. On completion, clean all glass inside and out, replace all cracked, scratched or broken panes and leave in good condition to the satisfaction of the Architect/ PMC & owner.

## **PAINT & POLISHING**

All materials required for the works shall be of specified and approved manufacture, delivered to the site in the manufacturer's containers with the seals, etc. Unbroken and clearly marked with manufacturer's name or trade-mark with a description of the contents and colour. All materials are to be stored on the site of the works.

Spray painting with approved machines will be permitted only if prior written approval has been obtained from the Architect/ PMC. No spraying will be permitted in the case of priming neither coats nor where the soiling of adjacent surface is likely to occur. The nozzle and pressure to be so operated as to give an even coating throughout to the satisfaction of the Architect/ PMC. The paint used for spraying is to comply generally with the specification concerned which is to be specifically prepared by the manufacturer for spraying. Thinning of paint made for brushing will not be allowed. Wood preservation shall be Solignum or other equal and approved impregnating wood preservative, and all concealed wood work shall be so treated. All brushes, tools, pots, kettles, etc. used in carrying out the work shall be clean and free from foreign matter, and are to be thoroughly cleaned out before being used with a different type of class of material.

All iron or steel surfaces shall be thoroughly scrapped and rubbed down with wire brushes and shall be free from rust, mill scale, etc. before applying the priming coat.

Surfaces of new woodwork which are to be painted, are to be rubbed down, knotted and stopped to the approval of the Architect/ PMC & owner.

Surfaces of previously painted woodwork which are to be repainted shall be cleaned with soap and water, detergent solution or approved solvent to remove dirt, grease, etc. whilst wet the surfaces shall be flatted down with a suitable abrasive and then rinsed down and allowed to dry. Minor areas of defective paint shall be removed by scrapping back to a firm edge and the exposed surface touched in with primer as described and stopped with putty. Where woodwork has been previously painted or polished and is to be newly polished, the same shall be prepared with scrapping, burning off or rubbing down.

Surfaces of previously painted metal which are to be repainted shall be cleaned down and flatted down as described in surfaces of previously painted wood work. Minor areas of defective paint and any rust and loose scale shall be removed completely by chipping, scrapping and wire brushing back to the bare metal and touched in with primer as described.

## **PLASTER**

Cement/lime plaster for internal surfaces shall be applied in two coats, as follows:

Undercoat 3/8" thick composed of 1-part cement, 4 parts lime putty, 12 parts clean washed sand, measured by volume, the whole laid evenly, straightened with a rule and scratched to form key.

Finishing coat 3/8" thick composed of 1-part cement, 3 parts lime putty, 6 parts clean washed sand, measured by volume, trowelled with a steel trowel to a smooth or textured finish in accordance with samples approved by the Architect/ PMC. A minimum period of 7 days must elapse between the application of undercoat and finishing coat. The total thickness of the plaster must not exceed 3/4".

Rough rendering shall be composed of cement and sand (1:4) floated to the thickness required to fill in voids behind facings, dubbing out to uneven surfaces, etc. Dubbing out must not under any circumstance exceed 1" in thickness at any point.

Screeds and backings shall be composed of cement and granite fine or sane (1:3) and shall be properly laid to rules and floated to a surface suitable to receive the finishing's specified.

Mixing of lime/cement plaster, cement rendering and screeds shall be carried out with machine driven roller-pan mixers of a type and size approved by the Architect/PMC. For smaller quantities, or in exceptional circumstances, the Architect/ PMC may require or approve mixing by hand on a clean dry floor or platform.

Measurement of all constituents is to be made by means of gauge boxes. Gypsum plaster shall be of approved manufacture, delivered to the site in the manufacturer's sealed bags or drums, bearing the name of the manufacturer and the brand of plaster are to be in accordance with B.S.1191 for the following types -Undercoat plasters are to be borrowing or "slow setting browning" of class "B", typea - retarded semi-hydrates.

Finishing plaster used on undercoats is to be of Class `B' type b - retarded semi hydrates or class "B" type c – dual purpose plaster.

Finishing plaster used or plasterboard is to be of "Board finish" type, Class "B", type b - retarded semi-hydrates. Keep's Cement is to be dual-purpose type in accordance with class "B", type c.

Plaster of Paris to be in accordance with class "B".

Joints of brickwork, etc. are to be thoroughly raked out and loose particles of mortar,etc. brushed out to form key for plaster. Concrete work generally is to have a coat of "spatter dash" applied to form key for plaster, etc. The concrete shall be dampened immediately after removal of formwork and "spatter dash" consisting of 1 part of cement and 2 1/2 parts coarse sand (by volume) mixed to the consistency of a thick slurry, thrown on with a hand trowel to thickness not exceeding 1/4". The "spatterdash" shall be waited one hour after application and left to harden.

All pavings, wall linings, etc. are to be adequately covered up and protected until the completion of the works. The whole of the finished work to be cleaned off and left in a sound and perfect condition to the satisfaction of the Architect/ PMC & owner. Where particularly, required, pavings will not be laid until completion of all otherwork.

Gypsum plaster to surface of concrete or brickwork is to be two-coat as follows:

Undercoat composed of one part "brewing" or slow setting browning plaster as described above with two parts of sand, the whole laid on evenly, straightened with a rule and scratched to form a key.

Finishing coat to be as described above, applied neat of with an admixture of not more than 25% volume by lime putty, trowelled with a steel trowel to smooth even surfaces.

The total thickness of two-coat work must no exceed 1/2".

Gypsum plasterboard shall be of approved manufacture and in accordance with B.S.1230. Consisting of a core of set gypsum plaster in accordance with B.S. 1191 sandwiched between two sheets of heavy paper to a nominal thickness of 3/8". Plasterboard is to be nailed to timber bearers with 1 1/4" \* 12 S.W.G. galvanized screws with 3/8" dis. heads, spaced about 6

inches apart and not less than 3/4" from the edges and ends. Nailing is to commence at the centre of the board. Boards are to be spaced 1/8" to 1/4" apart at the joints and end joints are to be staggered to break bond. The boards are to be fixed and cleaned at least 24hrs. before they should be wetted before plastering.

Gypsum plasterboard is to be prepared for plastering by filling the joints with 'board finish' gypsum plaster as described above and pressing into the plaster, dry reinforcing jute scrim cloth 3 1/2" wide trowelled as flat as possible. When the plaster to the scrim joints has set, thin coat of neat gypsum plaster is to be applied over the whole surface to level up followed immediately by a finish coat to a total thickness of 3/16". The finish coat when almost set is to be trowelled to a smooth surface using as little water as possible applied with a brush. The admixture of lime with gypsum plaster will not be permitted. Internal wall tiling is to be of a quality and equal to samples approved by the Designer as suitable for the standard of work required. Tiles are to be of 'A' Grade. Indian manufacture size 4 1/4" \* 4 1/4" \* 6mm thick cushion edge coloured egg shell glazed tiles fixed complete with rounded nosing tiles to external angles or as specified. The tiles are to be soaked in clean water and brushed on the underside with a cement slurry before bedding on a cement and sand (1:3) and painted in neat white or coloured cement.

Pavings composed of cement and sand (1:3) are to be trowelled smooth with steel trowel or floated with a wooden hand float as required.

Dividing strips of brass, stainless steel or plastic as specified and on approval, shall be provided and bedded to, finished flush with finished floor levels between different types of pavings or where abutting wood floors.

Stone flooring and cladding should be of dimensions, quality and colour as specified and shall conform to the relevant I.S. specification samples of stone materials should be got approved by the Designer/Client prior to installation allowed without extra charge, unless such variations are made after conduits, cables, etc. are fixed.

All cables shall be of 1st quality manufacturer and the Main Contractor will be required to submit samples of wiring materials to the Designer & owner, for their approval before commencing the installation.

#### **GENERAL SPECIFICATIONS FOR "UPHOLSTERED" FURNITURE:**

**TIMBER:** All timbers used are to be of top quality, free from knots, shakes, and worm holes, and with a moisture content of not more than 12% depending on the climatic conditions prevailing at the site.

Timbers which are completely hidden, that is when covered by upholstery material, can be of local hardwood, except where this interfaces with the strength of the product, as in the case of a leg or arm which is part covered and part finished.

**JOINTS:** All joints shall be standard, mortise and Tennon, dowel, dovetail, and crosshalved. Nailed or glued butt joints will not be permitted. Screws, nails, etc. will be of standard iron or wire unless stated otherwise on drawing. Where mortise and tenon joints are used, tenons should fit the mortise exactly. Where screws show on a finished surface, these will be sunk, and the hole plugged with a wood plug of the same wood and grain of the finished surfaces,

unless otherwise. Nails on finished surface will be neatly punched and the hole filled with wood filler to match the colour.

**UPHOLSTERY:** This will be of first-class standard workmanship with webbing, nosag springs, coiled springs, padding and filling as specified on drawing. Covering fabrics will be sewn, tufted, and corded as shown on the drawing.

**CUSHION VENTS:** Brass or Aluminium "cushion vents" should be installed at the back or under side of seatcushions (especially those covered in leather, vinyl plastic or very tightly woven fabric) to allow air to escape easily and to prevent torn seams.

**MATERIALS:** Finished timber shall be of the type specified, furnishing fabrics, colour, pattern, substance to be as specified, no variation of this will be permitted unless with prior approval of the Designer & owner.

**FINISH:** This will be as specified on the drawing and colour scheme chart where timber is finished in natural colour; care must be taken to "match" each separate piece of colour, before assembly. Where timber is stained, the stain or colour on each member must match.

**LIST OF APPROVED MANUFACTURER / BRAND NAME**

The following brand makes/ manufacturer's makes listed below shall be used with prior approval of the Engineer-In-Charge / Consultant.

The Engineer-In-Charge may approve additional vendors other than the vendor suggested.

**A. LIST OF MAKES FOR CIVIL WORKS**

<b>S.NO.</b>	<b>ITEM DESCRIPTION</b>	<b>MAKE/BRAND</b>	<b>REMARKS</b>
1.	CEMENT(OPC/PPC/ PORTLAND SLAG)	ACC/L&T/ JKCEMENT/BIRLA/ULTRATE CH/GUJARATAMBUJA	
2.	WHITE CEMENT	J K / BIRLA	
3.	HIGH YIELDSTRENGTH DEFORMED TMTBARS & MS ROUND	SAIL/TISCO/IISCO/JINDAL STEEL/ESSAR STEEL	Material shall be accepted based on manufacturer's test certificates provided manufacturers/vendors in case the raw material is used from other agencies, necessary third-party inspection reports issued by approved TPIA shall be produced along with dispatch document.
4.	STRUCTURAL STEEL	SAIL/TISCO/IISCO/JINDAL STEEL/ESSAR STEEL	
5.	BLOCK CHEMICAL ADHESIVE	TAMMY/LATICRETE	
<b>FLOOR/WALL FINISHING</b>			
6.	PAINTS	ASIAN PAINTS/ DULUX / NEROLAC/ BERGER PAINTS	
7.	CERAMIC TILES /VITRIFIEDTILES	NITCO/KAJARIA/ORIENT/SO MANY/JOHNSON/RAK	
8.	P.O.P	BIRLA WALL PUTTY/ JK WALLCARE	
9.	BRICK TILES	PIONEER/ UNISTONE/ULTRA/JINDAL MECHNO BRICKS	
10.	BRICK PAVERS	PIONEER/UNISTONE/JINDAL MECHNO BRICKS	
11.	FIBRE ACOUSTIC PANELLING	ARMSTRONG/ECOTONE/EAR CONS/ANUTONE	
12.	WOOD PANELLING	UNITEX/ECOTONE/EARCONS /PERGO	
13.	RAISE FLOOR	UNITEX	
14.	CARPET	ECO SOFT / TUNTEX / WELKIN	



15.	COBBLE, PAVERS	PIONEER/ UNISTONE/ INDAL MECHNO BRICKS	
<b>WOOD WORK</b>			
16.	COMM BOARDS / PLY/BLOCKBOARD	GREEN PLY/ DURO/NATIONAL/KITPLYPR ODUCTS/ CENTURY/ARCHID	
17.	DECORATIVE LAMINATE	FORMICA/ GREENLAM/ MERINOLAM/SUNMICA/DUR O/CENTURY	
18.	MELAMINE POLISH	PIDILITE/ NEROLAC/ DULUX/ASIANPAINTS/MRF	
19.	ANTI-TERMITE/FIRE PAINT	V IPER STAR-FR-881/ ACRO	
<b>DOORS AND WINDOWS FITTINGS</b>			
20.	HARDWARE FITTINGS	HETTICH, HAFFLE, GEZE, OZONE, DOORSET	
21.	CUPBOARD /DRAWER LOCK	GODREJ/ HARDWYN TRADERS/ GEZE/DOORSET/OZONE	
22.	CYLINDRICAL LOCK WITH KNOBS	GODREJ/ HAFFLE/ GEZE/ DOORSET/SECUREINDUSTRI ES	
23.	MORTICE LATCH & LOCK ANDHANDLES	GODREJ/OZONE/HARRISON/ DOORSET	
24.	HYRAULIC DOOR CLOSER (OVERHEAD/ FLOOR)	DOORMA/ DOORSET/ GEZE/ OZONE/GODREJ & BOYCE	
25.	ALUMINIUM SECTIONS	HINDALCO/ JINDAL/GAL ALUMINIUMEXTRUSIONS PVT. LTD./INDAL/ALUMAX	
26.	MISC. ALUMINIUMDOOR/WINDO W FITTINGSHINGES, TOWER BOLTS, LATCHES, STOPPER, STAYS ETC	JINDAL/ DOMAL/ ETERNIA/ AGVAFLAB/ADITYA BIRLA/HARDWYNTRADERS/ EBCO (P) LTD/ CLASSIC	
<b>DOORS, WINDOWS VENTILATORS</b>			
27.	ACOUSTIC DOORS	ENVIROTECH SYSTEMS PVT. LTD./ECOTONE/NAV AIRINTE RNATIONAL LTD/EARCONS	
28.	FLUSH DOORS	GREEN PLY/ DURO/ CENTURY/ NATIONAL/KITPLY PRODUCTS	
29.	ALUMINIUMWINDOW/VEN	JINDAL/ DOMAL/ ETERNIA/	

	TILATOR	AGVAFLAB/ADITYA BIRLA	
30.	ALUMINIUM SKIRTING	BAUX	
31.	ALUMINIUM COMPOSITE PANELS	ALUDECOR / ALSTRONG	
32.	ROLLING SHUTTER	RAMA ROLLING SHUTTER INDUSTRIES/PRAKASH AND CO./ISHWAR INDUSTRIES	
33.	GLASS	SAINTGOBAIN / MODI FLOAT / TRUTUF / ASAHI	
34.	FLOOR SPRING, FRAMELESS	DORMA / HETTICH / OZONE / DOORSET	
35.	STAINLESS STEEL	JINDAL / JNB INDUSTRIES / RAINFLEX METALS	
36.	STEEL PRIMER	ASIAN PAINTS / NEROLAC / BERGER PAINTS	
37.	S.S. ACCESSORIES	JINDAL / GIRIRAJ INDUSTRIES	
38.	MS SECTION	JINDAL / TATA / JTL INFRA LIMITED / SAIL / HSL / VSP	
<b>MISC ITEMS</b>			
39.	G.I. PIPE FITTINGS	TATA / JINDAL MEDIUM, BENDS / ELBOWS, UNIONS, T-SOCKETS -UNIK	
40.	GLUE	FEVICOL/DUNLOP/VEMICOL	
41.	FLOOR/WALL TILE ADHESIVE	TAMMY/LATICRETE	
42.	BLINDS	VISTA/DECOREX/ELEGANT DÉCOR	
43.	FALSE CEILINGS	ARMSTRONG / EARCONS / ECOTONE / ANUTONE	
44.	GYPSUM CEILING AND SECTIONS	INDIA GYPSUM/ GYPROC / BORAL	
45.	WATER PROOFING	ROFFE, XYPEX, PIDILITE	
46.	CORTEN STEEL	RIDHI SIDDHI STEEL CORP/CHAMPAKSTEEL ANDENGG/LADHANI METAL/ ALCHEMY	
47.	AC	SAMSUNG/HITACHI/DAIKEN /VOLTAS	
48.	SLIDING CHANNEL FOR	DOORMA/OZONE/HETTICH/	

	DRAWERS	GODREJ & BOYCE	
49.	ANTITERMITE PAINT	NOCIL/PYRAMID/TRISUL/MO NTARIINDUSTRIES	
50.	FASTENERS/RAWL PLUG	FISHER/HILTI/DASH FASTENERS	
51.	WATERPROOFING/CONSTR UCTIONCHEMICALS & WATERPROOFINGCOMPOU ND & MICROCONCRETE	PIDILITE/FOSROC/CHOKSI/R OFF/ CICO/SIKA/ DR. FIXIT	
52.	GLASS WOOL INSULATION	TWIGA	
53.	SUBMERSIBLE PUMPS	KSB PUMPSLTD/GRUNDFOSS/WIL O/KIRLOSKER/CROMPTON GREAVES	
54.	GRAPHICS FILM	3M SCOTCHCAL SERIES 3630	
55.	TOILET MODULARPARTITIONS	CENTURY / MERINO	
56.	FURNITURE	ASK SYSTEMS / INDO OFFICE SYSTEMS / DUNAMICS	

## LIST OF RELEVANT I.S. CODES (CIVIL)

Sl. No.	I.S. CODE NUMBER	TITLE
1.	<b>IS:8112-1989</b>	Specification for 43 grade ordinary 99ortland cement.
2.	<b>IS:383-1970</b>	Specification for coarse and fine aggregates from natural sources of concrete.
3.	<b>IS: 432 –1982 (Part–I)</b>	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement – Mild steel and medium tensile steel bars.
4.	<b>IS : 456 – 2000</b>	Code of practice for plain and reinforced concrete.
5.	<b>IS:814-1991</b>	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
6.	<b>IS:816-1969</b>	Code of practice for use of metal arc welding for general construction in mild steel.
7.	<b>IS : 875 –1987 (Part–1)</b>	Code of practice for design loads (other than earthquake) for buildings and structures.
8.	<b>IS: 875 –1987 (Part–2)</b>	Code of practice for design loads (other than earthquake) for buildings and structures Imposed loads
9.	<b>IS: 875 –1987 (Part–3)</b>	Code of practice for design loads (other than earthquake) for buildings and structures– Wind loads
10.	<b>IS :875-1 987 (Part–5)</b>	Code of practice for design loads (other than earthquake) for buildings and structures– Special loads and load combinations
11.	<b>IS:1077-1992</b>	Specification for common burnt clay building bricks.
12.	<b>IS:1080-1986</b>	Code of practice for design and construction of shallow foundations (Other than raft ring and shell)
13.	<b>IS: 1609-1991</b>	Code of practice for laying damp proofing treatment using bitumen felts.
14.	<b>IS: 1742-1983</b>	Code of practice for building drainage.
15.	<b>IS:1786-1985</b>	Specification for high strength deformed steel bars and wires for concrete reinforcement
16.	<b>IS: 1893-1984</b>	Criteria earthquake resistant design of for structures.
17.	<b>IS:1904-1986</b>	Code of practice for design and construction of foundations in soil. General requirement.
18.	<b>IS:2062-1992</b>	Structural steel (Fusion welding quality)
19.	<b>IS:3067-1988</b>	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
20.	<b>IS: 3068 –1986</b>	Specification for broken brick (burnt day) coarse aggregate for use in lime concrete.
21.	<b>IS:3414-1968</b>	Code of practice for design and installation of joints in buildings.
22.	<b>IS:4326-1976</b>	Code of practice for earthquake resistant design and construction of buildings.
23.	<b>IS: 10262-1982</b>	Recommended guidelines for concrete mix design
24.	<b>IS:13920-1993</b>	Ductile detailing of reinforced concrete structures subjected to seismic forces – code of practice.

25.	<b>IS. No. 3945-1966</b>	Code of practice for joins used in wooden furniture.
26.	<b>I.S.No. 4020-1967</b>	Wooden flush doors – typical method of test for.
27.	<b>I.S.No. 2338 (Part I) –1967</b>	Code of Practice for finishing of wood and wood-based materials Part – 1 – operations & workmanship
28.	<b>I.S. No. 7638-1975</b>	Methods of sampling of plywood.
29.	<b>I.S. No. 3129-1965</b>	Specification for particular board for insulation purposes
30.	<b>I.S. No. 7316-1974</b>	Decorative Plywood using plurality of veneers for decorative faces
31.	<b>I.S.No. 1734-1985</b>	Plywood method of Test
32.	<b>I.S.No. 3087-1969</b>	Wood Particle Boards (Medium Density)
33.	<b>I.S.No. 2046-1969</b>	Specification for decorative laminate
34.	<b>I.S. No. 8273-1976</b>	Fibrous gypsum plaster boards.
35.	<b>I.S. No. 2095-1365</b>	Gypsum plaster boards.
36.	<b>I.S. No. 2542 (Part 1) – 1976</b>	Gypsum Plaster concrete and products methods of Test for Part 1 Plaster and Concrete.
37.	<b>I.S. No. 8272-1976</b>	Gypsum Plaster for use in the manufacture if fibrous plaster boards.
38.	<b>I.S. No. 2441-1963</b>	Fixing ceiling covering, code of Practice for.
39.	<b>I.S. No. 2935-1977</b>	Specification for flat transparent sheet glass.
40.	<b>I.S. No. 3548-1966</b>	Glazing in building – Code of Practice for.
41.	<b>I.S. No. 117 - 1964</b>	Specification for read mixed paint, brushing, matt or eggshell flat finishing interior to Indian Standard color, as required.
42.	<b>I.S. No. 133-1975</b>	Specification for ready mixed paint, brushing, grey filler for enamel for use over primers.
43.	<b>I.S. No. 113-1975</b>	Specification for enamel, interior (a) under coating (b) finishing.
44.	<b>I.S. No. 129-1950</b>	Specification for ready mixed paint, brushing, grey filler for enamel for use over primers.
45.	<b>I.S. No. 533-1973</b>	Specification for gum spirit of turpentine, (oil of turpentine).
46.	<b>I.S. No. 101 – 1964</b>	Methods of tests for read, mixed paints & enamels.
47.	<b>I.S. No. 124 (Part 1) – 1976</b>	Specification for ready mixed paint, brushing, finishing semi glossy for general purposes.
48.	<b>I.S. No. 8756-1978</b>	Ball catches for use in wooden almirahs.
49.	<b>I.S. No. 799-1979</b>	Drawer locks, cupboards and box locks.
50.	<b>I.S. No. 7981 (Part I) – 1975</b>	Glosser of terms relating to builder's hardware (Part 1 Lock)
51.	<b>I.S. No. 401 –1982</b>	Approved wood preservative.
52.	<b>I.S.No. 1542-1977</b>	Specification for sand for plaster.
53.	<b>I.S.No. 2116-1980</b>	Specification for sand for masonry mortar.
54.	<b>I.S. No. 2386 (Part I) – 1963</b>	Methods of test for aggregates for concrete (Particle size and shape)

55.	<b>I.S. No. 2386 (Part 1) –1963</b>	Estimate of deleterious materials and organic impurities. Specific gravity, density, voids.
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56.	<b>I.S. No. 2386 (Part III) – 1963</b>	Specific gravity, density, voids, absorption and bulking. (Mechanical properties)
57.	<b>I.S. No. 2386 (Part IV)- 1963</b>	(Mechanical properties)
58.	<b>I.S. No. 3025-1986</b>	Methods of sampling and test for water.
59.	<b>I.S.No. 516-1959</b>	Method of test for strength of concrete.
60.	<b>I.S.No. 1322-1982</b>	Specification for bitumen felt for water proofing and damp proofing.
61.	<b>I.S.No. 2645-1986</b>	Specification for integral cement water proofing components.
62.	<b>I.S.No. 13311 (Part I – 1992</b>	Indian Standard for non-destructive testing of concrete method of test for Ultrasonic Pulse Velocity.
63.	<b>I.S. No. 13311 (Part II)- 1992</b>	Indian Standard for non — destructive testing of concrete method of testing by rebound hammer.
64.	<b>I.S. No. 226-1975</b>	Structural steel.
65.	<b>I.S. No. 1200-1974 (AK Parts)</b>	Method of measurement of building and Civil Engineering Work.
66.	<b>I.S. No. 1608-1972</b>	Method for tensile testing of steel products.
67.	<b>I.S. No. 2502-1963</b>	Code of practice for bending and fixing of bars or concrete reinforcement.
68.	<b>I.S. No. 12751 – 1979</b>	Recommended practice for welding of mild steel plain and deformed bards for reinforced construction.
69.	<b>I.S. No. 2212-1962</b>	Code of practice for brick work.
70.	<b>I.S.No. 1124-1974</b>	Methods of test for determination of water absorption. Apparent specific gravity and porosity of natural building stones.
71.	<b>I.S. No. 1125-1974</b>	Methods of test for determination of weathering of natural building stone.
72.	<b>I.S. No. 1126-1974</b>	Methods of test for determination of durability of natural building stone.
73.	<b>I.S. No. 3495 –(Part I to IV) – 1976</b>	Method of test for clay building bricks.
74.	<b>I.S. No. 1597-(Part I to IV) -1967</b>	Code of practice for construction of rubble stonemasonry.
75.	<b>I.S. No. 1597-(Part I to IV) -1967</b>	Code of practice for construction of ashlar stonemasonry.
76.	<b>I.S. No. 2185-(Part II) –1967</b>	Specification for concrete masonry units. Hollow and solid concrete blocks.
77.	<b>I.S. No. 2572-1963</b>	Code of practice for construction of hollow concrete block masonry.
78.	<b>I.S. No. 4101 –(Part I) – 1967</b>	Code of practice for external facings and veneers (Part– 1 Stone facing)
79.	<b>I.S. No. 204 –(Part I) – 1991</b>	Specification for tower bolts (Part I) ferrous metal.
80.	<b>I.S. No. 204 –(Part II) – 1992</b>	Specification for tower bolts (Part II) non-ferrous metal.

81.	<b>I.S. No. 208-1987</b>	Specification for door handles.
82.	<b>I.S. No. 848-1974</b>	Specification for synthetic resin adhesives for plywood and aminoplastic.
83.	<b>I.S. No. 851 –1978</b>	Specification for synthetic resin adhesives for construction work (Non structural in wood).
84.	<b>I.S. No. 1328-1982</b>	Specification for veneered decorative plywood.
85.	<b>I.S.No. 1566-1982</b>	Specification for hard – drawn steel wire fabric for concrete reinforcement.
86.	<b>I.S.No. 1130-1969</b>	Specification for marble (block, slab and tiles).
87.	<b>I.S.No. 287-1973</b>	Recommendation for maximum permissible moisture content of temper used for different purposes.
88.	<b>I.S.No. 303-1989</b>	Specification for plywood for general purposes.
89.	<b>I.S. No. 1003 (Part I) –1991</b>	Specification for timber paneled and glazed shutters (Part– I) Door shutters.
90.	<b>I.S. No. 1003 –(Part II) – 1994</b>	Specification for timber paneled and glazed shutters (part– II) Window and Ventilator Shutters.
91.	<b>I.S. No. 1868-1982</b>	Specification for anodic coating on aluminum and its alloys.
92.	<b>I.S. No. 3087-1985</b>	Specification for wood particle boards (Medium density) for general purposes.
93.	<b>I.S. No. 3097-1980</b>	Specification for veneered Particle Boards.
94.	<b>I.S. No. 3564-1986</b>	Specification for door closers (hydraulically regulated).
95.	<b>I.S. No. 12406-1988</b>	Specification for medium density fibre boards for general purposes.
96.	<b>I.S.No. 1141-1973</b>	Specification for code of practice for seasoning of timers.
97.	<b>I.S.No. 1659-1990</b>	Specification for block boards.
98.	<b>I.S No. 1734-( PartI- 20)- 1983</b>	Methods of test for plywood.
99.	<b>I.S No. 2202-(Part I)- 1991</b>	Specification for wooden flush door shutters plywood face panels.
100.	<b>I.S No. 2202 –(Part II) – 1983</b>	Specification for wooden flush door.
101.	<b>I.S No. 2209-( Part I)-1976</b>	Specification for mortice locks.
102	<b>I.S. No. 5523-1969</b>	Methods of testing anodic coatings on aluminium and its alloys.
103	<b>I.S. No. 800-1984</b>	Code of practice for general construction in steel.
104	<b>I.S. No. 1081-1960</b>	Code of practice for fixing and glazing of metal (Steel and aluminium) doors, windows and ventilators.
105	<b>I.S. No. 1599-1985</b>	Method for bend test.
106	<b>I.S. No. 2062-1984 (2062-1984)</b>	Steel for general structural purpose.

107	<b>I.S. No. 2074-1979 (2074-1992)</b>	Ready mixed paint, air drying and oxide zinc chrome, priming.
108	<b>I.S. No. 6248-1979</b>	Metal rolling shutters and rolling grills.
109	<b>I.S. No. 7542-1990</b>	Specification for hot rolled steel sections for doors, windows and ventilators.
110	<b>I.S. No. 1608-1572</b>	Method for tensile testing of steel products.
111	<b>I.S. No. 4351-1976</b>	Specification for steel door frames.
112	<b>I.S. No. 1237-1980</b>	Specification for cement concrete flooring tiles.
113	<b>I.S. No. 1443-1972</b>	Code of practice for laying and finishing of cement concrete flooring.
114	<b>I.S. No. 2114-1984</b>	Code of practice for laying in-situ terrazzo floor finish.
115	<b>I.S. No. 2571 – 1970</b>	Code of practice for laying in-situ cement concrete flooring.
116	<b>I.S. No. 3462-1986</b>	Specification for unbacked flexible PVC flooring.
117	<b>I.S. No. 3622-1971</b>	Specification for sand stone.
118	<b>I.S. No. 3670-1989</b>	Code of practice for construction of timber floor.
119	<b>I.S. No. 5318-1969</b>	Code of practice for laying of flexible PVC sheet and tie flooring.
120	<b>I.S. No. 5766-1970</b>	Code of practice for laying of burnt day brick flooring.
121	<b>I.S. No. 278-1978</b>	Specification for galvanized steel barbed wire for fencing.
122	<b>I.S. No. 73-1992</b>	Specification for paving bitumen.
123	<b>I.S. No. 217-1988</b>	Specification for cut back bitumen.
124	<b>I.S. No. 1203-1978</b>	Method of testing tar and bituminous material. Determination of penetration.
125.	<b>I.S. No. 2720-1981 (All Parts)</b>	Method of test for soils.
126.	<b>I.S. No. 277-1992</b>	Galvanized steel sheet (plain && corrugated).
127.	<b>I.S. No. 458-1988</b>	Specification for pre-cast concrete pipes (with or without reinforced).
128.	<b>I.S. No. 459 –1992</b>	Corrugated and semi-corrugated asbestos cement sheet.
129.	<b>I.S. No. 1230 –1979</b>	Cast iron rain water pipes and fittings.
130.	<b>I.S. No. 1626 –1994</b>	Specification for Asbestos cement.
131.	<b>I.S. No. 3144 –1992</b>	Mineral wool thermal insulation materials, Methods o tests.
132.	<b>I.S. No. 427 –1965</b>	Distemper, Oil emulsion, colour as required.
133.	<b>I.S. No. 428- -1969</b>	Distemper, Oil emulsion, colour as required.
134.	<b>I.S. No. 2339 –1963</b>	Aluminium paint for general purpose in dual container.
135.	<b>I.S. No. 2932 –1994</b>	Enamel, Synthetic, Exterior (a) Under Coating (b) Finishing
136.	<b>I.S. No. 2933 –1975</b>	Enamel, Exterior (a) Under Coating (b) Finishing



137.	<b>I.S. No. 5410 –1992</b>	Cement Paint.
138.	<b>I.S. No. 5411 –1974</b>	Plastic emulsion, Paint Part – I for interior use.
139.	<b>I.S. No. 6278-1971</b>	Code of practice for white washing and colorwashing.
140.	<b>I.S. No. 419- 1967</b>	Specification for putty for use in window frames.
141.	<b>I.S. No. 774 – 1984</b>	Specification for flushing cistern for water closets and urinals.
142.	<b>I.S. No. 775- 1970</b>	Specification for cast iron brackets and supports for wash basins and sink.
143.	<b>I.S. No. 1703 –1989</b>	Copper alloy float valves for water supply fittings.
144.	<b>I.S. No. 1795-1982</b>	Specification for sand cast iron spigot and socket soilwaster and ventilating pipes, fittings and accessories reaffirmed.
145.	<b>I.S. No. 1795-1982</b>	Specification for pillar taps for water supply purposes.
146.	<b>I.S. No. 2326-1987</b>	Specification for automatic flushing cisterns for urinals.
147.	<b>I.S. No. 2556-1995 (All Parts)</b>	Specification for various sanitary appliances (Vitrous China).
148.	<b>I.S. No. 3989-1984</b>	Specification for centrifugally cast (iron) spigot and socket. Soil waster and ventilating pipes, fittings and accessories.
149.	<b>I.S. No. 4985-1988</b>	Specification for unplasticised PVC pipes for potable water supply.
150.	<b>I.S. No. 7231 – 1984</b>	Specification for plastic flusing cistern (valveless siphonic type) for water closets and urinals, reaffirmed (1990)
151.	<b>I.S. No. 13983-1994</b>	Stainless steel sinks for domestic purposes.
152.	<b>I.S. No. 778-1984</b>	Specification for cast copper alloy gate and checkvalves for water works.
153.	<b>I.S. No. 780-1984</b>	Specification for sluice valves for water works purposes.
154.	<b>I.S. No. 781 –1984</b>	Specification for cast copper alloy screw down bib taps and stop valves.
155	<b>I.S. No. 909-1992</b>	Specification for underground fire hydrant, sluice valve type.
156	<b>I.S. No. 2692-1989</b>	Specification for ferrules for water services.
157	<b>I.S. No. 4736-1986</b>	Hot dip zinc coatings on mild steel tubes.
158	<b>I.S. No. 651-1992</b>	Specification for salt glazed stoneware pipes and fittings.
159	<b>I.S. No. 1726-1991</b>	Specification for cast iron manhole covers and frames.
160	<b>I.S. No. 6241-1971</b>	Method of test for determination of aggregates impact value of soft coarse aggregates.
161	<b>I.S. No. 5604-1970</b>	Method of test for determination of aggregates impactvalue of soft coarse aggregates.
162	<b>I.S. No. 6313 (All Parts)- 1981</b>	Anti termite measures in buildings.
163	<b>I.S. No. 1038-1975</b>	Steel doors, windows and ventilators.

164	<b>i.S. No. 4021 – 1976</b>	Timber door, window and ventilator frames.
165	<b>I.S. No. 1904-1978</b>	Structural safety of buildings, shallow foundations.
166	<b>I.S. No. 3597-1966</b>	Method of test for concrete pipes.
167	<b>I.S. No. 4082-1977</b>	Stacking and storage of construction of materials at site.
168	<b>I.S. No. 3548-1966</b>	Glazing in buildings.
169	<b>I.S. No. 3370-1965 (All Parts)</b>	Concrete structures for storage of liquids.
170	<b>I.S. No. 783-1959</b>	Laying of concrete pipes.

N.B The various items to be used in the interior decoration work shall be to ISI standards. Wherever the items/ products do not have ISI mark/ standard, these shall be got tested for their quality etc. at the approved laboratory and the necessary testing, charges shall be borne by the contractor.

The above list is only for guideline of the tenderer. Any amendments/ addition/ decision/ substitution made by the Bureau of Standard as on date will have to be taken into consideration while executing the items.

**D.A.F.F.P.L.**  
**SHAHBAD, MOHAMMADPUR,**  
**IGI AIRPORT, NEW DELHI**

**Technical Specifications - Electrical & FA System**

Project : D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

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## **Section – A**

### **Special Conditions of Contract**

#### **1.0 General**

- 1.1 The complete Electrical, Low Voltage & Extra Low Voltage Installation shall be carried out in strict accordance with Regulations of **Indian Electricity Act and Rules of Electricity Supply Authority, Relevant Indian Standards with particular reference to IS 1944/1960 (Personal Hazard Fire Safety of Buildings), IS 1646/1961 (Electrical Installation of Fire Safety of Buildings), IS 5216/1969 (Guide for Safety Procedures and Practices in Electrical Work), IS 5908/1970 (Electrical Installation in Buildings, Method of Measurements), National Electrical Code Of Practice 2005, National Building Code of India 2005 (SP 7 : 2005 Part IV) and Fire Insurance Company insuring the building.**
- 1.2 The Special Conditions of Contract are an extension of and are to be read in conjunction with the General Conditions of Contract. Should there be any contradictory requirements in the two, the requirement as per the Special Conditions of Contract shall prevail.
- 1.3 The special conditions of contract are also meant to amplify the specifications, schedule of quantities & drawings. The most stringent of the above shall apply. Should there be any ambiguity or inconsistency, the Contractor should report the same to the **Owner / Architect / Consultant** and obtain clarification before submitting his tender.
- 1.4 **All Equipment, Material, Switchgear and Cables etc. shall be adequately rated to suit the climatic conditions experienced in Gurugram, Haryana**
- 1.5 Clause in this specification shall apply equally throughout

**2.0 Location of Site**

2.1 The site of works is located at **Gurugram, Haryana**

**3.0 Site Conditions**

3.1 All equipments shall be suitable for satisfactory operation at the following site conditions

3.2 Maximum +50° Celsius, 90% relative humidity

3.3 Minimum -5° Celsius, 90% relative humidity

**4.0 Scope of Work**

4.1 The work to be carried out under this contract comprises the **Supply / Installation / Testing / Commissioning of Electrical, Low Voltage & Extra Low Voltage System for 'Vatika Engineering Office at Gurugram, Haryana'**. The Contractor shall carry out & complete the said work under this contract in every respect in conformity with the current rules & regulations of the Local Electricity Authority, the Indian Standard Institution, Indian Electricity Rules & Act with the directions of & to the satisfaction of the **Owner / Architect / Consultant**. The Contractor shall furnish all labour & install all materials, appliances, equipment necessary for the complete provision and testing / commissioning of the Installation as specified herein and shown on the drawings (**including equipment supplied by Owner**). This also includes any material, appliances, equipment not specifically mentioned herein or noted on the drawings as being furnished or installed but which are necessary & customary to make complete installation properly connected & in good working condition. The work shall include all incidental jobs/minor Electrical works connected with electrical installation such as excavation in trenches & back filling, cutting / drilling and grouting etc.

**In general, the scope of Electrical work to be performed under this contract shall comprise of the following :**

**4.2 Supply of the following :**

4.2.5 MDBs, SDBs & DBs

4.2.6 Cables, Mains, Sub-Mains & Cable Trays

4.2.7 Point Wiring with MS Conduit & FR-LSH PVC Insulated copper wires, Switches & Receptacles

4.2.8 MS Raceway, MS Conduit & Wiring for Communication & Extra Low Voltage Services

4.2.9 Fire Alarm and PA System

4.2.10 Light Fixtures, Lamps & Tubes

4.2.11 Invertors and Batteries

**4.3 Receiving / Storing / Handling / Installation / Testing / Commissioning of the following :**

4.3.5 MDBs, SDBs & DBs

4.3.6 Cables, Mains, Sub-Mains & Cable Trays

4.3.7 Point Wiring with MS Conduit & FR-LSH PVC Insulated copper wires, Switches & Receptacles

- 4.3.8 MS Raceway, MS Conduit & Wiring for Communication & Extra Low Voltage Services
- 4.3.9 Fire Alarm and PA System
- 4.3.10 Light Fixtures, Lamps & Tubes
- 4.3.11 Invertors and Batteries
  
- 4.4 Sanction / Approvals including statutory approvals from the Local Authorities for the installation & load sanctions including energisation of Electrical Installation (If required).**
  
- 4.5 Preparation of Shop Drawings, As-built Drawings in Autocad-2004 / Autocad-2009 / Autocad-2010 / Latest Version, completion documents, maintenance manuals & list of maintenance spares**
- 4.5.1 Shop Drawings in Autocad-2004 / Autocad-2009 / Autocad-2010 / Latest Version
- 4.5.2 As-built Drawings in Autocad-2004 / Autocad-2009 / Autocad-2010 / Latest Version
- 4.5.3 Completion Documents
- 4.5.4 Maintenance Manuals
- 4.5.5 List of maintenance spares for various equipments as called for.
  
- 4.6 Increase or decrease in scope of work**
- 4.6.1 **The owner reserves the right to increase or decrease the scope of work on any or all items or to change the nature of work involved in any or all items or to completely delete any items of the Work under the Contract.** The Contractor shall not be entitled to claim for loss of anticipated profits, for mobilization of additional resources, or for any other such reasons on account of these change orders.
  
- 5.0 Stipulations and Deviations to Tender Clauses**
- 5.1 Tenderers are advised to submit quotations strictly based on the terms and conditions and specifications contained in the tender documents & not to stipulate any deviations. No deviations from the given Specifications shall be accepted after the decisions are communicated by owner. Tenderers are required to specify the list of makes proposed in the quotation.
  
- 6.0 Ordering**
- 6.1 As soon as possible after receiving written notification of the acceptance of his tender, the Contractor shall order all the materials and equipment required to complete the contract. He shall submit to the **Owner / Architect / Consultant** detailed summary of all orders placed. These should be submitted for approval before orders are placed and provided with the following details : name of supplier / vendor, make of equipment, date of order & forecast of delivery date at site.
  
- 7.0 Standard of Materials**

- 7.1 When the material and equipment is specifically described and named in the specifications, it is so named or described for the purpose of establishing a standard of materials & workmanship to which the Contractor must adhere. The Contractor may submit with his tender a list indicating any alternative make of equipment that he proposes to supply for the proposed installation only after approval & clearance of the **Owner / Architect / Consultant**. Should the Contractor install the material or carry out the method in question before receiving approval from the proper authorities, the **Owner / Architect / Consultant** may direct the Contractor to remove the material in question immediately. The fact that this material has been installed shall have no bearing or influence on the decision by the **Owner / Architect / Consultant**. All materials, condemned by the **Owner / Architect / Consultant** as not approved for use are to be removed from the premises & suitable material delivered & installed in their place at the expense of the contractor. During the tender stage, the Contractor shall be deemed to have submitted his tender based on all materials & equipment specified or shown on the drawings & no alternative manufacturer or supplier of such material & equipment specified or shown shall be acceptable. If however, the material or equipment specified or shown on the drawings is not available due to any genuine reason, the Contractor shall get the written approval of the **Owner / Architect / Consultant** for the particular material / equipment prior to order.
- 7.2 The Contractor shall be responsible for the safe custody of all material including supplied by owner & shall insure them against theft, damage by fire, earthquake etc. A list of materials & equipment, together with a sample of each shall be submitted to the **Owner / Architect / Consultant** as directed by him within 30 days of the award of the contract.
- 7.3 All materials required for the works shall be new & the best of their respective kinds and shall be of uniform pattern. All materials are to be suitable for use in temperatures of 40-50 degree centigrade with comparative humidity.
- 7.4 The protective finishes must be provided on all materials and apparatus used on this contract to ensure that no deterioration is caused by the local climatic conditions. All materials shall be inspected by the Contractor to ensure that finishes are in accordance with the specifications.
- 7.5 All holes in Panels, Distribution Boards & similar equipment shall be blanked off to protect from dust & vermin. Where ventilation is necessary, holes are to be neatly covered. All cable entry holes on Switchgear and similar equipment shall be fitted with PVC / rubber bushing.
- 8.0 Workmanship**
- 8.1 The workmanship and method of installation shall conform to the best Engineering and Standard Practice. All work shall be performed by skilled tradesman and to the satisfaction of the **Owner / Architect / Consultant**. Helpers shall have qualified supervision.
- 8.2 Any work that in the opinion of the **Owner / Architect / Consultant** which does not conform to the best standard practice, shall be removed and reinstated at the contractor's expense. Permits certificates & licenses must be held by all tradesman for the type of work in which they are involved & where such permits certificates and licenses exist under government legislation.
- 9.0 Safety Site**
- 9.1 Contractor shall install and maintain any and all temporary lighting, access ways, and/or safety precautions (such as guard rails, temporary coverings for holes in floors etc.) that are deemed necessary for the efficient & safe execution of the works. In the event of disagreement as to the type or extent of such temporary lighting, access way, and/or safety precautions, the **Owner's** decision shall be final and binding. Lack of any direction or instruction by the **Owner's** shall not release Contractor from his responsibilities and obligations under this clause.



9.2 Contractor shall include cost for all items mentioned in clause 9.1.

**10.0 Hoisting, Transportation and Scaffolding etc.**

10.1 Contractor shall include for his own unloading & hoisting of materials & equipment, own scaffolding, rigging and access equipment and clean up rubbish disposal.

**11.0 Procedure**

11.1 Throughout all stages of work, the Contractor shall maintain a close liaison with the **Owner / Architect / Consultant** and with all other contractors involved in the work.

11.2 Site work shall commence immediately and shall proceed expeditiously and in harmony with the building work so as not to delay any particular agency in any way. All Plant / Equipment to be supplied and work to be done under this specification shall be manufactured and executed in the manner set out in the specification or where not so set out to the reasonable satisfaction of the **Owner / Architect / Consultant** and all the contractors works on site shall be carried out in accordance with such reasonable directions as the **Owner / Architect / Consultant** may give.

**12.0 Permits**

12.1 The Contractor shall obtain all necessary permits prior to work commencement for the excavation of Cable Trenches & Earth Stations etc. in areas where it is suspected that existing services are present. The Contractor shall carry out excavation work by hand. He shall also obtain the necessary permits from the respective authorities prior to working on major items of the High Side Installation. All application permits shall be made in writing with a copy to the **Owner / Architect / Consultant**.

**13.0 Liaisoning**

13.1 **The Contractor shall be responsible for Liaisoning with the Local, State & Central authorities. Charges towards Liaisoning are deemed to be included in tender rates. Liaisoning shall include but not limited to following activities :**

13.1.1 **Submission of Application for load sanction and obtaining the principal load sanction.**

13.1.2 **Arranging inspection of HT metering room by Supply Co. officials, installation of HT meter and allied electrical works.**

13.1.3 **Arranging energisation of installation with power from Supply Co.**

13.1.4 **Obtaining the final load sanction after submitting required documents.**

13.1.5 **Obtaining approval from Electrical Inspectorate for Electrical Installation including pertaining to HVAC, Plumbing & Fire Fighting.**

13.1.6 **Any other statutory approvals as required.**

13.1.7 **The Contractor shall be reimbursed on documentary proof, any statutory payments made in connection with carrying out above activities. The quoted rates shall be inclusive of carrying out all the above activities and nothing extra shall be payable on the above account.**

**14.0 Temporary and Trial Usage**

**Project : D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI**

- 14.1 It shall be understood and agreed that temporary and trial usage by the employer of any device, machinery, apparatus, equipment or any other work or materials supplied under this contract shall be available before final completion. It is further understood and agreed that the Owner shall have the privilege of such temporary and trial usage as soon as the Contractor shall claim that the said work is completed & in accordance with the drawings & specifications & to the manufacturer's instructions and for such reasonable length of time as the **Owner / Architect / Consultant** shall deem suitable for making a complete and through test of the apparatus, equipment or system under test.
- 14.2 No claim for the damage will be made by the Contractor for the injury to or breaking of any parts of the works which have been placed under test whether this damage has been caused by weakness, flaw or inaccuracy of structural parts or by defective material or workmanship of any kind whatsoever.
- 15.0 Cleaning**
- 15.1 The contractor shall ensure that all parts of the building are left in clean and tidy condition during execution of works. Upon completion of the contract and before operating any of the systems, the Contractor shall also clean out rubbish and dirt from the entire area.
- 16.0 Setting Out of Works**
- 16.1 The Contractor at his own expense shall set out all his works and take all measurements and dimensions required for the erection of his equipment & materials on site. Modifications if any which may be found necessary during the progress of the work shall be submitted in detail to the **Owner / Architect / Consultant** before proceeding with the works and Contractor must allow in his tender for all such modifications and for the provision of any sketches or drawings related thereto.
- 16.2 The position of all Panels, DBs, Cable Routes, Cable Trays, Raceway / Trunking, Wiring Systems, Control Switches, Service Outlets and Fixtures etc. shown on the drawings are to be assumed as being correct for the purpose of tendering. Final positions of these must be agreed with the **Owner / Architect / Consultant** & co-ordinate with all other agencies before installation.
- 16.3 The data given here in 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.
- 17.0 Drawings**
- 17.1 Contract Drawings duly signed by the Architect are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the structural, architectural & other services drawings and the direction of the **Owner / Architect / Consultant**.
- 17.2 Structural drawings shall take precedence over Architectural drawings, which in turn shall take precedence over Internal and External Electrical and Low Power Installation drawings and other services drawings in regard to all dimensions.
- 17.3 The Contractor shall examine all architectural, structural, services drawings & verify all dimensions as built at the Site before start of work & bring to the notice of the **Owner / Architect / Consultant** discrepancies if any. Any changes found essential to coordinate the installation of the Internal & External Electrical and Low Power Works with other installations shall be made with prior approval of the **Owner / Architect / Consultant** only.
- 18.0 Reference Drawings**
- 18.1 The Contractor shall maintain on site one set of all Drawings issued to him for reference.

**19.0 Conduit Layout**

19.1 Prior to fixing and laying of the conduits, the Contractor shall submit to the **Owner / Architect / Consultant** detailed layout plans of the conduit network & get the same approved before proceeding with the works. The layout plan shall contain particulars regarding size and routes of these conduits, location of junction & inspection boxes provided along the routes of these conduits.

**20.0 Revised Shop Drawings & Quantity Variation Statement**

20.1 For revised shop drawings whenever changes are indicated or shop drawings are made to indicate changes in layout, the particular drawing work shall be carried out within one week of approval of all the relevant shop drawings.

20.2 Along with revised drawings the contractor shall also submit two copies of a comprehensive variation in quantity statement to the **Owner / Architect / Consultant**.

**21.0 Manufacture's Instructions**

21.1 Specific instructions furnished by the manufacturer's relating to the equipment and materials used in this project shall be followed strictly in case these are not mentioned in the document.

**22.0 Guarantee**

22.1 At the close of the work and before issue of the final certificate of virtual completion, the Contractor shall furnish written guarantee indemnifying the **Owner / Architect / Consultant** against defective equipment / material and workmanship for a period of 12 months. The Contractor shall hold himself fully responsible for reinstallation or replacement to owner, the following :

22.1.1 Any defective work or material supplied by the contractor.

22.1.2 Any material or equipment damaged or destroyed as a result of defective workmanship by the contractor.

**23.0 Safety of Materials**

23.1 The Contractor shall provide proper and adequate storage facilities to protect all materials and equipment, including those issued by the owner against damage from any cause whatsoever. The contractor shall also be responsible for making inventory of material supplied by the owner at the time of receiving the same. Any deficiencies in the material supplied by the owner shall be immediately brought to be notice of the **Owner / Architect / Consultant**.

**24.0 Security**

24.1 Contractor shall be held entirely responsible for the security and the protection of their works at all times inclusive of non working hours. They shall be deemed to have included for all costs associated therewith. This clause shall enhance and complement clause of the General Conditions of Contract.

**25.0 Completion Certificate**

25.1 On completion of the electrical installation, a certificate shall be furnished by the Contractor countersigned by the Site Engineer, under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form as required by the local Supply Authority / Owner. **The Contractor shall be responsible for getting the whole electrical installation, inspected and approved by the local authorities concerned. Any drawings / documents required for this purpose shall be prepared & submitted to the concerned authorities by the Contractor.** This is irrespective of the fact whether equipment is owner supplied, contractor supplied or supplied by any other agency.

## 26.0 Engineer and Foremen

- 26.1 The Contractor shall employ competent, fully qualified full time Electrical Engineers & Licensed Foremen to direct the work of Electrical, Low Voltage & Extra Low Voltage Installation in accordance with drawings & specifications. The Electrical Engineers and Foremen shall be available full time on site to receive instructions from the **Owner / Architect / Consultant** or his nominee in the day to day activities throughout the duration of the contract. The Electrical Engineers and Foremen shall correlate the progress of work in conjunction with all relevant requirements of the supply authorities. In case the Contractor needs to replace or change his Electrical Engineers or Foremen, he shall obtain prior approval of the **Owner / Architect / Consultant** before doing so.
- 26.2 As evidence of his intentions, **the tenderer is required to submit with his tender manpower details with list of all Engineers, Foremen, Technicians & Electricians** to be employed on this contract giving details of their qualifications and experience to the satisfaction of **Owner / Architect / Consultant**.
- 26.3 The **Owner / Architect / Consultant** may demand at any time during the contract the replacement of the contractor's personnel who fail to satisfy this requirement of competence.

## 27.0 Specifications and Schedule

- 27.1 The specification and schedule of rates shall be considered as part of this contract & any work or materials shown on schedule & 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 the fixtures, controlling switches, wiring system etc. & are essentially diagrammatic and for guideline purposes.

## 28.0 Tools and Equipment

- 28.1 The Contractor shall provide all necessary tools, portable power tools, test equipment etc. which will be required in order to carry out the electrical works. This shall also include scaffolding required for any particular purpose in the installation.

## 29.0 Site Conditions

- 29.1 The Contractor shall take all necessary action to acquaint himself fully with site conditions. Any claim resulting from the Contractor not being aware of site conditions after tendering will not be accepted.
- 29.2 After the contract is awarded, the Contractor shall acquaint himself fully with existing services and obtain all necessary information to avoid any damage to the services during excavation etc.

## 30.0 Labels and Notices

- 30.1 Identification name plates shall be fixed on all switch-gear. These will identify the sub-station and / or out going ways. The labels shall be made of indestructible not-deteriorating material with lettering engraved in black on white background except where otherwise specified. Fixing shall be by means of rivets or screws in addition to any adhesive employed. All labels shall be English / Hindi as directed by the **Owner / Architect / Consultant**. All feeder pillars & mini feeder pillars in addition to identification labels shall have each way identified by a label to the same specification fitted in the feeder pillar. An indestructible "Danger 415 Volts" plates should be fitted externally with a double flash danger signal. The letters to be 12mm height minimum in signal red.

30.2 In addition, each distribution board shall have a chart detailing particulars of the circuits controlled which shall be fixed to the inside of the door. The details shall include the circuit load, description, the type and rating of the protection device and cable size. A sheet of transparent rigid plastic shall be used to completely cover the chart to prevent damage.

### **31.0 Packing and Receipt of Material**

31.1 The Contractor shall take every possible measure including an appropriately strong packing, proper supervision of loading and off loading and proper transportation by the most suitable route to ensure the safe delivery to site of plant and equipment. The Contractor shall keep on site up-to-date record of all materials received & fully annotated with details of the carrier and condition of equipment on arrival.

### **32.0 Recording of Work**

32.1 The Contractor shall keep a register and a set of drawings recording the progress of the works and details of all instruction received. These shall be available for the **Owner / Architect / Consultant** upon request. The contractor's site representative will submit a written report every two weeks outlining the progress of the work including work completed to date.

### **33.0 Painting and Finishing**

33.1 The following requirements shall be complied with unless otherwise specified :

33.1.1 Machined surfaces of plant and equipment which are to be left bright shall be suitably protected against rust before dispatching from manufacturer's works. Metal parts which are to be painted, shall before painting commences, be cleaned of all rust, scale, oil and other foreign matter by sand paper / wire brushes and shall be subject to approval of the engineer.

33.1.2 Before leaving manufacturer's work, all plant shall be treated to prevent rust special finishes, such as may be required on externally mounted and exposed equipment as described in the relevant clauses.

33.1.3 After erection of equipment on site, any damaged or defaced paint finish and other surfaces prone to deterioration shall be suitably treated and / or restored to prevent further deterioration.

33.1.4 The Contractor shall make sure that no salt, dust or other foreign matter comes into contact with base metal or freshly treated surfaces about to be painted and shall erect shelters or adopt such other approved measures as may be required by the **Owner / Architect / Consultant**.

### **34.0 Marking Out**

34.1 Routes and positions of systems as well as positions of all electrical equipments shall be marked out by the Contractor and approved by the engineer before such items are installed.

34.2 These items shall be installed in the positions shown on the drawings but reasonable variations may be made on site with the consent of the **Owner / Architect / Consultant**.

### **35.0 Fixing**

35.1 Screws fixing in brick, concrete or similar materials which necessitates plugging shall be made using steel wood screws into plugs in rotary drilled holes.

35.2 Items of switch gear, cable racks and trays etc. shall be fixed using corrosion resistant steel bolts ritted with expanding collars, e.g. 'Rawlbolts' set into rotary drilled holes of the correct size.

### **36.0 Contractor's Rates**

36.1 **The contractor's rates must include the cost of transportation, freight and insurance of materials to the site, loading, unloading, handling, supplying, fixing, testing, commissioning as required & placing in position all items of work intended to be operated in the BOQ or otherwise.**

### **37.0 Owner / Architect's / Consultants Decisions**

37.1 Matters not covered by the specification given in the contract as a whole shall be covered by the relevant ISI codes. If such codes for a particular subject have not been framed, the decision of the **Owner / Architect / Consultant** shall be final.

37.2 The work shall be carried out under the direction and supervision of the Architects or their representative at site who shall guide the owner from time to time. The Contractor shall intimate the name of his representative who would be supervising the construction & would be responsible for taking instructions for carrying out the work.

37.3 The Architects or their representatives at site shall have access to the workshops of the successful tenderers so as to ensure themselves of the quality of material and workmanship.

37.4 The **Owner / Architect / Consultant** decision with regard to the quality of material & workmanship will be final and binding, any material rejected by the **Owner / Architect / Consultant** shall be immediately removed by the contractor.

### **38.0 Defects Liability Period**

38.1 This period shall be in force from the date of "virtual completion" & **minor defects if any shall be corrected / rectified within 24 hours and major defects within 3 days which shall develop during this period.** However, if the same are not rectified by the Contractor within the period mentioned above the Owner with the concurrence of the **Owner / Architect / Consultant** shall get the work done at the risk and cost of the contractor. **The duration of defects liability period shall be 12 months.**

### **39.0 Occupying Part Areas**

39.1 If the owner wants to occupy areas in part, the Contractor shall have to complete the work of these areas in consultation with the owner and hand over the same to the Owner without affecting any of the clause of the contract agreement.

### **40.0 Rate only Items, Non Tendered / Extra Items and Quantities Exceeding the Tendered Quantities**

40.1 For all the above-mentioned items, a **written variation & change order signed by the Owner's Representative & Architect / Consultant has to be immediately obtained before procurement & execution. No payments will be entertained without the written variation order signed by Owner / Architect / Consultant.** The onus shall be on the Contractor to obtain such prior written variation order from the **Owner's Representative and the Architect / Consultant.**

### **41.0 Extra Items**

41.1 Rates for all extra items shall be derived from similar items existing in the tender as far as possible. Rates for extra items shall be based on market rates FOR Site including all trade discounts as well as agreed overheads and profits. These extra items shall be submitted along with rate analysis & all supporting documents as per enclosed format.

**Format for Extra Items**

#	Description	Rate (Rate analysis to be enclosed)	Qty	Authorized by	Special Remarks

- **Enclosure**

- Check list (All documents as per check list to be enclosed).
- Rate Analysis
- Supporting documents on which rate analysis is based.
- Photocopy of instructions issued by appropriate authority for executing the extra items.

- **Check List for Extra item rate approval**

- Photocopy of extra item clause for agreed overhead and profits.
- Photocopy of Invoice / Price List & discount valid on the date of LOI (Particular item to be highlighted)
- Reasons for executing the extra items. (Any items for which rate exists in the tender the same shall not be covered under extra item). This should be mentioned under the column of special remarks.
- Photocopy of instructions issued by authority instructing the execution of extra items.
- In case the rate for similar item exists in the tender, the same must be derived from the tender.

**42.0 Site Instruction Book / File**

42.1 Contractor shall be required to maintain a site instruction book / file to enable the **Owner / Architect / Consultant** or their representatives to record instructions given to contractor from time to time. Please note no drawings shall be issued for minor modifications / additions. Details shall be given in the form of instructions at site and shall be written in the site instruction book.

**43.0 Professional Integrity and Team Spirit**

43.1 It is the intent of the **Owner and the Architect / Consultant** that this Project will be executed in a spirit of teamwork & full professional integrity. The Contractor shall fully co-operate with all agencies concerned to fulfill this objective.

**44.0 Quality Assurance and Control Programme**

44.1 The Contractor shall establish an effective quality control system at the Site & implement the same through an independent team consisting of the Contractor's Representative & qualified & experienced engineers and technical personnel to enforce quality control on all items of the Work and the Project at all stages.

**45.0 Entry to the Site**

45.1 The **Owner** at his discretion has the right to issue passes to control the admission of the Contractor, his agents, employees and work people to the Site of the Work or any part thereof. Passes shall be returned at any time on demand by the **Owner**. The contractor shall follow all site related regulations especially concerning security and safety laid down by the **Owner**.

**46.0 Fire Precautions**

46.1 The Contractor shall take all precautions and preventive measures against fire hazards at the Site and shall assume full responsibility for the same.

**47.0 Accessibility**

47.1 The Contractor shall verify the sufficiency of the size of the shaft openings and suspended ceilings for proper installation of his piping. His failure to communicate insufficiency of any of the above, shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment that must be serviced, operated or maintained in fully accessible positions.

**48.0 Submittals by Electrical Contractor**

**48.1 SHOP DRAWINGS :** The Contractor shall prepare & submit to the **Owner / Architect / Consultant** for his approval detailed shop drawings of all cable tray layout Conduit Layout, Distribution System, Circuit Details, Special Pull Boxes and any other requirement within stipulated period.

48.1.1 Shop Drawings for Lighting, Small Power, Cable Tray / Trunking and Voice/Data System layout.

48.1.2 General Arrangement Diagrams.

- General Arrangement Diagrams of Panels shall include front, side, top & bottom view, sectional view, outline and dimensions, voltage, bus capacity, circuit breaker details and their arrangement / sizes.
- Typical control schematic diagram for each type giving designation to be referred on SLD.
- Terminal block details for all feeders for internal wiring connections.
- Bill of material giving make / rating / catalogue number of all components of the complete switch board.

**48.2 Makes of Materials and their Samples**

48.2.1 List of make of materials proposed to be used from the approved options.

48.2.2 Samples of material for approval.

**48.3 Inspection, Testing and Commissioning to be carried out by Electrical Contractor**

48.3.1 **All testing/commissioning shall be carried out in accordance with the specifications & test results shall be submitted in proper formats. Please note if test results are not submitted, payments for this stage and beyond shall not be released.**



48.3.2 **The Contractor shall also perform all such tests as may be necessary and required by the Owner / Architect / Consultant to ensure quality of the executed works and by local authorities to meet Municipal & other bye-laws, regulations in force. The Contractor shall provide all labour, testing equipment, materials etc. required for the performance of the tests. The contractor shall if so required by the Owner / Architect / Consultant, get any material tested at the laboratories approved by the Owner / Architect / Consultant at the cost of the contractor**

**48.4 Commissioning Report with all Test Results as required by Owner / Consultant**

48.4.1 On completion of installation, all tests shall be carried out in accordance with details mentioned in the specifications and shall be recorded in proper formats.

48.4.2 After successful completion of all tests, the commissioning report shall be duly signed by the Contractor / his representative as well the Site Manager and handed over to the **Owner / Architect / Consultant**.

**48.5 Progress Reports by Electrical Contractor**

48.5.1 The Contractor shall prepare weekly / monthly reports of planned and actual progress of the Work and the subsequent weekly / monthly scheduled work along with manpower details. These will also include material procurement status. These reports shall be submitted to **Owner's Representative** & shall be reviewed during the co-ordination meeting.

48.5.2 The Contractor shall submit monthly report along with monthly bills.

48.5.3 **Further progress charts and schedules shall be prepared by the Contractor as directed by the Owner / Architect / Consultant.**

**49.0 Completion Drawings**

49.1 At the completion of the works & before issuance of the certificate of virtual completion, the Contractor shall submit to the **Owner / Architect / Consultant** layout drawings drawn at approved scale indicating the complete Electrical And Low Power System as installed. These drawings shall be complete in all respects as desired by the Owner / Architect / Consultant and must provide the following information in particular :

49.1.1 Lighting, Small Power, Voice / Data and other misc. layouts giving details of location and rating of Switches / Receptacles along with necessary controls.

49.1.2 Conduiting / Raceway / Trunking Layouts along with details of run and size of conduits, inspection, junction and pull boxes.

49.1.3 Circuiting details in Lighting and Small Power drawings along with sizes of conductors.

49.1.4 Location of Distribution System Details / Charts for each individual DB in prescribed format.

49.1.5 Main & Sub-main Cable Layouts along with details of cable trays, location of all Panels, Distribution Boards and other particulars

49.1.6 Details of all single line diagrams and general arrangement diagrams.

49.1.7 Complete wiring diagram as installed & schematic drawings showing all connections in the complete Electrical and Low Power System.

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49.1.8 External layouts, particulars of all Cables & their routes, details of Earth Stations, size of all earthing conduction and Manholes etc. along with all equipment layout.

49.1.9 No. of sets required shall be as follows :

- White Prints (A0 / A1 size) : 3 Sets
- DVD / CDs : 3 Nos

49.1.10 All drawings shall be prepared on Acad Release 2004 / Acad Release 2009 / latest version.

- In addition to the above, Main SLD and Block diagram duly framed in A0 / A1 size to be mounted in LT Panel Room as required by Consultant.

### **50.0 Completion Document / Manuals**

50.1 All Completion Documents related to handing over shall be submitted before issuance of the certificate of Virtual Completion. Details of Completion Documents required shall be as follows :

50.1.1 As built Drawing along with final SLDs and GADs on ACAD Release 2004 / Acad Release 2009 / latest version (A0 / A1 size)

50.1.2 Commissioning Report duly filled and signed by Contractor.

50.1.3 Test Reports for all Electrical Equipment, Panels, Cables and Wires etc.

50.1.4 Electrical installation certificate duly signed by Contractor.

50.1.5 List of spares for two years maintenance along with necessary catalogues & addresses, telephone numbers and contact names of all particular vendors.

50.1.6 SLD Charts framed and fixed near all Panels as required by **Owner / Architect / Consultant**.

50.1.7 Proper Balancing of system along with Records as soon as site is operational.

50.1.8 One original set & two photocopied sets of operating and maintenance manuals which shall include brief description of the entire Electrical & Lower Power system, maintenance & operating instructions along with necessary circuit diagrams as well as catalogues, manufacturer's drawings, performance data and warranty cards. These manuals are to be duly approved by the **Owner / Architect / Consultant** before submitting them to the Owner.

### **51.0 Training of Owner's Personnel**

51.1 The Contractor shall train the Owner's Personnel to become proficient in operating the equipment installed. Training shall be done before the expiry of the defects liability period.

51.2 Training for major equipment shall be arranged by the Contractor at manufacturers' works at no extra cost.

51.3 The period of training shall be adequate and mutually agreed upon by the **Owner and Contractor**.

51.4 The Owner's Personnel shall also be trained for routine maintenance work adjustments, testing, minor repairs and replacement.

51.5 No extra charges shall be paid to the Contractor for training the Owner's personnel.

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- 51.6 All necessary support shall be rendered by Contractor to Owner for Training as well as Service during Defects Liability Period

## **Section – 1**

### **Technical Specification for MV Panels and Distribution Boards**

#### **I. General**

##### **1.00 Work Included**

- Panel Board Enclosures, Switch Gear and Accessories
- Internal wiring, control terminal blocks, name plates / labels and painting

##### **2.00 Related Work and Obligations**

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements, which may affect work of this section.
- Co-ordinate works with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

##### **3.00 General Requirements**

- This specification covers requirements for Supply, Erection, Testing & Commissioning of MV Panel Boards. The equipment offered by the Contractor shall be complete in all respects. Any material and component not specifically stated in this specification but which is necessary for trouble free operation of the equipment and accessories specifically excluded. All such equipment / accessories shall be supplied without any extra cost. Also, all similar components shall be interchangeable and shall be of the same family type and rating for easy maintenance and low spare inventory.

#### **4.00 Codes and Standards**

- Compliance with all applicable Indian / International standards, Indian Electricity Act and Indian Electricity Rules.
- IS 5 : Colors for ready-mixed paints and enamels.
- IS 375 / 1963 : Making & arrangement for switchgear, Busbars, main connections & auxiliary wiring
- IS 694 : PVC insulated cables for working voltages up to & including 1100V
- IS 13779 : A.C. Static Electricity Meters
- IS 1248 : Electrical Indicating instruments
- IS 1567 / 1960 : Metal clad switches (Current rating not exceeding 100A)
- IS 1951 / 1916 : Polyvinyl chloride sleeving for electric purposes
- IS 2147 / IS 12063 : Degree of protection provided by enclosures for low voltage switchgear and control gear.
- IS 2675 / 1966 : Enclosed distribution fuse boards & conduits for voltage not exceeding 1000 Volts
- IEC 60947 / IS 60947 (Part-2) : A.C. Circuit Breakers
- IS 8828 : Miniature Circuit Breakers
- IS 12640 : Residual Current Operated Circuit Breakers
- IS 2448 / 1962 : Adhesive insulating tapes
- IS 2551 : Danger Notice Plates
- IS 2705 : Current Transformers
- IS 2208 / 1962 : HRC Cartridge fuses links up to 650 Volts
- IEC 60947 / IS 60947 (Part-4, Sec-1) : Contactors & motors starter for voltages not exceeding 1000 V AC or 1200 V DC
- IS 60947 (Part-5, Sec-1) : Control Circuit Devices and Switching Elements
- IS 60947 (Part-1 & 5) : Actuators, Indicators
- IS 60947 (Part-1 & 5) : Timers

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- IEC 60947 / IS 60947 (Part-3) : Switch Disconnecter Fuse, Changeover Switches
- IS 3043 : Code of practice for earthing
- IS 3072 : Installation and Maintenance of switchgear
- IS 3202 : Code of practice for climate proofing of electrical equipment
- IS 3231/ IS 8686 : Electrical relays for power system protection
- IS 4237 : General requirements for switchgear & control gear for voltages not exceeding 1000 V
- IS 5082 : Wrought Aluminum & Al alloy for electrical purposes
- IS 6875 : Switches and push-buttons
- IS 8623 (Part-1) : Specification for factory built assemblies of switchgear and control gear for voltages up to & including 1000 V AC
- IEC 439 – 1 : Requirements for Type Tested & Partially Type Tested Assemblies
- IS 13703 (Part-2) : HRC Cartridge fuses
- IS 10118 : Code of practice for selection, installation and maintenance of switchgear and control gear
- IS 11353 : Guide for uniform system of marking & identification of conductors and apparatus terminals
- IS 12021 : Specification of control transformers
- Equipment inline with any other authoritative / internationally recognized standards such as IEC, British, USA and German etc. shall also be considered if it ensures performance equivalent or superior to Indian Standards. Prior approval shall be obtained from Consultant for use of this equipment / material. In such cases, the decision of Consultant shall be final and binding.

**5.00 Quality Assurance**

- Manufacturers regularly engaged in manufacture of panel boards and enclosures of types, sizes and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- Installation shall be carried out by a firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.

**6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.
- The Panel Boards shall be guaranteed against trouble free operation, defective workmanship, materials and design for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning, whichever is earlier. Any defects during this period shall be rectified free of cost.

## 7.00 Submittals

- Contractor to submit general arrangement diagrams with front, side, top & bottom view and inside view.
- General arrangement diagrams shall include outline and dimensions, voltage, main bus capacity, circuit breaker details and their arrangement / sizes.
- All drawings shall also indicate location / description of all operating / indicating components mounted on the front / rear of the panel for all feeders / starters.
- Typical control schematic diagram for each type giving designation to be referred on Single Line Diagram.
- Terminal block details for all feeders / starters power and control terminals provided for external as well as internal wiring connections.
- Panel board foundations with necessary dimensions.
- Details of shipping sections along with all dimensions.
- Bill of material giving make / rating / catalogue number of all components of the complete switch board.
- Shop drawings to scale of the room layout indicating the panel location.

## 8.00 Delivery

- All panels shall be carefully packed to avoid damage during transit. Panel boards shall be wrapped in polyethylene sheets for local shipment; whereas for outstation delivery, in addition to polyethylene sheet, the panels shall be packed in wooden crates to prevent damage to the finish.

## II. Products

### A. Panel Board Enclosures and Accessories

#### 1.00 Constructional Details of Panel Boards

- All Panel Boards shall be metal enclosed, indoor, floor / wall mounted, free-standing type.
- **All Switchboards frames and load bearing members** shall be fabricated using suitable mild steel structural sections or pressed & shaped CRCA sheet steel of thickness **not less than 2.0mm**. Frames shall be enclosed in CRCA sheet steel of thickness **not less than 2.0mm**. **Doors and covers** shall also be of CRCA sheet steel of thickness **not less than 1.6mm**. Stiffeners shall be provided wherever necessary. Rear doors shall made of **min 2.00 mm thick** CRCA, sheet steel and provided with three pin handle and lock.
- All panel edges & cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that these do not permanently bulge / bend by the weight of maintenance personnel working on it.
- The complete structures shall be rigid, self-supporting and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.

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- All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP : 52 as per IS : 2147.
- All cutouts shall be provided with synthetic rubber gaskets. The gaskets, wherever specified, shall be of good quality synthetic rubber with good aging, compression & oil resistance characteristics suitable for panel applications. Preference shall be given to Heat resistant – EPDM Gaskets.
- All Switchboards shall be of **uniform height not exceeding 1000 mm** unless otherwise mentioned / approved in general arrangement diagrams submitted by Contractor during detailed engineering.
- The minimum and maximum operating height shall be **400 mm** and **1800 mm** respectively. Height of Indicating instruments shall not be more than **1900 mm**. Measuring devices requiring visual supervision shall not be mounted above **1600 mm** from floor level.
- Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary provision for fixing to foundation / floor as required. The base frame height shall be such that floor finishing to be done by Owner after erection of the switchboards does not obstruct the movement of doors and cover etc.
- All Panel Boards shall be divided into vertical section, comprising of various compartments as mentioned below. However, these **compartments may be combined in case of Sub-Distribution Board.**

**1.01 Busbar Compartment**

- A completely enclosed bus bar compartment shall be provided for the horizontal & vertical Busbars. Bolted covers shall be provided for access to horizontal & vertical Busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. All Busbars shall be in separate compartment. Covers shall be provided with name plates indicating “Danger - Bus Bars” on it. Colour of the plate shall be White with letters in Red of danger name plates shall be inscribed with 6 mm size lettering.
- Shrouding shall be provided for Bus Bar with current rating above 2000 A. These shrouds located near conductors shall be made using non magnetic materials.

**1.02 Switchgear / Feeder Compartment**

- All equipment associated with an incomer or outgoing feeder shall be housed in a separate compartment of the vertical section. The compartment shall be sheet steel enclosed on all sides. The front of the compartment shall be provided with the hinged single leaf door with “Master Key” lock. **The feeders compartment door shall have two number anodized inscription plates. One inscription plate shall bear the feeder number & feeder rating and fixed to the door with rivets. The other inscription plate shall bear the feeder name and shall be fixed by screws. The feeder name plates shall be interchangeable.**

**1.03 Harmonic Filter Compartment**

- Space shall be provided LT Panel for installing Harmonic Filter. The Filter shall be selected at a later stage after the building is occupied & Harmonic analysis is done by competent agency.

**1.04 Cable Compartment or Cable Alley**



- **A full-height vertical cable alley of minimum 300mm width shall be provided for power & control cables.** Cable alley shall have no exposed live parts and shall have no communication with Busbar compartment. Cable terminations located in cable alley shall be suitably shrouded to prevent accidental contact by falling of tools etc. It shall be of such construction as to allow cable cores with lugs to be easily inserted in the feeder compartment for termination. The Contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged. Cable alley door shall be provided with name plates indicating "Cable Alley" on it.

#### 1.05 **Control Compartment**

- A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.
- Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboards, except for the horizontal Busbar compartment. Synthetic rubber gasket shall be provided between the panel sections to avoid ingress of dust into panels. Each shipping section shall have full metal sheets at both ends for transport and storage.
- After isolation of power and control circuit connections, it shall be possible to safely carryout maintenance in a compartment with the Busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section, insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.
- All 415 V switchgear (circuit-breaker) panels shall be of single-front type. All Panels shall also be of single-front construction. All single-front switchboards shall be provided with single-leaf, hinged or bolted covers at the rear. The bolts shall be of captive type. The covers shall be provided with 'Danger' labels. All panel doors shall open by 90deg. or more. The panel door shall be openable only after switching of the incoming power supply.
- Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the Busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live.
- All equipment and components shall be neatly arranged & shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to Consultants approval and shall be provided with Bakelite shrouding.
- The tentative power and control cable entries (top/bottom) required are indicated in the "Bill Of Quantity". However, the Owner / Consultant reserves the right to alter the cable entries, if required during detailed engineering, without any additional commercial implication.
- Each switchboard shall be provided with un-drilled, removable type gland plate, which shall cover the entire cable alley. Contractor shall ensure that sufficient cable glanding space is available for all the cables coming in a particular section through gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall be provided with gasket to ensure enclosure protection.

- The switchboards fed from indoor transformers will be flange connected to the same and shall be located as close as desirable to the transformers. The switchboards fed from outdoor transformers shall be connected through cables as indicated in the "Bill Of Quantity". Busduct connections wherever applicable shall be preferably in a straight line alignment. The Centre line of the Busduct will be finalized during detailed engineering.

#### **1.06 DC Control Bus & Power Pack**

- Irrespective whether specified in the BOQ or not DC copper control bus minimum 4 sq mm in size shall be provided with a dedicated power pack if DC control circuits are required in the panel. The power pack shall have 300 watt output. 150 watt of this output shall be backed with a battery for 15 minutes. Balance 150 watts shall be without battery back up.
- The vendor shall calculate the burden of DC components. In case the burden of DC control components as envisaged in the scheme is more than the minimum specified, he shall provide power pack accordingly. If the control scheme requires more than one DC voltage, each DC voltage shall be provided through a separate control bus and dedicated power pack.

#### **1.07 Gland Plates**

- **Gland plates for 2 Core, 3 Core, 3½ Core, 4 Core Cables shall be 2.5 mm thick CRCA zinc passivated. Thickness of zinc passivation shall be 100 microns. Wherever the size of gland plates exceeds 600 mm, same shall be split into two parts & provided with adequate supporting arrangement. Earth continuity between cable armour & panel body shall be maintained.**
- **For Single core cables 3.00 mm thick, Aluminium gland plates shall be provided. These shall be adequately supported to avoid any distortion or bulging while doing terminations.**

#### **2.00 Clearances**

- The minimum clearance in air between phases and earth for the entire run of horizontal and vertical Busbars and bus-link connections at circuit-breaker shall be 25mm. For all other components, the clearance between "two live parts" shall also be twenty-five (25) mm throughout. For a live part and an earthed part, the clearance shall be twenty (20) mm minimum. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal & vertical Busbars, the clearances specified above should be maintained even when the Busbars are sleeved or insulated. All connections from the Busbars up to MCCB / SFU / FSU shall be fully shrouded / insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits.

#### **3.00 Power Busbars and Insulators**

- All 415 V Panel Boards, SDBs and MCCs shall be provided with three phase and neutral Busbars as specified in BOQ. Entire Busbar system shall be insulated with colour coded, heat shrinkable PVC sleeves.
- All Busbars & jumper connections shall be of high conductivity aluminum alloy / copper of adequate size as specified in SLD / BOQ.

- The cross-section of the Busbars shall be uniform throughout the length of switchboard & shall be adequately supported & braced to withstand the stress due to the specified short circuit currents. **Neutral Busbar short circuit strength / cross section shall be same as main Busbars up to 400 Amps.**
- All Busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet moulded compound or equivalent type polyester fiber glass moulded insulators. Separate supports shall be provided for each phase and neutral Busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Bakelite / Hylam shall not be accepted. The Busbar insulators shall be supported on the main structure.
- All Busbar joints shall be provided with steel bolts, Belleville / spring washers and nuts so as to ensure good contacts at the joints. Non-silver plated Busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the Busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the Busbar.
- All copper to Aluminium joints shall be provided with suitable bi-metallic washers. Alternatively direct Bus Bar joints can be made between copper and Aluminium Bus Bar if tinned copper Bus Bars are used.
- All Busbars shall be colour coded as per IS : 375.
- All Busbars shall have PVC sleeves (not tapes) wherever called for in the specification.

#### 4.00 Earth Bus and Earthing

- A galvanized steel / aluminum earth bus of suitable size shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar.
- **The earth bus shall have sufficient cross section (150 sq. mm. minimum)** to carry the momentary short circuit and short time fault current to earth, without exceeding the allowable temperature rise.
- Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting earthing conductors. The horizontal earth bus shall project out of the switchboard ends and shall have predrilled holes for this connection. All joint splices to earth bus shall be made through at-least two bolts and taps by proper lug and bolt connection.
- All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. **Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.**
- **All metallic cases of instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm.** All the equipment mounted on the door shall be earthed through flexible wire / braids. Insulation colour code of earthing wires shall be green.
- CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit can be removed without disturbing the earthing of other circuit.

- **All hinged doors having potential carrying equipment mounted on it, shall be earthed by flexible wire / braid.** For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges / hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.
- **Interlocking :** Electrical, Mechanical or both interlocking in panels shall be provided as per single line diagram. Wherever extension of panels for future is indicated on the single line diagram, necessary provision of interlocking as a composite scheme shall be made. These contacts including spare contacts of switchgear shall be connected to plug in type terminal block at one end of the panel. The arrangement should be such that when in future extension panel is connected, no shut down of panel in use is required.
- Interlocking as required shall be provided both through shunt trip and closing coil in case of electrically operated circuit breakers.
- In case of manual draw out breakers, interlocking shall be provided through under voltage coil with supply from dedicated power pack.

## **B Switchgear**

### **1.00 Air Circuit Breakers**

- The ACB shall conform to latest IS 60947 (Part – 2) and IEC – 60947-2. The ACB shall comply with the isolation function requirement of IEC 60947-2 Section 7.12 & marked as suitable for isolation and disconnection to facilitate safety of operating personnel while the breaker is in use.
- The ACB shall have a rated service short circuit breaking capacity (Ics) not less than 40/50/65/80 KA rms at 415V, 50 Hz AC / as specified in SLD's and BOQ. The Service breaking capacity (Ics) shall be equal to ultimate breaking capacity (Icu) unless otherwise specified. The withstand capacity (Icw) for one second shall not be less than ultimate breaking capacity (Icu).
- ACB's shall be suitable for rated operational voltage up to 440 V AC, 50 Hz and insulation voltage up to 1000 V AC, 50 Hz.
- Circuit breakers shall be three / four pole, air break, horizontal drawout / fixed type as indicated in SLD/BOQ.
- Drawout type Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.
- There shall be "SERVICE", "TEST" & "FULLY WITHDRAWN" positions for the breakers. In "TEST" position the circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Self Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLY WITHDRAWN" position.
- Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE", "TEST", and "SPRING CHARGED" positions.

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- All circuit breakers shall be provided with “2 NO” & “2 NC” potential free auxiliary contacts. These contacts shall be in addition to those required for internal mechanism of the breaker and should be directly operated from breaker operating mechanism.
- All circuit breakers shall be provided with the following interlocks :
  - Movement of circuit breaker between “Service” and “Test” position shall not be possible unless it is in open position. Attempted withdrawal of a closed circuit breaker shall preferably trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exist between the fixed and drawout contact at the time of breaker trip, so that no arcing takes place even with the breaker carrying it’s full rated current.
  - Closing of circuit breaker shall not be possible unless it is in “Service” position, “Test” position or in “Fully Withdrawn” position.
  - Closing of circuit breaker shall not be possible till all interlock are checked and found OK. Ready to CLOSE contact shall be provided for all EDO Breakers.
  - Safety interlock shall be provided to prevent the ACB from falling out in a fully withdrawn position.
  - It shall be possible to close the door in “TEST ” position.
  - Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.
  - A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.
  - There should be a provision of positive earth connection between fixed & moving portion of the ACB either through connector plug or sliding solid earth mechanism. Earthing bolts must be provided on the cradle or body of fixed ACB.
  - It should be possible to bolt the drawout frame not only in CONNECTED position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.
  - Circuit breakers shall provided with castle key / electrical interlocking devices, as specified in “Bill Of Quantity”.
  - Access to accessories shall be prevented with ACB in ON condition.
- Mechanical tripping shall be possible by means of front mounted Red “trip” push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.
- **The manufacturer shall provide details of opening time duration to ensure discrimination and proper selection for feeder protections. All ACBs of 4000A and above shall be a single ACB unit. The manufacturer shall also indicate the mechanical and electrical life of circuit breaker and their rating inside cubical at 50°C.**
- ACBs shall comply with ROHS guidelines.

- Circuit breaker shall be provided with the following mechanisms, protection and accessories as specified in "Bill Of Quantity"

#### 1.01 Manually Operated Mechanism

- Manually operated mechanism shall be of manual spring charging stored energy type.
- The circuit breaker shall have a spring charging handle and push-button for closing the breaker mechanically after the spring has been charged. However, closing by spring charging handle after the spring has been fully charged shall also be acceptable, provided the movement of contacts does not take place with the movement of handle and the contacts operate only when the spring stored energy is released. Overcharging of spring shall not be possible.
- The closing action of the circuit breaker shall charge the tripping spring, thus making it ready for tripping.
- The circuit breaker shall be provided with the interlocks so that it shall not close unless the spring is fully charged.
- The mechanism shall be suitable for addition of motor mechanism at site if required for future upgrade without the need of any special accessories.

#### 1.02 Power Operated Mechanism

- Power operated mechanism shall be provided with a universal motor suitable for operation on 240 AC / DC Control supply, with voltage variation from 70% to 110% rated voltage. Motor insulation shall be class "E" or better.
- The motor shall be such that it requires not more than 10 seconds for fully charging the closing spring at minimum available control voltage.
- Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.
- The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operation shall be possible. **After failure of power supply at least one open-close-open operation shall be possible**
- Provision shall be made for emergency manual charging & as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.
- Provision for mechanical closing of the breaker only in "TEST" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.

#### 1.03 Protection

- The Integral Self Powered Microprocessor Based Unit shall be provided on Circuit Breaker for over load, short circuit and earth fault protection with adjustable dials for current and time setting as specified in BOQ / SLDs . Specific LED indications should be provided for short circuit, over current and earth fault operation for faster fault diagnosis and reduced down time. The trip indication shall not need any external supply for display.

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- Microprocessor Releases as specified in BOQ / SLD shall be EMI / EMC compatible while fitted inside breaker. Microprocessor Releases shall be provided with integral LCD Display of load current and individual loading of all the three phases as specified in BOQ / SLDs. It shall be possible to record maximum value of instantaneous current value in release with integral display.
- Relays wherever specified, shall be CT operated and these shall trip the breaker through shunt trip release / under voltage trip release for desired protection.
- Four Pole ACB shall have Adjustable Neutral Protection.
- Wherever earth fault release has been asked for in 3 Pole breakers, additional CT shall be provided on the neutral bus link. This CT shall have characteristics matching to the CT's installed in the ACB for the purpose.
- Microprocessor Releases shall have Thermal Memory i.e. when the breaker shall re-close after tripping on overload, then the thermal stress caused by the overload if not dissipated completely, shall get stored in the memory of releases and this thermal memory shall ensure reduced tripping time in case of subsequent overloads and earth fault. Realistic Hot/Cold curves shall take into account the integrated heating effects to offer closer protection to the system.
- It shall be possible to change the release settings of ACB online without tripping.

#### **1.04 Accessories**

- All accessories like shunt release, under voltage, motorized mechanism etc. shall be front mounted, requiring no adjustments and can be fitted at site and should be continuously rating.
- All circuit breakers shall be provided with closing and trip coils as per BOQ. The closing coil shall operate correctly at all values of voltage between 70% to 110% of rated control voltage.

The trip coil shall operate satisfactorily at all values of voltage between 40% to 110% of rated control voltage and shall be of continuous duty cycle.

#### **2.00 Moulded Case Circuit Breakers (MCCBs)**

- The Moulded case circuit Breaker (MCCB) shall conform to the latest IS 60947 (Part-2) and IEC 60947-2. The MCCB shall comply with the Positive Isolation Function requirement of IEC 60947-2 and marked as suitable for isolation and disconnection to facilitate safety of operating personnel while the breaker is in use.
- The MCCB shall have a rated service short circuit breaking capacity (Ics) not less than 25 / 35 / 50 / 65 / 80 KA rms at 415V, 50 Hz AC / as specified in SLDs & BOQ. The Service breaking capacity (Ics) shall be equal to ultimate breaking capacity (Icu) unless otherwise specified.
- MCCBs shall be suitable for rated operation voltage up to 415 V AC, 50 Hz and rated insulation voltage up to 690 V AC, 50 Hz.

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- MCCBs shall be of triple pole / four pole construction as per enclosed BOQ. Operating mechanism shall be quick-make, quick-break and trip-free type. The "ON", "OFF" and "TRIP" positions of the MCCBs shall be clearly indicated and visible to the operator when mounted as in service. Front of door operating handle shall be provided with pad lock and door interlock. Front of door operating handle shall be provided with door interlock defeat mechanism to facilitate inspection of the MCCB during 'ON' position.
- The MCCB shall be current limiting type. MCCB shall have Arc extinguishing device contained in a compact, high strength, heat resistance, flame retardant, halogen free insulating moulded case with high withstand capability against thermal and mechanical stresses.
- MCCBs shall comply with Class-II front facia as per IEC 60664 and shall have cross bolted terminals to withstand thermo dynamic forces during short circuit conditions.
- The trip command of releases in MCCB shall override all the other commands. The MCCB shall not be restricted to line / load connections. MCCB shall be provided with test trip Push Button to check the proper function of tripping mechanism.
- MCCBs shall be capable of withstanding the thermal stresses caused by overloads & locked rotor currents of values associated with protective relay settings of the motor starting equipment and the mechanical stress caused by the peak short-circuit current of value associated with the switchgear rating. The maximum tripping time under short circuit shall not exceed 10 milliseconds.
- Where mechanical interlocking is called-for between two Incomer and Bus Coupler or between two Incomers without Bus Couplers, proper arrangement for interlocking shall be provided.
- MCCB terminals shall be shrouded and designed to receive Bus Bar Links / cable lugs for cable sizes relevant to circuit ratings.
- MCCBs shall comply with ROHS guidelines.

#### 2.01 Protection

- **MCCBs shall be provided with Thermo-Magnetic / microprocessor type releases as specified in SLD / BOQ.**
- The MCCBs above 250 Amps shall be provided with thermo-magnetic / microprocessor based overload and short circuit release as specified in SLD / BOQ. All electronic releases shall be EMI / EMC compatible.
- Wherever Earth Fault Protection has been indicated in drawings / BOQ, it shall be add on module with MCCBs & have adjustability from 20% to 50% of rated current with adjustable time delays. The integrated system shall be immunized against nuisance tripping as per IEC 61000-4 standards.
- MCCB shall have suitable indication for ON / OFF as well as Over Load, Short Circuit and Earth Fault to differentiate between 'Normal ON / OFF operation' and 'Fault Tripping situation'.
- In case of 4 Pole MCCB the neutral shall be defined and capable of offering protection up to full rating.
- It shall not be possible to by-pass / switch-off the short circuit or earth fault protection in MCCBs.



## **2.02 Accessories**

- The MCCB shall have common field fittable snap-on auxiliaries for entire range. All MCCBs shall be provided with Spreaders and Phase Barriers.
- The trip coil shall operate satisfactorily at all values of voltage between 40% to 110% of rated control voltage and shall be of continuous duty cycle.

## **3.00 Miniature Circuit Breaker (MCBs)**

- Miniature Circuit Breaker shall comply with IS 8828 – 1996 / IEC 898 – 1995.
- MCBs shall be suitable for Isolation as per IEC and shall indicate true position of Contacts.
- Miniature Circuit Breaker shall be quick make & break type for 230 / 415 V AC & 50 Hz application. The housing of MCBs shall be heat resistant and having a high impact strength. The breaking current of MCBs shall not be less than 10000 Amps, at 230 V / 415 V. The MCBs shall be flush mounted & shall be provided with trip free manual operating mechanism with mechanical 'ON' and 'OFF' indications. MCBs shall be suitable for isolation function and line load reversibility.
- MCBs shall be current limiting type class – 3. MCBs shall be classified as B, C, and D as per standard Ref. IS as per the Tripping characteristics curves defined by all the manufactures. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS / IEC and the manufactures shall publish the value.
- MCBs shall be calibrated at an ambient temperature of 40 degree.
- The MCB contacts shall be silver nickel alloy and contact tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCBs shall be provided with magnetic coil releases for short circuit protection and thermal release for over load protection. The over load or short circuit devices shall have a common trip bar in the case of DP, TP, TPN and FP Miniature Circuit Breakers & shall have 20000 electrical operations up to 63A. The terminals shall be protected against finger contact to IP 20 Degree of protection.
- MCBs shall have a facility to accommodate accessories like auxiliary contacts, trip alarm contact, shunt trip and under voltage add-on blocks.

## **4.00 EL + MCB / RCCB / ELCB**

- The RCCB / ELCB should comply with IEC 1008 & shall be suitable for use with pure AC/AC with DC off set, for frequency range of 50 Hz to 400 Hz. The RCCB / ELCB shall be protected against nuisance tripping by a protective device, limiting such tripping to a peak value of 250 A according to the 8/20 wave for instantaneous devices. RCCBs / ELCBs shall be suitable for isolation function and line load reversibility.
- EL + MCB / RCCB shall have Earth leakage, over load and short circuit protection where as ELCB shall have Earth leakage protection only. RCBO / RCCB wherever provided in UPS systems / DB shall be super immunized / equivalent.

- EL + MCB / RCC B / ELCB shall be quick make & break type. The housing shall be heat insulated & having a high impact strength. The moving contacts of the Phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism for closing / opening of all the three phases simultaneously. The neutral moving contact shall be so mounted on the common bridge that at the time of closing, the neutral makes contact first before the phases and at the time of opening, the neutral breaks last after allowing the phases to open first.
- The core balance transformer ensures positive detection of earth leakage currents. The incoming current shall pass through the toroidal core transformer. As long as the current in the phase & the neutral shall be the same, no electromotive 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 will cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. The device shall be current operated independent of the line voltage, current sensitivity of 30mA/100mA/300mA at 240 / 415V AC as specified in BOQ.
- EL + MCB / RCCB / ELCB shall have trip free nature of mechanism ensuring that it cannot be closed when an earth leakage fault persists.
- Test device shall be there to check the integrity of earth leakage detection system and the tripping mechanism. It shall have box type terminals & capture screws ensuring easy connection of cables and protected against finger contact to IP 20 Degree of Protection.

#### **5.00 Motor Protection Circuit Breakers (MPCB)**

- The Motor Protection Circuit Breaker shall be used for DOL / STAR-DELTA starting of motors up to 110.0 KW shall offer protection to motors against overload, short circuit and phase failure. The MPCBs shall be suitable for Type 2 co-ordination. It shall have quick make, quick break mechanism suitable for AC 3 duty and shall be capable of operating in temperatures up to 55 degree centigrade and temperature compensated. The MPCBs shall have a minimum breaking capacity of 50 KA at 415 V 50 Hz. The MPCBs shall have rotary door operating mechanism handle and shall have a facility to accommodate auxiliary contact, short circuit signaling contact, under voltage release and shunt trip.

#### **6.00 MCB Isolator**

- MCB Isolator shall be quick make and break type. The housing shall be heat resistant and having high impact strength. The overall dimensions and fixing arrangement of Isolator shall be same as that of MCB. MCB Isolator shall not be provided with any protection.

#### **7.00 Indicating Instruments (Digital Type)**

- All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96mm. Square size Digital Type with Built-in Selection, and shall have an accuracy class of 1.0 or better. The covers & cases of instruments and meters shall provide a dust & vermin proof construction. Digital meters to be provided for single phase Panels shall not incorporate Built in Selector Switch.
- All instruments shall be compensated for temperature errors and factory calibrated.

#### **8.00 Instrument Transformers**

- All current transformers shall be tape insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition & the specified ambient temperature. The class of insulation shall be 'E' or better.
- All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block where star point formation and earthing shall be done.
- CT shorting links are to be provided to avoid burning / damage of CTs in case of opening of CT terminals.
- Current transformers may be multi or single-core type. All CTs shall be provided with supports independent of Busbar / Busbar supports.
- The CTs shall be located in such a way that they can be easily approached for maintenance without necessitating shut down of adjacent feeders.

#### **9.00 Selector Switches**

- Selector switches shall be of rotary type, with plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.
- Contacts of switches shall be spring assisted & shall be of suitable material to give a long trouble free service.

#### **10.00 Push Buttons**

- Push-buttons shall be of spring return, push-to-actuate type. Their contacts shall be rated to make, continuously carry and break 10 A at 240 V AC and 1 A (inductive) at 220 V DC.
- All push-buttons shall have one normally open (1 NO.) and one normally closed (1 NC) contact, unless specified otherwise. The contact faces shall be of silver alloy.
- All push-buttons shall be provided with integral plates marked with its function.
- The colour of the button shall be as follows :
  - **Green** for motor START / breaker CLOSE.
  - **Red** for motor STOP / breaker OPEN.
- All push-buttons on panels shall be located in such a way that Red push-buttons shall always be to the left of Green push-buttons.
- All emergency push-buttons shall have mushroom knobs.

#### **11.00 Indicating Lamps**

- **Indicating lamps shall be of the panel mounting, LED type and low watt consumption.** The LED lamps shall have plates marked with its function, wherever necessary.
- Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :

- **Red** for R-Phase / MCCB “ON” / Contactor ‘ON’
- **Yellow** for Y-Phase
- **Blue** for B-Phase
- **Green** for Contactor ‘OFF’
- **Amber** for Breaker / Starter ‘TRIP’
- Lamp cover shall be easily replaceable from the front of the cubicle.
- LED indicating lamps should be located just above the associated push-button / control switches. Red lamps shall invariable be located to the right of green lamps.
- When associated with push-buttons, red lamps shall be directly above the green push-button and green lamp shall be directly above the red push button.
- All LED indicating lamps shall be suitable for continuous operation at  $\pm 25\%$  of their rated voltage.

#### **12.00 Control Circuit MCBs**

- Miniature Circuit Breakers for Control Circuits shall comply with IS 8828-1996 / IEC 898-1995. MCBs shall be quick make and break type for 230V / 415V AC/DC applications.
- The housing of MCBs shall be heat resistant and having a high impact strength. The breaking current of **MCBs shall not be less than 6000 Amps**, at 230 V / 415 V. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical ‘ON’ and ‘OFF’ indications. MCBs shall be suitable for isolation function and line load reversibility.
- The MCB contacts shall be silver nickel alloy and contact tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCBs shall be provided with magnetic coil releases for short circuit protection and thermal release for over load protection. The terminals shall be protected against finger contact to IP 20 Degree of protection.

#### **13.00 Control Transformers**

- The control transformers shall be 415 V / 240 V or 415 / 110 Volt as specified in SLD / BOQ with Centre point earthed, dry type and insulation class ‘B’ or better. The sizing of control transformers shall be reconfirmed by Contractor during approval of GADs considering the actual load of power contactors, auxiliary contactors, indicating lamps & other equipment in the module circuit. Contractor shall also ensure that control transformers are adequately designed for meeting the momentary loading requirements & the voltage drop during this condition shall not be more than 5%.

#### **14.00 Power Factor Improvement LT Capacitors**

- The capacitors shall conform to IS 13340 / IS 13341 / IEC 831. The capacitors shall be delta connected suitable for 415 V 3 phase 50 Hz AC supply. Metalised Polypropylene (MPP) capacitors of suitable KVAR as mentioned in BOQ/SLD shall be provided to improve power factor, reduce voltage drop and reduce power costs.

- The capacitors shall be suitable for a continuous over current of 1.5 times of rated current combined with overvoltage and presence of harmonics as per IEC clause 21. The capacitor shall be tropicalised for an ambient of 55 degree centigrade as per IEC 831. The capacitors shall be self healing type and provided with pressure sensitive Disconnecter safety device. The impregnation shall be non PCB biodegradable type or Inert gas, so as not to have any degenerated properties and shall be non-oxidizing. The watt loss per KVAR shall not exceed 0.5 watts. The capacitor shall be provided with suitable discharge resistor. The expected life of capacitors shall not be less than 1,00,000 continuous hours. The capacitors shall be provided in M.S. sheet steel container.

#### **15.00 Contactors for Controlling Capacitor Banks**

- Contactors provided for switching on & switching off the capacitor banks through Automatic Power Factor Relay shall be suitable for Capacitor duty.

#### **16.00 Automatic Power Factor Control Relay**

- Automatic power factor control relay shall be solid state / microprocessor based that automatically can manage capacitor banks compensate for the reactive power absorbed by the load. The relay shall control the power factor of the installation by giving signals to switch "ON" or "OFF" power factor correction capacitors.
- When the power factor falls below the setting, the relay shall switch the capacitor "ON" in sequences i.e. first in first out or first in last out.
- Relay shall have built-in digital power factor meter with LED / LCD display. Relay shall be provided with Dead Band facility to prevent the system from overcorrection and hunting. Relay shall have under current blocking system to shut down the relay by the switching off all capacitors one by one in sequence when load current is below setting. Relay shall also have built-in Auto / manual control, special timing sequence and preferably facility for No voltage / Over voltage / Over temperature protection.
- Relay shall have RS 232 port interface protocol or RS 485 port with MODBUS.

#### **17.00 Battery Charger**

- Battery Charger shall be capable of Charging 24 volt DC or 12 volt DC batteries as specified. Charger shall have 16 Amps current output. The battery charger shall have facility for trickle / boost charging of the batteries on auto mode. The charger shall be housed in MS sheet steel enclosure and placed inside the Panel at a convenient and easily accessible position.
- The Charger shall have the following indications :
  - Battery Charger tripped
  - Batteries Charging
  - Batteries Charged
  - Batteries Low
- The terminal for all above indications shall be brought out to a terminal strip for remote wiring these indications to lamps located on Panel door.

## **C Internal Wiring, Control Terminal Blocks, Name Plate / Labels and Painting**

### **1.00 Internal Wiring**

- All switchboards shall be supplied completely wired internally up to the terminals, ready to receive external cables.
- All intercubicle & inter panel wiring & connections between panels of same switchboard including all bus wiring shall be provided by Contractor.
- All auxiliary wiring shall be carried out with 1100 V grade, single core, stranded copper conductor, colour coded, PVC insulated wires. Conductor size shall be 1.5 mm<sup>2</sup> (min.) for control circuit wiring & 2.5 mm<sup>2</sup> (min.) for CTs.
- PVC insulated, standard copper wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the door shall be properly sleeved or taped.
- All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and blocks.
- All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible.
- Engraved core identification ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The ferrule shall be of self-locking type. The wire identification marking shall be in accordance with IS : 375.
- Wiring for equipment, which are to be supplied by the Owner and for which the Contractor has to provide mounting arrangement in his panels, shall also be provided by the Contractor, up to the terminal blocks.
- All connections from vertical Busbars for individual modules above 100 A shall be made with Copper / Aluminum links only. The cable connections for module up to 100 A shall be selected in such a way that there will not be any melting / shorting in case of a short circuit inside the module and the cable shall have current rating to carry the let through energy of the corresponding breakers in case of a fault. For power wiring colour coded wire insulation / tapes shall be provided.

### **2.00 Control Terminal Blocks**

- Control terminal blocks shall be of 1100 Volts grade, rated for minimum 10amps and in one piece molding. It shall be complete with insulating barriers, clip-on type terminals and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams.
- All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size up to 2.5 mm<sup>2</sup> each.
- All terminals shall be numbered for identification and grouped according to the function. Engraved white-in-black labels shall be provide on the terminal blocks.
- Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.

- Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.

### 3.00 Name Plates and Labels

- All Panel Boards shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation.
- All name plates shall be of anodized aluminum with white engraved lettering on black background.

### 4.00 Painting

- All sheet steel work shall be pretreated, in tanks, in accordance with IS : 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint on panels shall be applied. Finishing paint on Panels shall be Powder Coated, Siemens Grey, shade RAL-7032 throughout Orange Peel Finish with Electrostatic method or as approved by the Owner's / Consultant while approving the shop drawings.

## D Final Distribution Boards

**1.00 The distribution boards shall be fabricated from 16 / 18 SWG CRCA sheet steel as called for in particular specifications / BOQ.** Intermediate plate shall be provided so that no live parts are accessible even when the door is open. The door shall be earthed with braided copper wire. The door shall be openable up to 120 degree. The hinges shall be so provided that door can be completely removed if required. The hinges shall be robust in nature. **The protection shall be minimum IP 42.** Configuration whether 4 tier, 2 tier, horizontal or vertical shall be as described in the BOQ. Generous wiring space shall be provided for ensuring space for wire loops and ease of connections. Distribution boards to be used for distribution of UPS supply shall have provision for insulated links for dedicated earthing.

- The neutral, dedicated earth and earth links shall be adequately sized to receive the cable i.e. incomers up to 16 sq mm and outgoing up to 6 sq mm. Neutral link for distributing neutral from incomer to individual phases shall be capable of receiving 16 sq mm cable incoming as well as outgoing. Chrome plated panel locks or finger operated opening knob shall be provided as per approved GA drawings. All Busbars shall be high conductivity electrolytic grade copper insulated type. Din channels shall be provided with end closer to lock the MCBs.
- TPN DBs shall be suitable for Per-Phase Isolation having separate Neutral Bars for each Phase.
- The distribution board shall be suitable for surface mounting or recess mounting as required.

### 2.00 Painting

- All sheet steel work shall be pretreated, in tanks, in accordance with IS : 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint on panels shall be applied. **Finishing paint on Panels shall be Powder Coated, Siemens Grey, shade RAL-7032 throughout Orange Peel Finish with Electrostatic method or as approved by the Owner's / Consultant while approving the shop drawings.**

### **III. Testing**

#### **1.00 Type Tests**

- Certificates to be provided by Panel Manufacturer for the following :
  - Temperature Rise Limits
  - Dielectric Properties
  - Short Circuit Withstand Test
  - Effectiveness of Protective Circuit
  - Clearance and Creepage Distance
  - Mechanical Operation of Switchgear
  - Degree of Protection

#### **2.00 Routine Shop Tests**

- The following routine shop tests shall be carried out at Panel manufacturers factory :
  - A general visual check shall be carried out. This shall cover measurement of overall dimension, location, number & type of devices, terminal boxes, connection of terminals and Phase Sequence etc.
  - Verification of Wiring and Control Circuits shall be carried out.
  - Manual operation of all Circuit breakers shall be checked.
  - Dry insulation test with power frequency voltage for the main & auxiliary circuits shall be conducted as follows :

Power Circuits	-	2500 Volt (for one minute)
Control Circuits	-	1500 Volt (for one minute)
Control Circuits Aux. Circuits connected to Sec. of CT's	-	2000 Volt (for one minute)
- Insulation resistance of the main and auxiliary circuits shall be checked after high voltage test is conducted. Insulation resistance shall be greater than 100 Mega Ohms at 500 V between Phase to Neutral and greater than 200 Mega Ohms at 500 V between Phase to Phase.



### 3.00 Routine Tests during Installation at Site

- The following routine tests shall be carried out during Installation at site :
  - A general visual check shall be carried out. This shall cover measurement of overall dimension, location, number and type of devices, terminal boxes, connection of terminals & Phase Sequence etc.
  - Verification of Wiring and Control Circuits shall be carried out.
  - Manual operation of all Circuit breakers shall be checked.
  - Dry insulation test with power frequency voltage for the main & auxiliary circuits shall be conducted as follows :
    - Power Circuits
    - Control Circuits
- Aux. Circuits connected to Sec. of CTs
- Insulation resistance of the main and auxiliary circuits shall be checked after high voltage test is conducted. Insulation resistance shall be greater than 100 Mega Ohms at 500 V between Phase to Neutral and greater than 200 Mega Ohms at 500 V between Phase to Phase.
- Electrical Operational Test and Relay / Release Setting

## Section – 2

### Technical Specification for MV Cables

#### I. General

##### 1.00 Work Included

- MV Cables (PVC insulated / XLPE Cables)
- The cable installation shall include laying, testing & commissioning, all trench work, sleeves, ducts and all necessary fixing and cable terminations at both ends of the cable.
- Ducts and sleeves shall be provided at road crossings, under paved roads and footpaths. The duct crossings shall include 25% spare capacity to cover possible future requirements. Ducts / sleeves shall also be installed for future use as indicated in the drawings.
- The contractor shall work out the control cabling schedule between HT Panel and Transformer, Transformer & Regulator (In case of AVR), Main LT Panel & DG Sets, HT Panel & Main LT Panel and other equipments not specified herein but forming scope of work for installation testing and commissioning. The control cabling schedule made by Contractor shall be subject to Consultants approvals. Any delay due to non-procurement of control cables shall be sole responsibility of the contractor.

##### 2.00 Related Work and Obligations

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements which may affect work of this section.

- Co-ordinate work with all other trades affecting, or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

### **3.00 General Requirements**

- This specification covers requirements for supplying, laying, testing and commissioning of PVC insulated / XLPE cables for medium voltage system. All cables shall be of the same make as specified in the list of approved Make Of Materials.
- Cable sizes shall be as shown on the drawings. Sizes smaller than those specified shall not be accepted.

### **4.00 Codes and Standards**

#### **4.01 Applicable to PVC Insulated Cables**

- The cables shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules :-
  - IS 1554 (Part-I) : PVC insulated (heavy duty) electric cables - Part I for working voltages up to and including 1100 Volts
  - IS 5959 (Part-I) / 1970 : Polythene insulated & PVC sheathed (Heavy duty) electrical cable
  - IS 1596 / 1960 : Terms for Electrical cables and conductors
  - IS 1596 / 1970 : Polythene insulated and PVC sheathed cable
  - IS 8130 : Conductors for insulated electric cables and flexible cords
  - IS 3975 : Mild steel wires, strips and tapes for armouring of cables
  - IS 3961 (Part-II) : Recommended current ratings for cables : Part II PVC insulated and PVC sheathed heavy duty cables
  - IS 5831 (1984) : PVC insulated and sheathing
  - IS 1753 : Aluminium conductors for insulated cables
  - IS 694 : PVC insulated cables for working voltages upto & including 1100V

#### **4.02 Applicable to XLPE Insulated Cables**

- The cables shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules :-
  - IS 5959 (Part-I) / 1970 : Polythene insulated & PVC sheathed (Heavy duty) electrical cable
  - IS 1596 / 1960 : Terms for Electrical cables and conductors
  - IS 8130 : Conductors for insulated electric cables and flexible cords
  - IS 3975 : Mild steel wires, strips and tapes for armouring of cables

- IS 8130 : Aluminium / copper conductors
- IS 7098 (Part-I / 1988) : Product code for XLPE cables

#### **5.00 Quality Assurance**

- Manufacturers regularly engaged in manufacture of cables, whose products have been in satisfactory use in similar service for not less than 5 years.
- Installation shall be carried out by a firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.

#### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.
- The MV Cables shall be guaranteed against trouble free operation, defective workmanship and materials for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning, whichever is earlier. In case of any defects during this period cables shall be replaced free of cost by the Contractor.

#### **7.00 Delivery, Handling and Storage**

- All cables shall be carefully transported to site to avoid damage during transit. While on site all cables shall be stored in a proper manner to prevent damage or moisture ingress at the ends.

### **II. Products**

#### **1.00 General Construction**

- The cables shall be brand new and in good condition. These shall be suitable for laying in cable trunkings, trays, trenches, ducts, conduits and underground buried installation with uncontrolled backfill and possibility of flooding by water.

#### **1.01 Core Identification**

- The cores shall be identified by different colours as follows :
  - Single core : Black
  - Two core : Red and Black
  - Three core : Red, Yellow, Blue
  - Four core : Red, Yellow, Blue, Black
  - Three and half core : Red, Yellow, Blue and reduced neutral core in Black

#### **1.02 Laying Up**

- In multicore cables, cores shall be laid up as per the above colour scheme, interstices shall filled wherever necessary to make the laid up cores circular.

#### **1.03 Inner Sheath**

- Laid up cores shall be bedded over with thermoplastic material for protection against mechanical and electrical damage.

#### **1.04 Armouring**

- Armouring shall be provided over the inner sheath to guard against mechanical damage. Armouring shall be generally of galvanized steel wires or strips, (In single core cables used in AC system armouring shall be by non-magnetic hard Aluminium wires/strips). Round steel wires shall be used where the diameter over the inner sheath does not exceed 13 mm; above 13 mm, flat steel strip armour shall be used.

#### **1.05 Outer Sheath**

- Specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS: 5831-198 shall be extruded to form the outer sheath. Specially formulated Flame Retardant Low Smoke & Halogen (FR-LSH) compound for outer sheath shall be provided of XLPE Cables.

#### **1.06 Product Code**

- As per IS : 7098 : Part I, the codes as under shall be followed :

<b>Constituent</b>		<b>Code</b>
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

#### **2.00 PVC Insulated Cables**

- All power / control cables for use on MV systems shall be heavy duty type, 1100 V grade with Aluminium / copper conductor, PVC insulated inner sheathed, armoured / unarmoured and overall PVC Sheathed.
- The construction of the conductors shall be "Stranded" for Aluminium cables as well as for Copper cables.
- The core insulation shall be with PVC compound applied over the conductor by extrusion and shall conform to the requirements of IS : 5831.
- For multicore cables, if the armouring is specified in the specification / BOQ the same shall be single round galvanized steel wires / galvanized steel strips.

- The outer sheath for the cables shall be applied by extension and shall be of PVC compound conforming to IS : 5831. To protect the cables against rodent and termite attack, suitable chemicals shall be added into the PVC compound of the outer sheath. The chemicals of the insulation, armor and outer sheath materials shall be governed by values given in Section-VI of IS : 1554 (Part-I).

### **3.00 XLPE Insulated Cables**

- XLPE cables shall consist of low density polyethylene molecules of carbon and hydrogen in form of long flexible chains. Slippage between long chains is prevented by cross linking them & heating to temperatures 250 deg. C to 300 deg. C. This strengthens cables against stress cracking and gives them greater resistance to fight ageing in hot air.

### **4.00 Site Inspection**

- All cables shall be inspected upon receipt at site and checked for any damage during transit

### **5.00 Tests**

- PVC insulated cables shall be subjected to tests as required by IS : 1554 Part I.
- XLPE insulated cables shall be subjected to test as required by IS : 7098 Part I.

#### **5.01 Type Tests**

- Certificates to be provided by Cable Manufacturer for the following :
  - Tests on Conductor : Annealing Test for Copper, Tensile and Wrapping Test for Aluminium, Measurement of Resistance
  - Test for Thickness of Insulation and Sheath
  - High Voltage Test
  - Insulation Resistance Test
  - Test for Armouring Wires / Strips
  - Flammability Test

#### **5.02 Routine Shop Tests**

- The following routine shop tests shall be carried out at Cable manufacturer's factory :
  - Acceptance Tests for Conductor and Insulation
  - High Voltage Test
  - Conductor Resistance Test

#### **5.03 Routine Tests during Installation at Site**

- The following routine tests shall be carried out during Installation at site :
  - A general visual check shall be carried out for overall dimension.
  - Insulation resistance test

#### **5.04 Fire Survival Circuit Integrity Power Cables**

- Fire Survival Armoured Cable with Aluminium/Copper Conductor having Glass Mica (Fire barrier) tape covered with crosslinkable high module Ethylene Propylene Rubber (HEPR) insulation and LSZH inner and outer sheath. Basic design as per BS-7846 for copper and IEC-60502-1 for aluminium (Latest Editions).
- The cables should meet circuit integrity at 1000 volts with simultaneous action of Fire, Impact & water on single sample when tested in accordance to category-3 of BS 8519:2010
- The cables should not emit toxic gases in case of fire. The toxicity index should be less than 3 (refer NES 713).
- The cables should comply with the requirements of IEC-61034 Part 1&2 (Measurement of Smoke density of cables burning under defined conditions).
- The cables should comply with the requirements of BS EN 60754 (Determination for amount of halogen acid gas content which shall not be greater than 0.5%)
- Fire & type test reports of each lot from 3rd party inspection agency required prior to despatch.

### **III. Installation, Testing and Commissioning**

#### **1.00 Erection**

- Cable network shall include Power, Control, lighting and communication cable which shall be laid in trenches, cable trays, cable trunking or conduits. Erection of cable trays / trunking as required shall be the responsibility of the Contractor. All tray / trunking levels shall be checked after erection and marked in as built drawings. Cable routing layout shall be checked at the site to avoid interference with structures, heat sources, drains, piping and air-conditioning duct etc. and necessary adjustment shall be done to suit the site conditions.
- All cable routes shall be carefully measured & cables cut to the required lengths, leaving sufficient lengths for the final connection of the cable to the terminal of the equipment. The various cable lengths cut from the cable reels / drums shall be carefully selected to prevent undue wastage of cables. **The quantity indicated in the cable BOQ is approximate.**
- The Contractor shall ascertain the exact requirement of cable for a particular feeder by measuring at site and avoiding interference with structure, foundation, pipe lines or any other works.
- Cables shall be laid in complete, uncut lengths from one termination to the other. Where joints are unavoidable, the location of such joints shall be got approved by consultant.
- Cables shall be neatly arranged in the trays / trunkings / trenches in such a manner so that criss-crossing is avoided and final take off to the panel / equipment / motor is facilitated. Arrangement of cables within the trays / trunkings / trenches shall be responsibility of the Contractor.
- All cables shall be identified close to their termination points by cable numbers / identification as per details mentioned in Single Line Diagram. Cable tags shall be used for this purpose.
- Wherever cables / earthing tapes are crossing the walls / floors appropriate size of GI sleeves shall be provided. The sleeves in walls shall slope outwards to avoid moisture travelling along the cable length. After the cables have been pulled through sleeves the gaps shall be properly sealed to avoid ingress of moisture.

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- Each underground cable shall be provided with identity tags securely fastened at each end before the cable enters the ground.
- All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all cables shall be taped with an approved PVC or rubber insulating tape.
- Removal of concrete covers from RCC cable trenches for purposes of cable laying & restating them in their proper positions after the cables are laid shall be done by the Electrical Contractor at no extra cost.
- Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cables leaving trenches shall be coiled and provided with a protecting cover until such times the final termination to the equipment / Panel is completed.
- **At all changes in direction in horizontal and vertical places, the cable shall be bent smooth with a radius of bent not less than 12 times the diameter of the cable.**
- **If required insulation tapes of appropriate voltage & in red, yellow, blue and black shall be wrapped just below the lugs for phase / neutral identification. No insulation tape is to be provided on the thimbles / lugs, these shall be shrouded with proper shrouds.**
- Where the cable is pulled through conduits, to prevent damage to the cable approved cable lubricant shall be used for this purpose.
- At road crossing and other places where cables enter pipe / sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.
- Cables laid in vertical run of cable trays / trunking shall be suitably clamped by means of GI saddles / clamps with GI bolts, nuts and washers, where as cable in horizontal run of cable trays shall be tied by means of nylon cords / cable ties / GI clamps as directed.

## **2.00 Cable tags and Route Markers**

- **Route Markers** : Route markers shall be provided wherever cables are laid in soft soil. These shall be provided near the cable entrance to rooms and at the turning points, the distance between two route markers shall not exceed 30 meters. The route markers shall be at 100 mm dia, cast iron, minimum 10 mm thick. The route marker shall convey the voltage grade and depth of the cable laid. Height of the alphabets shall be minimum 12 mm. These shall be fixed by grouting 40x40x5 mm angle appropriate length in the ground.
- **Cable Tags** : Cable tags indicating the cable identification by means of cable number or description shall be provided near the end terminations. Cable tags shall also be provided where cable crosses room / enclosed space enroute. These shall be provided at distance of 15-20 meters (Minimum one tag shall be provided in each such room) or as directed by Project Manager / Site Engineer.
- The cable tags shall be of anodized Aluminium plate and tied to the cable properly after the cables have been laid and dressed. Wherever cables are laid in hume pipes cable tags shall be provided in the manholes.



- Temporary cable tags shall be provided before laying of cables. The layers of ABRO Tape 50-65 mm wide shall be wrapped along the circumference of the cable and cable identification marked with permanent marker in neat hand writing. After writing the ABRO tape shall be covered with transparent cello tape. The temporary tags shall be provided at 5 meters from ends and additional at every 15 to 20 meters.

### **3.00 Examination of Work**

- **No work shall be covered by backfilling or otherwise put out of view without the approval of the Consultant / Engineer-in-charge.** The Contractor shall give due notice to the Consultant / Engineer-in-charge whenever any such work is ready for examination & the Consultant / Engineer-in-charge shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work.

### **4.00 Field Tests**

- **All low voltage cables furnished under the contract shall be tested by the Contractor in the presence of the Consultant / Engineer-in-charge to ensure and prove satisfactory performance and for same the Contractor shall provide all test equipment required.**
- **The Contractor shall test all cables using DC voltage injection equipment (Digital type).**
- Immediately upon the installation of all main and sub-main cables, these shall be pressure tested. **The insulation resistance of all cables when tested with 500 volt DC Meggar shall not be less than 1 Mega Ohm.**

## **IV. Measurement**

- 1.00** Cable shall be measured by length.

## **Section – 3**

### **Technical Specification for Cable Tray / Raceway / Under Floor Trunking**

#### **I. General**

##### **1.00 Work Included**

- Ladder type GI cable tray (Hot Dip Galvanized)
- Perforated MS / GI cable tray
- MS Trunking / Raceway and Junction Boxes
- GI Trunking / Raceway and Junction Boxes
- Supporting devices

##### **2.00 Related Work and Obligations**

- The general requirements apply to work specified in this section.
- Examine all other sections of the specifications for requirements which may effect work of this section.
- Co-ordinate work with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under this Contract.

##### **3.00 General Requirements**

- This specification covers requirement for supplying and fixing of cable tray / trunking for various services in accordance with the specifications and as indicated in the drawing.

#### **4.00 Codes and Standards**

- Compliance with all applicable Indian standards, Indian Electricity Act and Indian Electricity rules.

#### **5.00 Quality Assurance**

- Cable tray and cable trunking shall only be purchased from manufacturers specializing in the manufacture of the type of cable trays mentioned herein.
- Manufacturers may be asked to provide proof of supply of similar types of cable tray and cable trunking to know users.
- Cable tray and cable trunking shall generally be to manufacturer's standard for construction and materials. Where this contradicts any part of this specification, the manufacturers shall state this at the time of tender.

#### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.
- The cable tray and cable trunking shall be guaranteed against trouble free operation, defective workmanship, materials and design for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning, whichever is earlier. Any defects during this period shall be rectified free of cost.

#### **7.00 Delivery, Handling and Storage**

- The cable tray and cable trunking shall be inspected for the following :
  - Damage
  - Compliance with specification
  - Quality
- Store cable tray & trunking in factory installed coverings in a clean, dry indoor space which provides protection against weather.

## **II. Products**

### **1.00 Ladder Type Cable Tray (Hot Dip Galvanized)**

- Cable tray shall be supplied and installed in accordance with the details shown on the drawings. The design and general arrangement of all ladder type cable trays shall be neat with adequate supports and shall be to the approval of the Consultant.
- Main Channels / Runners / Rungs used for ladder type cable tray shall be prefabricated type of minimum 2.5mm thick CRCA sheet steel hot dip galvanized. The width of cable tray and Rung's spacing shall be as specified in BOQ / Drawings.

- Ladder type cable tray accessories (Bends, Tees, Cross & Down) shall be hot dip galvanized. All accessories like Tees, Bends – Vertical / Horizontal shall be factory fabricated only. No extra charges shall be paid to Electrical Contractor for accessories and these shall be measured in length along with cable tray for payment purpose.
- **SAMPLE OF CABLE TRUNKING / RACEWAY SHALL BE SUBMITTED FOR APPROVAL BY PROJECT MANAGER / CONSULTANT.**

#### **2.00 GI / MS Perforated Cable Tray**

- Cable tray shall be supplied and installed in accordance with the details shown on the drawings. The design and general arrangement of all trays shall be neat with adequate supports and shall be to the approval of the Consultant.
- Cable tray shall be prefabricated perforated type of minimum 2.0mm thick CRCA sheet steel, enamel painted or Galvanized sheets (for trays) as specified in enclosed BOQ.
- **Perforated type cable tray accessories (Bends, Tees, Cross & Down) shall be minimum 2.0mm thick CRCA sheet steel, enamel painted or galvanized. All accessories like Tees, Bends – Vertical / Horizontal shall be factory fabricated only. No extra charges shall be paid to Electrical Contractor for accessories and these shall be measured in length along with cable tray for payment purpose.**
- **SAMPLE OF CABLE TRUNKING / RACEWAY SHALL BE SUBMITTED FOR APPROVAL BY PROJECT MANAGER / CONSULTANT.**

#### **3.00 GI Cable Trunking / Raceways**

- Cable trunking / raceways shall be supplied and installed in accordance with the details shown on the drawings. The design and general arrangement of all trunking shall be neat with adequate supports and shall be to the approval of the Consultant.
- **Cable Trunking / Raceways for use above false ceiling & Under Floor GI Cable Trunking / Raceway shall be manufactured with 1.6 mm thick galvanized sheets and proper edge for secure lid fixing by means of screws at not more than 600mm centers. The top covers for trunking / raceway shall be as specified in BOQ / Drawings. The total sectional area of the cable installed in trunking shall not exceed 45% of the internal cross-sectional area of the trunking.**
- **SAMPLE OF CABLE TRUNKING / RACEWAY SHALL BE SUBMITTED FOR APPROVAL BY PROJECT MANAGER / CONSULTANT.**

#### **4.00 Colour Coding For Cable Tray / Trunking**

- **Colour coding for cable tray / trunking shall be as follows :**
- **Galvanised Ladder Type Cable Tray for Power cables in Main Plant Rm / LT Rm Area.**
- **Galvanised Perforated Cable Trays in Basement for areas other than Main Plant Room / LT Room.**
- **Orange MS Perforated cable tray for Power / Sub-main cables in other areas (wherever applicable).**
- **Orange MS Trunking for power wiring (wherever applicable).**

- **Blue MS Trunking above false ceiling for computer cables (wherever applicable).**
- **Grey MS Trunking above false ceiling for telephone cables (wherever applicable).**
- **Galvanized Trunking above false ceiling for Power / Sub-main cable, computer, telephone & other low power cables.**
- **Galvanised under floor trunking for voice and data cables.**

#### **5.00 Painting with Synthetic Enamel paint**

- **Preparation of Surface** : The surface shall be thoroughly cleaned and dusted off. All rust, dirt scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is commenced. The primer shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall then be taken in hand. Before primer is applied, holes and undulations shall be filled up with plaster of paris and rubbed smooth.
- The primer shall be applied with brushes, worked well into the surface & spread even and smooth. The painting shall be done by crossing and laying off.
- **Application** : The number of coats including the under coat shall be stipulated in the item.
- **Under Coat** : One coat of the specified ordinary paint of shade suited to the shade of the top coat, shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.
- **Top Coat** : Top coat of synthetic enamel paint of desired shade shall be applied after the under coat is thoroughly dry. The number of coats shall be as stipulated in the item. The paint will be applied in the usual manner with brush, or spray. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface. On painting steel work, care shall be taken while painting over bolts, nuts, rivets, overlaps etc.
- **Baking** : After applying two coats of enamel paint the cable tray / trunking shall be placed in suitable oven and dried at the proper temperature as recommended by the Paint Manufacturer (130 to 140 degree centigrade) to obtain proper bounding of the paint to the mild steel surface. The cable tray / trunking can be alternatively powder coated.

### **III. Installation**

#### **1.00 Cable Tray**

- Cable trays shall be coupled by means of rigid edge bars and fish plates and care shall be taken to eliminate dangerous bolt ends projecting through the flanges.
- Effective continuity between sections of trays shall be ensured by separate bonding strips bolted across each coupling point. The contact surfaces shall be thoroughly cleaned prior to bonding.

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- Cable tray for horizontal runs suspended from the ceiling shall be installed with flanges facing downwards and the tray shall be supported with purpose made round mild steel rods (threaded at both ends) or other such supporting devices as approved by the Consultant at sufficient centers to prevent the tray from sagging and to provide an overall rigid construction. Cable tray fixed to walls or ceiling soffits shall be installed with flange outwards or downwards respectively & shall be fixed with an approved fixing with spacing washers such that the tray is at least 10mm from the surface of the wall or ceiling.
- The complete installation shall be free from burrs and sharp edges.
- Where exact sizes of cable trays are not detailed, then the Electrical Contractor shall ensure that all cable trays are liberally sized to suit the installation.
- **For requirements of larger than 1000 mm width two trays shall be run side by side.**
- **Maximum support span for cable trays shall not exceed 1200 mm unless design is approved for larger span. The maximum support span shall however be decided by Consultant / Site Engineer in accordance with site conditions. This may be reviewed as per site conditions and reduced to 1000 mm or 900 mm as required.**
- Where two lengths of cable trays are coupled together additional supports shall be provided on either side to ensure proper alignment. These supports shall be provided less than or 300 mm on either side.
- Dash fasteners used for fixing cable trays shall be Hilti / Cannon make or equal. Size of dash fasteners shall vary between 6 mm to 12 mm depending on size and weight of cable tray. Arrangement for structural supporting system for cable trays shall be responsibility of the contractor and subject to approval of the consultant / Site Engineer. Shop drawings wherever necessary shall be prepared and submitted for approval by the Contractor.
- **Proper sealing arrangement shall be provided where cable tray passes through wall / cutout with fire retardant mortar.**

## **2.00 Cable Trunking**

- Where cutting or slotting of trunking is carried out, all sharp edges and burrs shall be removed. Where cables pass through slots in trunking the perimeter of the slot shall be shrouded with continuous PVC sleeving.
- All trunking and accessories shall be finished, externally and internally, with enamel paint as indicated in BOQ to prevent the formation of rust, unless otherwise specified. Cables installed in the trunking shall, wherever practicable, be laid with the larger size of cables at the bottom.
- **Dash fasteners utilized in horizontal / vertical trunking runs, shall be installed at distances not exceeding 750 mm. All cables bound to the supporting MS flats / straps inside the trunking shall be at a maximum spacing of 600mm.**
- Where trunking terminates at electrical apparatus, a suitable flanged coupling shall be provided.
- Sealing end pieces shall be used to blank off the end of all trunking.
- **Where trunking is installed with the open side down, suitable cable retaining straps shall be installed in each compartment of the trunking at a maximum spacing of 600mm.**
- Where conduit / flexible conduit terminates on trunking, the connection to the trunking shall be by means of separate couplings / checknuts.

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- Where the paint has been damaged or removed from trunking, the metal work shall be repainted.
- Particular care must be taken when carrying out the trunking installation to ensure that effective earth continuity is achieved. At each joint in the trunking, e.g. between straight lengths, tee units, angle units etc., a proper bonding strip shall be connected across the joints. The Contact surfaces of the trunking shall be thoroughly cleaned and the bonding strips fixed by two M4 round head screws and nuts on each side, connected with suitable locking washers.
- Where trunking passes through fire division walls, floors, ceilings or partitions, internal fire division barriers shall be provided.
- Where two lengths of cable trunking are coupled together or where cable trunking is terminated into junction boxes additional supports shall be provided on either side to ensure proper alignment. These supports shall be provided less than or 300 mm on either side.
- Dash fasteners used for fixing cable trunking shall be Hilti / Cannon make or equal. Size of dash fasteners shall vary between 6 mm to 12 mm depending on size and weight of cable trunking. Arrangement for structural supporting system for cable trunking shall be responsibility of the contractors and subject to approval of the consultant. Shop drawings wherever necessary shall be prepared and submitted for approval by the Contractor.
- **Proper sealing arrangement shall be provided where cable tray passes through wall / cutout with fire retardant mortar.**

#### **IV. Measurement**

- 1.00** Cable tray / trunking shall be measured by length.

## Section – 4

### Technical Specification for Earthing System

#### I. General

##### 1.00 Work Included

- Installation, Testing and Commissioning of Earthing System
- Earthing Stations
- Electrolytic Grade Copper Earthing Tapes
- Electrolytic Grade Copper Earthing Plates / Pipes / Rods
- GI Earthing Tapes
- GI Earthing Plates / Pipes / Rods
- Earth Test Links

##### 2.00 Related Work and Obligations

- To meet the general requirements apply to work specified in this section.



- To examine all the other sections of the specification for requirements, which may affect work of this section.
- To co-ordinate works with all other trades affecting or affected by activities of this section; Co-operate with such other trades to assure the steady progress of all operations under the contract.

### **3.00 General Requirements**

- The intent of this specification is to define the requirement for the supply, installation, testing and commissioning of the Earthing system.
- All non-current carrying metal parts of equipment including the metal case of all Panels shall be earthed by means of Copper Tape / GI Tape in accordance with particular specifications. Copper Tape used for Neutral shall always be provided with heat shrunk PVC sleeves.

### **4.00 Codes and Standards**

- The earthing system shall comply with all applicable Indian Standards (IS 3043 : 1987 - Code of Practice for Earthing) as well as IEEE 80 : 2000. The installation shall also comply with Indian Electricity Act and Indian Electricity rules as well as relevant international standards.

### **5.00 Quality Assurance**

- The Contractor shall ensure that all materials furnished & installed by him under the contract shall meet the requirements of relevant Indian & International Standards. The Contractor shall also verify all test results and ensure that these are in accordance with the requirements as mentioned in the specifications.

### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.

### **7.00 Delivery, Handling and Storage**

- The earthing material shall be inspected for the followings :-
  - Damage
  - Compliance with Specification
  - Quality
- While on site, the material shall be stored in proper manner to prevent rusting / damage.

## **II. Products**

### **1.00 General Details**

- The earthing material shall be brand new and in good condition. Earthing Strips / Earthing Plate / Earthing Pipes / Earthing Rods shall be GI / Copper / Copper Bonded Steel as called for in particular specifications / BOQ. GI Tapes / Copper Tapes / PVC insulated green earth wires shall also be in accordance with details as mentioned in the Drawings / BOQ.

### **2.00 Earthing Stations**

**a. General Earthing**

- Earth Electrode (Plate / Pipe / Rod) shall be driven to a sufficient depth to reach permanently moist soil.
- Electrodes shall preferably be situated in a soil which has a fine texture and which is packed by watering and ramming as tightly as possible. Wherever practicable, the soil shall be dug up, all lumps broken and stones removed from the immediate vicinity of the electrodes.
- In case of Plate Earthing, the earthing electrode shall consist of a tinned copper plate not less than 900 mm x 900 mm x 6 mm thick or GI plate 900 mm x 900 mm x 10 mm thick unless otherwise specified. The earth plate shall be set vertically & surrounded with suitable quantity of backfill material complying to '**IEEE 80 - 2000 Clause 14.5.d**'. A 20 mm dia GI pipe shall run from the top edge of the plate to the ground level & shall be provided with a funnel and a mesh for watering the earth through pipe.
- **In case of Pipe Earthing**, the earthing pipe shall be minimum 50 mm dia 14 SWG for GI Pipe and minimum 38 mm dia 16 SWG for Copper Pipe. The Pipe shall be surrounded with suitable quantity of Backfill material confirming to '**IEEE 80 - 2000 Clause 14.5.d**'. The top of the pipe shall be provided with a funnel and a mesh for watering the earth through pipe.
- Earth electrode / funnel shall be covered with heavy duty cast iron cover housed on a masonry chamber approximately 300 mm x 300 mm x 300 mm deep. The covers shall have sturdy locking arrangement. They shall also be provided with stumbling free, non protruding lifting arrangement.
- In case of Rod Earthing, the earthing electrode shall be minimum 32 mm dia Galvanized MS Rod for Sub-Stations & 25 mm dia Galvanized MS Rod for LT Panels. The earthing rod shall be set vertically and surrounded with suitable quantity of Backfill material complying with '**IEEE 80 - 2000 Clause 14.5.d**'.

**b. Maintenance Free Earthing**

- **In case of Rod Earthing**, the Earthing Electrode shall consist of Copper Rod of suitable dia for achieving desired surface area. In case of use of Copper Bonded Steel Rod, the thickness of molecularly bonded copper coating shall not be less than 250 micron. The earthing electrode & bonding material shall comply with UL 467 for Grounding and Bonding Equipment. The earthing electrode arrangement shall be provided with ground enhancing material complying with IEEE 80 : 2000 clause 14.5 'd'.
- The Ground enhancing material in its set form shall have a resistivity of not more than 20 Ohm-cm. the Proposed Material shall not dissolve or decompose or otherwise pollute the soil or the local water table. **The earthing stations shall be guaranteed for minimum 25 years for restricting earthing resistance as mentioned in BOQ. The necessary Calculation for achieving the guaranteed Earthing resistance value shall be submitted by vendor for approval.**
- The electrodes shall have a clean surface, not covered by paint, enamel, grease or other material of poor conductivity.

**III. Installation, Testing and Commissioning**

**1.00 Erection**

- The earth continuity resistance shall not exceed the specified values as per testing in BIS regulations.

- A removable test link shall be provided as near as possible to the earth electrode for isolating of the earth electrode /earth pits to check their resistance periodically. Wherever tape is fixed to the building structure, it shall be by means of purpose made saddles. Fixing shall be made by using purpose made plugs and clamps. Fixings requiring the drilling of the hole through the strip shall not be used. Joints in tapes shall be tinned before assembly and riveted with a minimum of two rivets severed solid. A drawing showing the proposed arrangement shall be submitted by the contractor for approval before any work is carried out at site. Care shall be taken that the excavations for earth electrode may not affect the column footings or foundation of the building.
- **The Earth Pit for lightning conductors shall be at least 7M away from Earth Pits for Body Earthing of equipments & at least 10M away from Earth Pits for dedicated / clean earth. The Earth Pits for Body Earthing of equipment shall be at least 10M away from Earth Pit for dedicated / clean earth.**
- **The Contractor shall visit the site during the tender stage for purpose of ascertaining ground condition as well as soil resistivity value regarding main / auxiliary earths & no extra charges shall be entertained after the contract is awarded.**
- The exact location of earth conductors, earth electrodes and earthing points shall be determined at the site by the Contractor in consultation with the Consultant & the same shall be indicated in as built drawings.
- Earthing Conductor shall be GI or Copper tapes or Copper wires with PVC insulation as specified in BOQ. **The Copper tape shall have more than 85% conductivity.**
- All Tapes shall be jointed to ensure earth continuity. **GI Tapes shall be jointed by welding and painting the same with zinc rich paint. All Copper Tapes above surface level shall be tinned and riveted at the joints with minimum two rivets for 25 mm wide tapes and four rivets for 32 mm wide & above tapes. All Copper Tape buried in soil shall be joint with exothermic welding to ensure proper connection & low contact resistance.**

#### **2.00 Examination of Work**

- No work shall be covered by backfilling or otherwise put out of view without the approval of the Consultant / Engineer-in-charge. The Contractor shall give due notice to the Consultant / Engineer-in-charge whenever any such work is ready for examination and the Consultant / Engineer-in-charge shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work.

#### **3.00 Field Tests**

- Each electrodes shall be tested for earth resistance by means of standard DIGITAL EARTH TEST METER. The tests shall be carried out preferably after a protracted dry spell. The distance between two electrodes shall not be less than twice the length of electrode.
- **No Earth Station shall have a ohmic resistance more than 2 ohms for equipment earthing as measured by a DIGITAL Earth testing apparatus.**
- **No Earth Station shall have a ohmic resistance more than 1 ohm for dedicated / clean earthing as measured by a DIGITAL Earth testing apparatus.**

#### **IV. Measurement**

- 1.00** Earthing stations shall be enumerated and Earthing Tapes / PVC insulated copper wires shall be measured by length.

**V. Submittals**

**1.00 Following Test Certificates / Submittals shall be furnished by Vendor during Tender submission :**

- **Compliance of Earthing Electrode to UL 467 - Grounding & Bonding Equipment / KEMA83C : 1990 (in case of maintenance free earthing)**
- **Confirmation of Eco friendliness of ground enhancing material & compliance to IEEE 80 : 2000 clause 14.5 'd' (in case of maintenance free earthing)**
- **Necessary Calculations for achieving the guaranteed Earthing resistance value for approval.**
- **Guarantee of restriction of maximum ohmic value of earth station as per specifications for at least 25 years (in case of maintenance free earthing)**

## **Section – 5**

### **Technical Specification for Conduits**

#### **I. General**

##### **1.00 Work Included**

- MS Conduits
- PVC Conduits
- Flexible, Bends, Junction Boxes and Accessories
- Installation

##### **2.00 Related Work and Obligations**

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements which may affect work of this section.
- Co-ordinate work with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

##### **3.00 General Requirements**

- This specification covers requirements for supplying & fixing concealed / surface mounted conduits for various services in accordance with the specifications and as indicated in the drawings. **All conduits shall be ISI marked.**

#### **4.00 Codes and Standards**

- The conduits shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules :-
  - IS 9537 (Part-I, 1980) : Specification for Conduits for Electrical Installations (General Requirements)
  - IS 9537 (Part-II, 1981) : Specification for Conduits for Electrical Wiring (Rigid Steel Conduit)
  - IS 9537 (Part-III, 1983) : PVC conduit pipes
  - IS 3072 / 1965 : Flexible steel conduits for electrical wiring
  - IS 2667 / 1966 : Fittings for rigid steel conduits for electrical wiring

#### **5.00 Quality Assurance**

- The Contractor shall ensure that all materials furnished and installed by him under the contract shall meet the requirements of relevant Indian standards.

#### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.

#### **7.00 Delivery, Handling and Storage**

- Conduit and accessories shall be inspected for the followings :-
  - Damage
  - Compliance with specification
  - Quality
- The conduits shall be protected from weather, fire or mechanical damage during storage.

### **II. Products**

#### **1.00 General Detail**

- The MS conduits /PVC conduits, bends, flexible, boxes and accessories shall be brand new and in good condition.

#### **2.00 MS Conduits**

- MS Conduits shall be ISI marked, ERW type (Electric Resistance Welded), black stove enameled inside and outside, manufactured by High Frequency Induction Welding process and shall conform to all relevant Indian standards.

- Minimum wall thickness of MS conduits shall be 1.6mm (16 SWG) up to 32mm & 2.0mm (14 SWG) for 38mm and 50mm dia. The conduits shall be delivered to the site in original bundles and each length of conduit shall bear the label of the manufacturer. The number of insulated copper wires that may be drawn into the conduits of various sizes shall be in accordance with relevant Indian standards and space factor shall not exceed 40%.

### **3.00 PVC Conduits**

- PVC Conduits shall be ISI marked, manufactured by Extrusion Process and shall conform to all relevant Indian standards.
- PVC Conduits shall be heavy gauge, high impact PVC smooth inside & outside. The polyvinylchloride conduit and accessories shall be of one manufacturer and the manufacturers installation instructions shall be deemed to form part of the specification.
- Minimum wall thickness shall be 1.8/2.0 mm for all conduits up to 50mm dia.
- The conduits shall be delivered to the site in original bundles and each length of conduit shall bear the label for the manufacturer. The number of insulated copper wires that may be drawn into the conduits of various sizes shall be in accordance with relevant Indian standards and space factor shall not exceed 40%.

### **4.00 GI / PVC Flexible**

- GI Flexible shall be used along with MS Conduits wherever necessary and PVC Flexible with PVC conduits unless otherwise mentioned in the particular specification.
- GI / PVC flexible conduits where applicable shall be used only to items of equipment which are withdrawable or subject to vibration or adjustment. The flexible conduits shall have a minimum length of 300mm & have sufficient length to allow the full range of withdrawal adjustment or movement necessary, terminated at each connection with proper couplers and checknuts. All earth conductors shall be taken internally through the conduit and fixed to the earth terminal of the light fixtures & switch boxes etc.

### **5.00 Bends, Junction Boxes and Accessories**

- Bends, Junction Boxes & accessories shall be MS / PVC as required. Bends shall not have radius less than 2½ times the outside diameter of the conduit & junction boxes shall be one / two / three / four way as necessary during installation at site.
- Circular inspection boxes shall be of minimum 50 mm dia rust proof, manufactured from sheet steel with smooth external and internal finish. These boxes shall be provided to facilitate removal and replacement of wires when required.
- **Termination to accessory boxes shall be carried out with proper checknut in case of MS Conduits along with rubber bushes which shall be provided both for MS as well as PVC conduits.**

## **III. Installation**

### **1.00 Erection**

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- Conduits shall be concealed, wherever possible unless stated otherwise, by chasing into walls, installation in ceiling spaces or trunking or direct burial within poured concrete. No chases will be cut without approval of the consultant. Conduits shall be securely fixed to reinforcement or shuttering to prevent displacement. All boxes & conduits shall be fitted covers or plugs to prevent ingress of moisture or rubble & shall remain sealed until ready for wire pulling. No conduits shall be installed in screed or plaster unless such is of ample thickness & prior approval is obtained. All conduits must be checked where run in floor screeds before the floor screed is laid.
- Conduits shall have draw in boxes every 10M of straight run or 7.5 M of lengths containing bends or every third bend. Conduit shall not have more than two right angle bends in any run without provision of draw in box / junction box.
- In case of MS Conduits, joints between conduits & accessories shall be securely made to ensure earth continuity & positive mechanical connection.
- Conduits shall be installed in such a manner that all cables / wires can be drawn in after erection with ease by means of a pull wire.
- Conduits connections for MS conduits shall be screwed to metal and all conduits joints shall be painted with approved metallic paint. The threads and sockets shall be free from grease and oil. Connections between screwed conduits and sheet metal boxes shall through a coupler through the conduit.
- When necessary, bends and diversions may be achieved by means of bends and / or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly screwed and flushed with the finished wall surface.
- **Surface conduits shall be fixed by means of space bar saddles with base at intervals not more than 750 mm. The saddle with base shall be galvanized mild steel flat, and properly treated, securely fixed to support by means of screws. Where circular inspection box / inspection bends are mounted for necessary bends and diversion. All conduits shall be provided with saddles with base within 150 mm on either side of the inspection box / bend.**
- All conduits shall be installed neatly and as unobtrusively possible parallel to general building lines where run on the surface of walls and ceilings. Laid in a straight line from point to point when concealed. Care must be taken where run in floors to prevent damage to the finish until floor screeds are laid.
- Cables shall not drawn until the conduiting is complete. Conduits shall not be installed in contact with steel, water, gas or heating pipe work. A distance of 150 mm shall be maintained from other services wherever possible. Conduits shall not be left with any untreated rust patches on surfaces or installed by fixing nails.
- All screws used to secure cover plates, ceiling roses, batten type lamp holders, fan controllers or surface mounted luminaries to circular shall be galvanized and have a m4 thread. These screws shall have a pin head, countersunk head or raised head as required by the particular item to be fixed. Screws shall be of sufficient length to fully engaged the threaded lugs of the conduit box. Self tapping screws shall not be used for the above purposes under any circumstances.
- All flush conduit boxes shall be installed with the front face level with the finished surface; where necessary extension sections shall be added. All circular conduit boxes shall be drilled and screwed with a minimum of one fixing; adaptable boxes and rectangular boxes for socket outlets, light switches and spur units etc., with a minimum of two fixings.



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- All joints between PVC conduit and PVC accessories shall be glued by a solvent welding process. Conduit of not less than 25 mm shall be used throughout unless otherwise specified in particular specifications / BOQ.
- They shall be protected from weather and all mechanical damage during installation and at the same time protected by means of wooden plugs, plastic plugs or plastic caps to prevent the entrance of plaster or foreign matter during erection.
- The conduit work shall be concealed in floors, walls & roof slabs. The wiring shall be continuously and effectively protected along its whole length, with conduits mechanically continuous throughout. Cable capacities to be drawn in the conduit shall be as laid in the ISI regulations for the size of the conduit to be used. The number of cables shall include separate earth wires in accordance with the standard regulations.
- **PVC conduits shall not be used where not approved by IEE wiring regulations including hazardous locations and areas of high ambient temperature / above false ceiling.** PVC conduit installation shall be generally in accordance with requirements specified for steel conduits except that they shall be installed with plastic fitting boxes and sets, with bends and sets formed with the help of helical spring fitted internally with the conduit warmed sufficiently of it to move without deformation of the bore and without avoidable wall thinning on the outside of the bend. With length coupled together by means of PVC socket jointed by solvent solution. For the above separate earth wire shall be used to ensure earth continuity.

**2.00 Examination of Work**

- Prior to laying and fixing of conduits, the Contractor shall carefully examine the drawings indicating the layout, satisfy himself about the sufficiency of number & sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of the Consultant. Any modifications suggested by the Contractor shall be got approved by the Consultant before the actual laying of conduits is commenced / completed.

**IV. Measurement**

- 1.00** Conduits shall be measured by length or form part of the enumerated items in case of point wiring etc.

## Section – 6

### Technical Specification for PVC Insulated FR-LSH Copper Wires

#### I. General

##### 1.00 Work Included

- PVC insulated FR-LSH Copper Conductor Wires (1100 Volt grade) ISI marked

##### 2.00 Related Work and Obligations

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements, which may affect work of this section.
- Co-ordinate works with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

##### 3.00 General Requirements

- This specification covers requirements for supplying, laying, testing and commissioning of PVC insulated FR-LSH Copper Conductor Wires, 1100 volt grade in existing MS / PVC conduits in accordance with the specifications and as mentioned in the drawings. **All PVC insulated FR-LSH Copper Conductor Wires shall be ISI marked.**

##### 4.00 Codes and Standards

- The wiring shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules :-
- IS 694 / 1990 : Wiring as well as flexible cords (metric)
- IS 2448 / 1962 : Adhesive insulating tapes.
- All tests should comply with ASTM Standards.

#### **5.00 Quality Assurance**

- Manufacturers regularly engaged in manufacture of wires, whose products have been in satisfactory use in similar service for not less than 5 years.

#### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities, which manufacturer and Contractor may have by other provisions of the contract document.
- The wires shall be guaranteed against trouble free operation, defective workmanship and materials for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning, whichever is earlier. In case of any defects during this period cables shall be replaced free of cost by the Contractor.

#### **7.00 Delivery, Handling and Storage**

- All wires shall be carefully transported to site to avoid damage during transit. While on site all wires shall be stored in a proper manner to prevent damage or moisture ingress.

### **II. Products**

#### **1.00 General Detail**

- All copper conductor wires shall be PVC insulated, FR-LSH, unsheathed, solid / stranded annealed electrolytic grade copper conductor.
- 1100 volt grade in accordance with IS 694 / 1990 and ISI marked.
- 1.0 sq. mm. PVC insulated FR-LSH copper wires shall be solid conductor.
- 1.5 sq. mm. PVC insulated FR-LSH copper wires and above shall be stranded conductor.
- Multi stranded copper conductors can be used with approval of Consultant.

#### **2.00 Colour Codes**

- Red, Yellow & Blue coloured PVC wires for three phase, Black for Neutral, White for 'Off' wire & Green for Body Earth shall be used. Dedicated Earth Wire wherever required shall be Yellow + Green.

#### **3.00 Co-Axial Cables**

- Coaxial cables for TV, CCTV shall be solid annealed bare electrolytic grade copper conductor with gas injected physical foam PE dielectric, poly laminated Aluminium tape followed by copper braiding, jelly filled and overall PVC sheathed.

**4.00 Maximum Capacity of Conduits for Drawing in PVC Insulated Wires / Cables to IS:694 / 1990**

#	Size of Conduit Wire Size in sq. mm.	20 mm	25 mm	32 mm	40 mm	50 mm
		Number of Wires / Cables				
•	1.5	4	8	12	-	-
•	2.5	3	6	10	-	-
•	4.0	2	5	8	-	-
•	6.0	-	4	7	-	-
•	10.0	-	3	5	6	-
•	16.0	-	2	3	5	7
•	25.0	-	-	2	3	6
•	35.0	-	-	-	2	5
•	50.0	-	-	-	-	3

- The table shows maximum capacity for simultaneous drawing of Cables manufactured in accordance with IS : 694 / 1990. This table applies to all type of conductors

**5.00 Circuit Details**

- Lighting / Fans Points – 10 Points or 800 Watts on each Circuit whichever is less
- 6 Amps Switched Socket Outlet (Raw Power) – 10 Points or 800 W on each Circuit whichever is less
- 6 Amps (Twin) Switch Socket Outlet (UPS) – 4 Sets on each Circuit
- 6 Amps (Triple) Switch Socket Outlet (UPS) – 2 Sets on each Circuit
- 16 Amps Switch Socket Outlet (Raw Power / UPS) – 2 Nos. on each Circuit
- A/C Outlet – 1 No. on each Circuit

**6.00 Tests**

- PVC insulated wires shall be subjected to tests as required by IS : 694 .

**6.01 Type Tests**

- Certificates to be provided by Wire Manufacturer for the following :

- Tests on Conductor : Annealing Test for Copper, Measurement of Resistance
- Test for Thickness of Insulation and Sheath
- High Voltage Test
- Insulation Resistance Test
- Flammability Test

#### **6.02 Routine Shop Tests**

- The following routine shop tests shall be carried out at Cable manufacturer's factory :
  - Acceptance Tests for Conductor and Insulation
  - High Voltage Test
  - Conductor Resistance Test

### **III. Installation**

#### **1.00 Erection**

- The system of internal wiring shall consist of PVC insulated FR-LSH copper conductor solid / stranded wires 1100 volt grade in PVC / MS conduits as called for. Conduits shall be concealed or surface mounted as required.
- Prior to laying & fixing of conduits, the contractor shall examine the drawings indicating the layout, satisfy himself about the sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of architect / consultant before the commencement of the work. Any modifications suggested by the contractor shall be got approved by the architect / consultant before the actual laying of the conduits. Maximum capacity of conduits for drawing in PVC insulated FR-LSH wires shall be as per IS 694/77.
- Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phase shall not run in the same conduit.
- The drawing and jointing of PVC insulated FR-LSH copper conductor wires & cables 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. Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square. In case multi stranded wires are used the same shall be provided with lugs for all conductor sizes.

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- Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional areas to take all strands. Connecting screws shall have flat 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. Conductors having nominal cross sectional area exceeding 6.0 sq. mm shall always be provided with cable sockets. At all bolted terminals, flat washer of large area and approved steel spring shall be used. Nuts & bolts shall be used for all connections. Only certified wiremen & cable jointers shall be employed to do jointing work. All wires shall have the manufactures label and shall be brought to site in original packing. For all internal wiring, PVC insulated wires of 1100 volt grade 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. If the use of joints is unavoidable due to any specific reason, prior permission, in writing, shall be obtained from the architect / consultant. No wires shall be drawn into any conduit, until all work of any nature, that may cause injury to wires, is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits, the conduit shall be thoroughly cleaned of moisture, dirt, dust or any other obstruction by forcing compressed air through the conduit. The minimum size of PVC insulated FR-LSH Copper Conductor Wires for all sub-circuit wiring for light points shall be 2.5 sq. mm.
- Mains & submains, cables and wires where called for shall be of the rated capacity and approved make. Every main and submain wire shall be drawn into an independent adequate size conduit. An independent earth wire of proper rating shall be provided for every single phase submain. For every three phase sub-main, 2 nos. earth wires of proper rating shall be provided. The earth wires shall be taken internally through the conduit and fixed to the appropriate earth terminal. Where mains & sub-mains are connected to switchgear, sufficient extra length of cable shall be provided to facilitate easy connections and maintenance.
- **Balancing of circuits in 3 phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.**
- Color code shall be maintained for the entire wiring installation : red, yellow, blue for three phase, black for neutral, white for 'off' wire and green for PVC insulated earthwire (if PVC insulated FR-LSH Earth Wire is called for) and yellow + green for Dedicated Earth Wire.
- Point Wiring for light points, fan points, exhaust fan points, switch socket outlets shall include the cost of conduits wire, earth wire, ceiling rose / connector, junction box, fan hook box, switch mounting box, receptacle, switch and switch plate complete as required & nothing shall be paid over and above the quoted rates.
- Staircase and corridor lights shall be on separate circuits and shall be independently connected so that it could be operated by on switch installation on the ground floor easily accessible to fire fighting staff at any time.

## **2.00 Examination of Work**

- **No work shall be covered or otherwise put out of view without the approval of the Consultant / Engineer-in-charge.** The Contractor shall give due notice to the Consultant / Engineer-in-charge whenever any such work is ready for examination & the Consultant / Engineer-in-charge shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining & measuring such work.

## **3.00 Field Tests**

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- The following Field Tests shall be carried out for the Wiring Installation : All low voltage wires furnished under the contract shall be tested by the contractor to ensure and prove satisfactory performance
- Insulation Resistance
- Earth Continuity
- Polarity

**IV. Measurement**

- 1.00** Wires shall be measured by length or form part of the enumerated items in case of point wiring etc.
- 2.00** Looping from switch of initial first light point to switch of next first light point shall form part of circuit wiring and nothing extra shall be paid over and above quoted rates.

## Section – 7

### Technical Specification for Switches, Socket Outlets & Receptacles

#### I. General

##### 1.00 Work Included

- Switches
- Socket outlets
- Receptacles
- Installation (includes fixing, testing and commissioning)

##### 2.00 Related Work and Obligations

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements, which may affect work of this section.
- Co-ordinate work with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

##### 3.00 General Requirements

- This specification covers requirements for supplying, fixing, testing & commissioning of Switches, Socket Outlets & Receptacles.



- The requirements specified in these clauses refer to switches, socket outlets and receptacles on 50 Hz, AC supplies and nominal 240 volts. All 240 volts outlets shall be three pin type with earth contact effectively connected to earth in all cases.

#### **4.00 Codes and Standards**

- The switches, socket outlets and receptacles shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules :-
  - IS 3845 (1966) : Light and power switches
  - IS 5987 (1970) : Light and power switches
  - IS 1293 (1967) : Socket outlets
  - IS 4615 (1968) : Socket outlets
  - IS 5133 (1969) : Boxes for enclosure of electrical accessories.
  - IS 3854 (1966) : Switches for domestic & similar purposes.

#### **5.00 Quality Assurance**

- The Contractor shall ensure that all materials furnished & installed by him under the contract shall meet the requirements of relevant Indian Standards.

#### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.
- The switches, socket outlets and receptacles shall be guaranteed against trouble free operation, defective workmanship & materials for a period of 18 months from the date of supply or 12 months from the date of erection & commissioning, whichever is earlier. In case of any defects during this period switches, socket outlets and receptacles shall be replaced free of cost by the Contractor.

#### **7.00 Delivery, Handling and Storage**

- All switches, socket outlets and receptacles shall be carefully handled and stored at site in a neat and orderly manner for fixing the same at a later date.

### **II. Products**

#### **1.00 General Detail**

- The switches, socket outlets and receptacles shall be brand new and in good condition.

#### **2.00 Switches, Socket Outlets and Receptacles**

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- Light / Power switches shall comply with IS 3845 - 1966 and IS 5987 - 1970. These shall be rated for 6 amps or 16 amps whichever is applicable and shall be one way, two way or intermediate as detailed & match the switched socket outlets in design. All switches shall be the type suitable for the nature of supply to which they are to be connected. Socket outlets shall be 6 amps or 16 amps single or twin which ever is required and manufactured in accordance with IS 1293 - 1967 and IS 4615 - 1968.
- For external locations the switches shall be of weather proof pattern with IP – 67 degree of position.

### **III. Installation, Testing and Commissioning**

#### **1.00 Erection**

- Switches controlling the light points shall be connected to the phase wire of the circuit. Where several switches on one phase are shown they will be installed in composite ganged units. **Different phases shall not be ganged in one box unless each phase is segregated in a separate compartment.**
- Where possible the arrangement of switches in ganged boxes shall be similar in plan to the lighting plans they control. Switches not so arranged shall be labeled in an approved manner to indicate the circuits controlled.
- All switches, sockets, switch plates and other receptacles for light & power shall be covered with cling film during installation. This cling film shall be neatly removed after the final painting / polishing of walls / furniture is over.
- All fixing boxes shall be MS / GI boxes as called for with proper brass earthing terminal. Sunk switches and socket outlets shall be mounted in above boxes with minimum depth of 50 mm. The face plate of switches shall be fixed square and flushed with the wall. **The switch controlling the socket outlet shall be on the phase wire of the circuit.**
- The mounting height to the bottom of the outlet box shall be 1050 mm unless otherwise specified and where the structure and furnishing permits. The distance from the edge of the door to the near edge of the switch shall be 225mm. The swing of the door shall be checked on site before marking out any chases for switch positions. Socket outlets shall be supplied & installed by the Contractor in position and of the type indicated on the drawings or the schedules and shall be installed in the position indicated. Switched or unswitched as required on the drawings mounted in multi assemblies where grouped.
- Sockets for special circuits will be particularly specified. Any requirement for sparkles switches / sockets will be particularly indicated. Where socket outlets are mounted on work benches, they shall be mounted 150mm above the bench surface unless otherwise specified and not flushed with the bench surface. Generally outlets shall be installed 50mm above the skirting level to the bottom of the outlet box.
- Surface mounted switches connected to surface mounted conduits shall be fixed to either MS or PVC moulded box as required.
- The earthing to each socket in case of Raw Power shall be effected by terminating the main earth conductor to a proper earth terminal fixed in outlet box. For this earth terminal the Contractor shall install an earthing fly lead of 2.5 sq. mm. cross sectional area with an overall insulation of PVC coloured green to the socket outlet earthing terminal. The fly lead shall be of sufficient length to facilitate the ease of removal during maintenance. Where a cable outlet / socket outlet of 20 amps / 16 amps is installed for purpose of supplying power to A/C units the same shall be mounted in a position as indicated on the drawings.

- In case of sockets required with Dedicated ground supply, there shall be 2 nos. PVC insulated green and yellow + green earth wires one to be taken from brass earthing terminal mounted in the box and the other from earth pin of the receptacles / socket.

**2.00 Examination of Work**

- The Contractor shall give due notice to the Consultant / Engineer-in-charge whenever any such work is ready for examination and the Consultant / Engineer-in-charge shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining such work.

**3.00 Field Tests**

- All low voltage cables furnished under the contract shall be tested by the Contractor in the presence of the Consultant / Engineer-in-charge to ensure and prove satisfactory performance and for same the Contractor shall provide all test equipment required.
- Each socket outlet / receptacle shall be tested for the following :-
  - Open ground
  - Open neutral
  - Open hot
  - Hot / Ground reverse
  - Hot / Neutral reverse
  - Correct

**IV. Measurement**

- 1.00** Switches, Socket Outlets and Receptacles shall be enumerated.

## **Section – 8**

### **Technical Specification for Lighting Fixtures, Ceiling Fans, Bracket Fans & Exhaust Fans**

#### **I. General**

##### **1.00 Work Included**

- Fluorescent / CFL / Incandescent / Halogen / LED Light Fixtures
- Fluorescent / CFL / Incandescent / Halogen Lamps
- Ceiling Fans
- Bracket Fans
- Exhaust Fans
- Installation, Testing and Commissioning

##### **2.00 Related Work and Obligations**

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements, which may affect work of this section.
- Co-ordinate work with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

### **3.00 General Requirements**

- This specification covers requirements for supplying, fixing, testing and commissioning of Lighting Fixtures, Lamps, Tubes, Ceiling / Bracket Fans and Exhaust Fans in accordance with make and catalogue numbers as mentioned in BOQ.

### **4.00 Codes and Standards**

- The Lighting fixtures, Ceiling fans, Bracket fans and Exhaust fans shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules.
- IS 371 / 1966 : Ceiling roses, two and three terminal
- IS 418 / 1963 : Electric Lamps, Tungsten Filament general service
- IS 1913 / 1969 : General and safety requirement for electric light fitting
- IS 3837 / 1966 : Waterproof electric light fitting

### **5.00 Quality Assurance**

- The Contractor shall ensure that all materials furnished & installed by him under the contract shall meet the requirements of relevant Indian standards.
- Manufacturers regularly engaged in manufacture of Lighting Fixtures, Lamps / Tubes, Ceiling / Bracket Fans and Exhaust Fans as required, whose products have been in satisfactory use in similar service for not less than 5 years.
- Installation shall be carried out by a firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.

### **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.
- The Lighting Fixtures (excluding compact fluorescent lamps, fluorescent tubes & halogen lamps), Ceiling Fans, Bracket Fans and Exhaust Fans shall be guaranteed against trouble free operation, defective workmanship & materials for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning, whichever is earlier. In case of any defects during this period cables shall be replaced free of cost by the Contractor.

### **7.00 Delivery, Handling and Storage**

- All lighting fixtures, fans and exhaust fans shall be inspected for the followings :-
  - Damage
  - Compliance with specification
  - Quality
- These shall be protected from weather, fire or mechanical damage during storage

## **II. Products**

### **1.00 Lighting Fixtures / Luminaries**

- All Lighting Fixtures to be used in the installation shall be in accordance with make and catalogue number as mentioned in BOQ or as approved by the Architect / Consultant. Lighting fixtures shall be complete in all respects including, housing lamps, tubes, lamp holders, reflectors, ballast, starters and wiring.
- All luminaries control gear components and wiring shall be enclosed in sealed boxes which can protect from corrosion.
- Recessed, surface mounted and suspended luminaries shall be designed for use with control gear having maximum case temperatures, installed in ambient temperature and conditions stated in Indian Standards and IEC relevant sections.
- All luminaries shall be labeled with the voltage, wattage, frequency and current rating to include control gear and lamps, manufacturer's name and fixture type.
- All ballast shall be of the dry type epoxy resin encapsulated copper iron unless otherwise mentioned in the particular specification. In case HF Electronic Ballast are required, these shall be specially called for in the BOQ.
- Where reflector & louvers assembly are employed with fluorescent lamps, these shall be constructed from anodized aluminum coloration.
- Wherever called for luminaries shall be fitted with dry type high power factor correction capacitors correcting to 0.95 lagging.
- The metal canopy shall be finished with a white high gloss solve enameled paint.

### **2.00 Lamps**

- All Fluorescent / CFL / Incandescent / Halogen / LED Lamps shall be in accordance with those specified in BOQ or as approved by Architect / Consultant.
- Colour of lamps shall be verified with Architect / Consultant prior to ordering.
- All Lamps and Tubes shall be suitable for 230 Volt AC, 50 Hz supply system.

### **3.00 Ceiling / Bracket / Exhaust Fans**

- Ceiling, Bracket & Exhaust fans shall be in accordance with sizes, makes and catalogue numbers as mentioned in BOQ.

## **III. Installation**

### **1.00 Erection**

- Lighting Fixtures, Fans and Exhaust Fans shall be installed at locations and heights as verified by the Architect / Consultants.
- All wiring from Junction box up to the fixtures shall be through PVC/GI flexible along with couplers as called for or not called for in BOQ.
- Equipment earthing connections with green copper wire for each lighting fixture shall be provided.

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- Fixtures shall be fastened securely to structure support and check to ensure that solid pendent fixtures are plumb.
- Interior lighting fixtures, fans and exhaust fans shall be cleaned of dirt and debris upon completion of installation.
- It shall be Contractor's responsibility to protect installed fixtures, fans and exhaust fans from damage during remainder of construction period.
- In addition to above all fixtures shall be installed as per manufacturer's recommendations and contractor shall be responsible for coordinating with the manufacturer. After the fixtures are installed he shall also be responsible for obtaining in writing from the manufacturer that the fixtures have been installed as per their recommendations.

**2.00 Examination of Work**

- Upon completion of installation of interior lighting fixtures & after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance, otherwise, remove and replace with new units and proceed with retesting.

**IV. Measurement**

- 1.00** Light fixtures, fluorescent lamps, CFL, LED, Halogen lamps, ceiling fans, bracket fans and exhaust fans shall be enumerated.

## Section – 9

### Technical Specification for Addressable Fire Alarm System

#### I. General

##### 1.00 Work Included

- The Design consists of a multi loop Panel located in the Security / Fire Control Room along with Repeater Panel which shall cater to the Fire Alarm System of the complete building.
- The scope of work under this head shall include Supply of Analogue Addressable Fire Detection cum Alarm System for complete building and shall cover areas marked by the line diagram plus any other area which may be decided subsequently to be protected by Fire Alarm system.
- The work under this system shall consist of furnishing all material, equipment & appliances as per detailed schedule of quantities to install the said system, complete with Analogue Addressable Fire Alarm Panel, Addressable Detectors, Monitor Module, Control Module, Fault Isolators, Hooters, Manual Push Button Stations, Power Supply, Interface unit to monitor flow switch, Input Cards, Output Cards, relays etc for de-energising other systems such as electrical supply, access control, lifts.
- The system shall be able to interface with the Fire Fighting System.

##### 2.00 General Requirements

- The fire alarm system shall be fully analog addressable, pre-signal, non-coded system in accordance with NFPA and shall be in compliance with UL listed and FM approved.



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- The contractor shall supply and install the following fire alarm system and equipment as shown on the drawings and specified herein. In case system is to be installed in more than one phase, areas for different phases shall be demarketed on drawings.
- This specification covers requirements for supply of Fire Alarm System along with all devices as detailed in the particular specifications.
- All testing and commissioning results shall be properly recorded.

### **3.00 Codes and Standards**

- Fire detection and alarm system shall comply with the following codes and standards
  - NFPA 72/2010 : National Fire Alarm Code
  - NFPA 70/2002 : National Electrical Code
  - UL 38 : Manual Signaling Boxes for Fire Alarm Systems
  - UL 268 : Smoke Detectors for Fire Alarm Signaling Systems
  - UL 268A : Smoke Detectors for Duct Application.
  - UL 464 : Audible Signal Appliances
  - UL 521 : Heat Detectors for Fire Protective Signaling Systems
  - UL 864 : Control Units and Accessories for Fire Alarm Systems
  - UL 1971 : Signaling Devices for Hearing Impaired
  - Factory Mutual (FM)
  - IEC 60332 : Tests on electric cables under fire conditions
  - IEC 61034-2/1997 : Measurement of smoke density of cables burning under defined conditions – Part 2: Test Procedure & Requirements
  - IEC 60754 : Tests on gases evolved during combustion of electric cables
  - IEC 60529/1989 : Degree of protection provided by enclosures (IP Code)
  - IS 2175 :1988 : Heat Sensitive Detectors for use in Automatic Fire
  - IS 2189 : 1999 : Code of practice for installation of Automatic Fire Alarm System
  - IS 732 : 1989 : Code of practice of Electrical Wiring Installations (system voltage not exceeding 660 V)
  - IS 9537 : 1981 : Rigid Steel Conduits with medium protection

### **4.00 Quality Assurance**

- The Vendor shall ensure that all materials furnished and installed by him under the contract shall meet the requirements of relevant International and Indian Standards. The Vendor shall also verify all test results and ensure that these are in accordance with the requirements as mentioned in the specifications.

#### **5.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer may have by other provisions of the contract document.
- The Fire Alarm System shall be guaranteed against trouble free operation, defective workmanship & materials for a period of 18 months from the date of supply or 12 months from the date of erection & commissioning, whichever is earlier. In case of any defects during this period detectors etc. shall be replaced free of cost by the Vendor.

#### **6.00 Delivery, Handling & Storage**

- All Devices, Detectors, Hooters, MCPs, RIs and Fire Alarm Panel shall be carefully handled and delivered at site.

### **II. Products**

#### **1.00 General Detail**

- Material Description
- The fire alarm system shall be a fully analog addressable system whereby detection & alarm call points are loop-wired, giving fully analog output signals representing the true values of sensed phenomena to the control panel which incorporates intelligence, to make the decision of fire (or fault) based upon the analog information received.
- The system shall be electrically supervised for all initiating circuits, alarm signal sounding circuits and power supply circuits.
- The addressable loops connecting addressable detectors, monitor modules, control modules, output modules, relay modules and line isolators to the fire control panel shall be wired in loops to form "Class A" or full duplex configuration. Line isolators shall be provided to isolate damaged parts of the cable loop and reduce to two wire half-duplex configuration when one of the paths has failed.
- Wiring from initiating devices (manual stations) and alarm notification devices to modules shall be wired in form of a "Class A" (4 wires).
- The fire alarm system shall be able to interface the following other system :
  - Fire fighting water flow alarm switches (for monitoring of activated status).
  - Fire fighting supervisory switches (for monitoring of activated status).
  - Clean agent fire suppression systems (for monitoring of alarm activated status).
  - Deluge pre-action system (for monitoring of alarm activated status, if required).
  - Electric fire pump control panels (for monitoring of activated status).
  - Lifts / Escalators (for sending the evacuation signal to lift/escalator control panels).
  - Station Management System; SMS (for sending the system status & alarm signals to SMS for monitoring).

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- Station centralized master clock system (for synchronization of Date & Time).
- Automatic Fare Collection System; AFC (for sending the evacuation signal to the system).
- The System shall be Computer aided micro processor based with central control and monitoring facility. The basic function of the system shall be to be able to achieve pin point location of alarm indication. Secondary functions such as pre warning of possible alarm situation, self diagnosis, checking upon faulty detectors and switching on / off of unrelated activities such as power supply shall also be possible in this system.
- Each loop shall have a minimum of 250 addressable devices (125 addressable detectors + 125 addressable modules) in a circuit. The fire alarm panel itself shall have the mother boards / transponders / interface of each zone built-in.
- Annunciation (Hooter Alarm) facility shall also be in built into the panel, the panel being able to initiate alarm signal for any particular area.
- The system shall be fully supervised for all fault conditions with distinctive alarms operated for fault and fire conditions. Test push buttons / features shall be provided to test the electronic circuits and detector conditions.
- While as per site conditions approximately 125 devices are located on one loop, a buffer of 50 devices has been kept for changes in plan etc. The vendor shall however, not include the cost of soft wiring the address of detectors that are not required until commissioning of the system. In essence, the loop shall be able to accept 15 to 20 more detectors at a later date without replacement of the loop card.

## **2.00 Fire Alarm Control Panel**

- The Fire Alarm Control Panel shall be micro processor based fully Analogue Addressable Analogue Control which shall control all Analogue Addressable devices, detectors, Manual Call Stations and Switching Systems (for disconnecting power supply) connected to it and other Input Devices such as Magnetic Contacts and Flow Switches.
- All addressable units shall be connected to the panel through the loop cards and shall be addressable through individualized numbers. The panel shall be able to obtain analogue value for all detectors in the circuit through a pulsed digitalized current data. The panel shall be able to analyze all analogue inputs from all addressable units and through its own software and ambient level screening the panel shall be able to identify Fire, possible Fire or Fault conditions. The unit supervision shall be dynamic and continuous.
- The fire alarm panel shall itself have all loop cards in it. No isolated mother board or transponder is being considered. Each loop shall be able to access a minimum of 250 addressable devices. The design has been based on 125 detectors per loop.
- The Panel shall also give adequate warning signal whenever there is dust accumulation in detectors and put the point of its replacement it should be possible to change the level of ambient alarm calibration condition either by the use of software programme operable by the owner or by resetting the detector.
- Short circuiting, loose wiring or missing units shall also be reported at the panel with pin point or segment wise location. In such cases, the system through the use of fault isolators shall be able to isolate the segment between the two fault isolators.
- The Panel shall have a Liquid Crystal Display Alpha - Numeric (Min. 640 Characters) type on it to immediately indicate all conditions. In case of testing of the system from the panel, the display shall be able to give readouts of analogue value of all detectors being tested. The panel shall also be able to carry out continuous self monitoring when in normal conditions.

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- The Panel shall also be able to discriminate between false alarms and fire conditions as well as priority selection of alarm address in case alarm activates in two or more remotely located Units simultaneously. In such cases, the Manual Call Box shall be reported first, group of sequentially laid detectors (in one room for example) second and a detector with the greatest obscuration over a period of time third.
- The Panel shall also be able to actuate Switches automatically in case of Fire condition, that of Power Supply or other Systems such as piped pressurized gas supply. The Vendor shall be required to design and install the System in operation in coordination with the relevant Contractors. The Vendor shall not be allowed to charge extra on this account and such charges shall be included in his package.
- The System shall be fail safe and adequate safe guards should be under taken that in the event of a failure of a part of the system, it shall not handicap the complete system. The Mother Board shall be of Modular Construction.
- The vendor shall undertake the responsibility of the complete installation, commissioning, user trials, training & maintenance of the System as required. The Vendor shall take all responsibility for preparation and installation of System Software into the Panel. The Software shall be such so as to be easily operated by the Owner's Personnel, is secured against Software errors, ability to be upgradable so as to incorporate more Detector Units or replacement / changing of Detector units, can incorporate more features at a later date such as Illumination Control, Security etc.
- The Panel shall have its own Battery Back up of a minimum of 24hours run. The Battery shall be sealed maintenance free type.
- It shall be able to withstand temperature variation from 0° Centigrade to 50° Centigrade. The acceptable Relative Humidity (non Condensing type) shall be upto 90%. The Voltage rating shall be from 17 V DC to 28 V DC, through the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.
- The Panel shall be totally enclosed dust and vermin proof type made of minimum 16 gauge dust inhibited sheet with even baked finish. The panel shall be of completely solid state design.
- The logic circuitry shall be based on high noise immunity, solid state hardware employing modular construction. Logic cards shall be epoxy fiber glass construction.
- The System shall meet the NFPA 71 & 72 standards and all equipment excluding cabling and wiring shall be listed with UL / FM.
- Further, the System shall be expandable and be able to add at least 100 more Units in the Panel through additional Loops.
- The Panel shall have software to cater to the change over of any of the operating Loop Cards to an extra Loop Card. Other software necessary to actually change the terminals of a Loop from an existing Loop Card to the extra Loop Card shall be carried out at site as and when required. Charges for such software, loading, test run etc. shall be indicated when required.
- The Main Panel shall have minimum integrated 8 channel Digital Voice Evacuation and 2 way Communication Fire Fighters System capable to supervision of all the speaker circuits with minimum 120 zone control and accessories required to complete the system.

### **3.00 Power Supply**

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- The control panel shall derive 230 Volts power from main supply. A standby power supply shall be immediately available in the event of failure of normal supply and shall automatically be connected so as to maintain the equipment in condition such that fire alarm originating from the operation of detector can be given. The standby battery as secondary supply shall be such that when charged by associated battery charging equipment it can operate independently for a period of 24 hours. It shall have enough power supply to cope with additional load resulting in alarm originated from two separate zones for the two hours.
- Suitable arrangements shall be incorporated to prevent secondary batteries from discharging through the charging equipment in the event of its breakdown or a failure in the supply.
- Necessary automatic changeover from normal to standby DC supply in case of main supply failure shall be provided by the Contractor.
- In addition to the batteries, a battery charger suitable for operation on the auxiliary power shall be supplied. The capacity of the charger shall be such that the same can boost charge the battery (within 8 hours) while supplying the rated load of the fire detection and annunciation system. Facilities shall be provided to limit the voltage supplied to fire detection and alarm system. In case the AC supply on the input side of the charger fails, the necessary power for the complete fire detection and alarm system shall be supplied by the battery.
- Switches, Fuses / MCBs, overloaded devices, voltmeter, ammeter and earth fault indicating device shall be furnished for the power supply system.
- Visible and audible annunciation for troubles or failure in the power supply system like "Charger Failure", "Battery Low Voltage", etc. shall be provided.
- Battery earth / fault indication / annunciation shall be included in the panel.
- The electronic cards to be used in the battery chargers shall be of PCB type with male / female type plug-in contacts.
- Automatic boost / trickle charging facility shall be included in chargers.

**4.00 Photo Electric Type Smoke Detector (Addressable Type)**

- The Photo Electric Smoke Detector shall have an optical sensing chamber that operates on the light scattering principle shall respond to those particles that form optically dense smoke. When smoke enters the sensing chamber, it shall scatter light which shall be received by a photo cell. The signal shall be amplified and digitized for reception by the Panel. The Detector shall activate on receiving smoke particles in the 0.5 to 10 micro metre range. The detector shall be completely solid state with LED indication at the base.
- The Photo Electric Smoke Detector shall be combined with Class 'A1' thermal sensor. Each element shall have monitoring possible for measuring actual levels, as well as temperature rate of rise. When required, it shall be possible to isolate smoke sensing while retaining thermal sensing.
- The Detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage (17 to 28 volts DC) two wire supply. The detector shall be provided with response indicator (LED) and the sensitivity of the detector shall not vary with change in ambient temperature, humidity, pressure or voltage variation.

- Neither its performance shall be not affected by air current upto 10 mtr per second. The detector shall be suitably protected against dust accumulation / ingress & it shall be free from maintenance & functional test at intervals. All detectors shall be identical in construction design & characteristic to facilitate easy replacement. The detector housing shall be damage resistant made of polycarbonate or proprietary self-extinguishing material.
- The coverage per smoke detector shall be upto a minimum of 70 SQ M. This coverage area shall reduce depending upon structural configurations or partitions etc. It shall be possible to connect Smoke Detector with Heat Detector or Manual Push Button in the same circuit. The sensitivity of detector shall be set / adjusted by the supplier to suit the site requirement.
- It shall have in-built safety device to monitor the removal and pilferage of the detector. The detector also must have facility for remote indication. The quiescent current flow must not exceed 50 milliamps and alarm condition current shall be maximum 60 milliamps.

**5.00 Photo Electric Type Smoke Detector Combined with Class 'A1' Thermal Sensor (Addressable Type)**

- The Photo Electric type Smoke Detector combined with Class 'A1' thermal sensor shall be intelligent Analogue Addressable detector with its own manually-set digital code and be able to give analogue output to the Fire Alarm Panel regarding its condition. It shall be able to communicate with the Fire Alarm Panel by the pulses emitted from the Panel.
- The base of the Detector shall be interchangeable with other Smoke or Heat Detectors. The enclosure shall meet IP 40 protection grade.
- It shall be able to withstand temperature variation from 0 Degree Centigrade to 50 Degree Centigrade. Relative Humidity (non Condensing type) upto 90% shall not hamper its performance. The voltage rating shall be from 17 V DC to 28 V DC, though the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.
- The Detector shall meet the requirements of either FM / UL and shall be approved by FM / UL. It shall be possible to test the working of detector both from the Panel as well as locally by means as designed by the Vendor.

**6.00 Intelligent Addressable Multi-Criterion Detectors**

- The multisensor analog detector shall use a light scattering type photoelectric smoke sensor & an ambient temperature sensor to sense changes in air samples from its surroundings. The detector shall be totally free of radioactive components.
- The integral microprocessor shall employ time based algorithms to dynamically examine values from the two sensors simultaneously and initiate an alarm based on that data.
- The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, age and humidity.
- Smoke density in the chamber shall be measured by a symmetrical optical system.
- Smoke detectors element shall respond to invisible and visible smoke & combustible gases & shall have an inherently stable sensor with built-in automatic compensation for changes in ambient conditions

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- The temperature sensor shall self-adjust to the ambient temperature of the surrounding air and input an alarm when there is a change of 65 Deg F (35 Deg C) in ambient temperature or reaches a fixed temperature alarm set point of 135 Deg F (57 Deg C) nominal.
- The detector shall be suitable for direct insertion into air ducts up to 0.91 m high and 0.91m wide and air velocities up to 0-2.54 m/sec without requiring specific duct detector housings or supply tubes. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%.
- The detectors shall have no moving parts or components subject to wear and tear and shall have serial no. and seal of the approving laboratory / body.
- All electronic circuits must be solid state devices and virtually hermetically sealed to prevent their operations from being impaired by dust, dirt or humidity.
- All circuitry must be protected against usual electrical transient and electromagnetic interference.
- Reversed polarity or faulty zone wiring shall not damage the detector.
- The response sensitivity of each smoke detector shall be field adjustable to a minimum of two pre-determined (factory calibrated) levels. It shall be possible to test the sensitivity of a detector in the field
- The response (activation) of a detector shall be clearly visible from the outside by a flashing light of sufficient brightness.
- A built-in (optional) integrated circuit shall allow the suppression of brief deceptive phenomenon.
- A built-in barrier shall prevent entry of insects into the sensor.
- The information shall be stored in the integral processor & transferred to the analog loop controller for retrieval using a laptop PC or Program/Service Tool.
- The detector shall be designed for fast and simple laboratory cleaning.
- The detector shall be inserted into or removed from the base by a simple push-twist mechanism to facilitate exchange or cleaning and maintenance.
- The detector shall be connected to the Fire Alarm Panel via fully supervised two-wire circuits (Class "A" wiring).
- During maintenance, interchanging of detectors a system failure should not occur on removal of the detectors from bases.

#### **7.00 Manual Actuated Alarm-Initiating Devices (Manual Stations)**

- Manual Call Box shall be of Pull down / Break Glass type units, completely encased in a lexan or ABS housing with provision for cable or conduit coupling. The manual call box shall have the word prescribed in clear bold letters on fascia window "In Case of Fire Pull Down or Break Glass".
- The Manual Call Box station shall be fully addressable with its own set code and operated by digitized signals sent from the panel. The voltage range shall be from 15 V to 28 V. It shall have protection as per IP 24. The operating temperature range shall be from 0 Degree C to 50 Degree C. Relative Humidity (non condensing) range for performance parameters shall be between 0 to 90%. Further, it shall conform to FM / UL.

#### **8.00 Alarm Notification Appliances**

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- The alarm notification appliances shall be of the combination of audible / visible alarm devices, recess mounted and shall be colored red.
- The audible alarm devices shall be of the piezoelectric mini horn producing high sound level (minimum 85 dBA at 10 feet) and in compliance with the applicable requirements of UL 464.
- The visible alarm devices shall be xenon strobe light flash with clear lens. The rated strobe output shall be 15/75 candela peak power in compliance with the applicable requirements of UL 1971/UL 1638 consequently. The strobe flash rate shall be 1 flash per second.
- The Hooter / Strobe shall be of electronic type and shall give discontinuous / intermittent audible alarms whenever any detector or pull station operates. It shall be possible to control the hooter / strobe audible alarm in case it is not required to sound the alarm except for the panel.
- It shall be complete with electronic oscillations, magnetic coil (sound coil) and accessories, ready for mounting (fixing).

**9.00 Fault Isolator**

- The Fault Isolator shall be able to detect wire short circuit / loose wiring / partial earth fault and similar conditions and shall be able to isolate that segment from the circuit, so that the rest of the circuit continues to operate.
- Fault Isolator shall operate in pairs in any loop and whenever any short circuit occurs between any two of them, both immediately shall switch to an open circuit state and isolate the length of wiring between them. The Isolators should automatically return to the closed circuit as soon as the short circuit is corrected.
- The Fault Isolator shall indicate of its changed state. It shall also have an in built LED to give local alarm.

**10.00 Control Module**

- The module shall be addressable & commendable Units controlled from the Fire Alarm Panel that shall automatically energize circuits to disable electrical circuits for Power Supply etc. The Enclosure shall meet IP 24 protection grade.

**11.00 Monitor Module**

- The module shall be addressable & shall take inputs from flow switches, gas flooding Panel etc. & report back to the Main Fire Alarm Panel. The Enclosure shall meet IP 24 protection grade.

**12.00 Repeater Panel (Network)**

- The Panel shall be controlled by a Micro Processor that shall control all fire / fault / short signals. The micro processor shall continually monitor each zone in the Panel for each signal, as well as the condition of the battery.
- The Panel shall be provided with an LCD Display Unit that shall provide alphanumeric information on the fire / fault signal with zone number.
- For accessing the LCD Display, a keypad operation shall be provided. The Keypad shall have Help Menu and other functions controlled from either Function Keys or by a combination of keypad numbers. By using the keypad, one can scroll through the event list for at least a month.

**13.00 Software**



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- The GUI based software must be capable of graphically representing each facility being monitored with floor plans and icons depicting the actual locations of the various systems and / or sensors.
- The Software shall be capable of integrating CCTV, Access control System.
- The Software shall be on Peer to Peer in Network and shall not be dependable on any single panel or Node failure.

**III. Inspection**

- The vendor shall provide detailed "Quality Assurance Plan" being implemented at the site to ensure that the Fire Alarm System meets the requirement of the specifications.
- The vendor shall also submit inspection schedule of Fire Alarm Panel & Devices etc. The inspection shall be under taken by the authorized representative of the owner / consultant.

**IV. Technical Details For Analogue Addressable Fire Alarm System and Field Device**

**- Fire Alarm System**

- System Type : Microprocessor based Analog Addressable Fire Alarm System
- Panel Type : Multiloop, each loop being single pair 1.5 sq mm x 2 copper conduction type
- Wiring Type : Class A closed loop
- Input Devices : Optical Smoke combined with Class 'A1' thermal sensor, Manual Call Box, Interface Card
- Output Devices : Speaker / Hooter, Relay, operated power supply Shut Off
- Number of Inputs : 250 addressable devices per loop, 125 detectors & 125 modules per loop
- Panel Location : Security / Fire Control Room
- Standards to be followed : NFPA 72
- Approval by : Local Fire Service

**- Fire Alarm Panel**

- Panel Type : Microprocessor based Analog Addressable Fire Alarm Panel
- Number of Loops : As indicated in particular specifications
- Material of Construction : Cold Rolled Street Sheet
- Thickness of Sheet : 18 SWG or 16 AWG / as per UL specifications
- Finish : Epoxy finished on two layers of primer paint
- Door : One number for accessing Zone Cards and Relay Units  
One number for accessing Battery Unit. To be dust & vermin proof.
- Wiring Standard : As per NEC and NEMA

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- Primary Function : To provide alarm signal with detector function address
  - : To provide pre-alarm signal with detector address
  - : To activate relay unit connected to specific detector address
- Secondary Function : To provide warning in case of dust functions accumulation in Detector
  - : To subsequently raise threshold level as per requirement
  - : To indicate segment wise fault indication
  - : To discriminate between fault and fire conditions
  - : To provide priority selection of alarm signal
  - : To provide surface mounted keypad / membrane switches for alarm accept, function keys or re-programme.
- Display Type : LCD type alphanumeric (Min. 640 Characters)
- Display Requirement : Detector alarm address
  - : Detector pre-alarm analog output with address
  - : Detector fault with address
  - : Any given detector analog value
- Approval : FM / UL
- Standards : NFPA 72
- Buttons : To give output station address in case of activation
- Input Power Supply : 220 Volt, AC 50 Hz, Single Phase
- Output Supply : 17 – 28 Volt, DC, through rectifier
- Standby Power : 27 Ah. Sealed maintenance free battery including trickle / boost battery charger
- Enclosure Protection : IP 54
- Environment : 0-50° Centigrade
- Printer output : The Panel shall have an optional RS 232 port
- **Photoelectric Type Smoke Detector Combined with Class 'A1' Thermal Sensor**
- Type : Analog Addressable Optical Type Smoke Detector combined with class 'A1' Thermal Sensor
- Approvals : FM / UL
- Standards : NFPA 72

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- Power Supply : 17 - 24 Volt, DC
- Sensitivity : Particles between 0.6 to 10 micrometer range
- Enclosure Protection : IP 40
- Address Device : DIP Switch or Rotary Switch
- Environment : 0-50° Centigrade upto 90% humidity, Non-condensing type
- Detector Material : Polycarbonate or proprietary self extinguishing material
- Output Signal : LED at base
- **Manual Call Box**
- Type : Addressable Input Station
- Approvals : FM / UL / Notifier / Edwards / Siemens / Bosch
- Standards : NFPA
- Power Supply : 17 - 24 Volt, DC
- Enclosure Protection : IP 24
- Address Device : DIP Switch or Rotary Switch
- Environment : 0-50° Centigrade upto 90% humidity, Non-condensing type
- Alarm Device : Manual Break Glass or Pull - down lever type
- Colour : Red
- Lable : Instruction set as in case of Emergency Break Glass or Pull lever.
- **Fault Isolator**
- Power Supply : 17-24 V, DC
- Enclosure Protection : IP 24
- Environment : 0-50° Centigrade upto 90% humidity, non-condensing type
- Construction Material : Polycarbonate or proprietary self extinguishing material

**Technical Specification For Conduit & Wiring of Fire Alarm System**

**I. General**

**1.00 Work Included**

- The scope of work under this Section shall include laying of wiring and conduits etc, necessary for installation of the Analogue Addressable Fire Alarm System. Any openings / chasing in the wall / ceiling required to be made for the installation shall be made good in appropriate manner.

## **2.00 Related Work and Obligations**

- The general requirements apply to work specified in this section.
- Examine all the other sections of the specification for requirements, which may affect work of this section.
- Co-ordinate works with all other trades affecting or affected by activities of this section. Co-operate with such other trades to assure the steady progress of all operations under the contract.

## **3.00 General Requirements**

- This specification covers requirements for supply and erection of wiring and conduits for Analogue Addressable Fire Alarm System.

## **4.00 Codes And Standards**

- The wiring and conduits shall comply with all applicable Indian Standards, Indian Electricity Act and Indian Electricity rules :-
  - IS 9537 (Part-II, 1981) : Code of standards for GI / MS conduit pipes.
  - IS 9537 (Part-III, 1983) : Code of standards for PVC conduit pipes.
  - IS 694/1990 : Code of standards for wiring as well as flexible cords (metric)

## **5.00 Quality Assurance**

- The Contractor shall ensure that all materials furnished & installed by him under the contract shall meet the requirements of relevant International and Indian Standards.

## **6.00 Guarantee**

- Manufacturer shall provide guarantee for work under this section. However, such guarantee shall be in addition to and not in lieu of all other liabilities which manufacturer and Contractor may have by other provisions of the contract document.
- The Conduit & Wiring shall be guaranteed against trouble free operation, defective workmanship & materials for a period of 18 months from the date of supply or 12 months from the date of erection and commissioning, whichever is earlier. In case of any defects during this period conduits & wiring shall be replaced free of cost by the Contractor.

## **7.00 Delivery, Handling and Storage**

- All material shall be carefully handled and stored at site in a neat and orderly manner for fixing the same at a later date.

## **II. Products**

### **1.00 General Detail for GI / MS Conduits**

- The GI / MS conduits, bends, flexible, boxes & accessories shall be brand new & in good condition.

## **2.00 GI / MS Conduits**

- GI / MS Conduits shall be ISI marked, ERW type (Electric Resistance Welded), black stove enameled inside and outside, manufactured by High Frequency Induction Welding process and shall confirm to all relevant Indian standards.
- Minimum wall thickness of GI / MS conduits shall be 1.6mm (16 SWG) up to 32mm & 2.0mm (14 SWG) for 40mm and 50mm dia. The conduits shall be delivered to the site in original bundles & each length of conduit shall bear the label of the manufacturer. The number of insulated copper wires that may be drawn into the conduits of various sizes shall be in accordance with relevant Indian standards and space factor shall not exceed 40%.

## **3.00 GI Flexible**

- GI Flexible shall be used alongwith GI / MS Conduits wherever necessary unless otherwise mentioned in the particular specification.
- GI conduits where applicable shall be used only to items of equipment which are withdrawable or subject to vibration or adjustment. The flexible conduits shall have a minimum length of 300mm and have sufficient length to allow the full range of withdrawal adjustment or movement necessary, terminated at each connection with proper couplers and checknuts. All earth conductors shall be taken internally through the conduit.

## **4.00 Bends, Junction Boxes and Accessories**

- Bends, Junction Boxes and accessories shall be GI / MS as required. Bends shall not have radius less than 2½ times the outside diameter of the conduit & junction boxes shall be one / two / three / four way as necessary during installation at site.
- Circular inspection boxes shall be of minimum 50 mm dia rust proof, manufactured from sheet steel with smooth external and internal finish. These boxes shall be provided to facilitate removal and replacement of wires when required.
- Termination to accessory boxes shall be carried out with proper checknut in case of GI / MS Conduits along with rubber bushes which shall be provided for GI / MS conduits.

## **5.00 Fire Survival Circuit Integrity Control Cables**

- Fire survival armoured cable should be of 600/1000 volts, twisted, with class-2 Copper conductor having halogen free ceramified silicon insulation as per BS EN 50363 and LSZH inner & outer sheath. Outer sheath should be anti-rodent with LSZH properties
- The cable should retain circuit integrity as per as per EN 50200:PH-120
- The cables should not emit toxic gases in case of fire. The toxicity index should be less than 3 (refer NES 713)
- The cables shall comply with the requirements of IEC-61034 Part 1&2 (Measurement of Smoke density of cables burning under defined conditions).
- The cables shall comply with the requirements of BS EN 60754 (Determination for amount of halogen acid gas content which shall not be greater than 0.5%)
- The cable manufacturer should provide factory production control certificate related to the manufacturing of Fire Resistant Wires & cables from LPCB

## **5.00 General Details for Wiring**

- All copper conductor wires shall be PVC insulated, FR-LSH, unsheathed, solid / stranded annealed electrolytic grade copper conductor.
- 1100 volt grade in accordance with IS 694 / 1990 and ISI marked.
- 1.0 and 1.5 sq. mm. PVC insulated FR-LSH copper wires shall be solid conductor.
- 2.5 sq. mm. PVC insulated FR-LSH copper wires and above shall be stranded conductor.

#### **6.00 Colour Codes**

- Colour codes for Fire Alarm System Wiring shall be Red & Black.

### **III. Installation**

#### **1.00 Erection (Conduits)**

- Conduits shall be concealed, wherever possible unless stated otherwise, by chasing into walls, installation in ceiling spaces or direct burial within poured concrete. No chases will be cut without approval of the consultant. Conduits shall be securely fixed to reinforcement or shuttering to prevent displacement. All boxes & conduits shall be fitted covers or plugs to prevent ingress of moisture or rubble and shall remain sealed until ready for wire pulling. No conduits shall be installed in screed or plaster unless such is of ample thickness and prior approval is obtained. All conduits must be checked where run in floor screeds before the floor screed is laid.
- Conduits shall have draw in boxes every 10M of straight run or 7.5 M of lengths containing bends, or every third bend. Conduit shall not have more than two right angle bends in any run without provision of draw in box/junction box.
- In case of GI / MS Conduits, joints between conduits and accessories shall be securely made to ensure earth continuity and positive mechanical connection.
- Conduits shall be installed in such a manner that all cables / wires can be drawn in after erection with ease by means of a pull wire.
- Conduits connections for GI / MS conduits shall be screwed to metal and all conduits joints shall be painted with approved metallic paint. The threads and sockets shall be free from grease and oil. Connections between screwed conduits and sheet metal boxes shall through a coupler through the conduit.
- When necessary, bends and diversions may be achieved by means of bends and / or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly screwed and flushed with the finished wall surface.
- Surface conduits shall be fixed by means of space bar saddles at intervals not more than 450 mm. The saddle shall be galvanized mild steel flat and properly treated, securely fixed to support by means of screws.
- All conduits shall be installed neatly and as unobtrusively possible parallel to general building lines where run on the surface of walls & ceilings. Laid in a straight line from point to point when concealed. Care must be taken where run in floors to prevent damage to the finish until floor screeds are laid.

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- Cables shall not be drawn until the conduiting is complete. Conduits shall not be installed in contact with steel, water, gas or heating pipe work. A distance of 150 mm shall be maintained from other services wherever possible. Conduits shall not be left with any untreated rust patches on surfaces or installed by fixing nails.
- Conduit of not less than 20 mm shall be used throughout unless otherwise specified in particular specifications / BOQ.
- They shall be protected from weather & all mechanical damage during installation and at the same time protected by means of wooden plugs, plastic plugs or plastic caps to prevent the entrance of plaster or foreign matter during erection.
- The conduit work shall be concealed in floors, walls and roof slabs. The wiring shall be continuously and effectively protected along its whole length, with conduits mechanically continuous throughout. Cable capacities to be drawn in the conduit shall be as laid in the ISI regulations for the size of the conduit to be used. The number of cables shall include separate earth wires in accordance with the standard regulations.

**2.00 Erection (Wiring)**

- The system of internal wiring shall consist of PVC insulated FR-LSH copper conductor solid wires 1100 volt grade in PVC / GI / MS conduits as called for. Conduits shall be concealed or surface mounted as required.
- Prior to laying & fixing of conduits, the contractor shall examine the drawings indicating the layout, satisfy himself about the sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes & other relevant details. Any discrepancy found in the drawings shall be brought to the notice of architect / consultant before the commencement of the work. Any modifications suggested by the contractor shall be got approved by the architect / consultant before the actual laying of the conduits. Maximum capacity of conduits for drawing in PVC insulated FR-LSH wires shall be as per IS 694/77.
- Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phase shall not run in the same conduit.
- The drawing and jointing of PVC insulated FR-LSH copper conductor wires and cables shall be executed with due regard to the following precautions. While drawing wires through conduits care shall be taken to avoid scratches & kinks which may cause breakage of conductors. There shall be no sharp bends. Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square.

- Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional areas to take all strands. Connecting screws shall have flat 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. Conductors having nominal cross sectional area exceeding 6.0 sq. mm shall always be provided with cable sockets. At all bolted terminals, flat washer of large area and approved steel spring shall be used. Nuts and bolts shall be used for all connections. Only certified wiremen & cable jointers shall be employed to do jointing work. All wires shall have the manufactures label and shall be brought to site in original packing. For all internal wiring, PVC insulated wires of 1100 volt grade 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. If the use of joints is unavoidable due to any specific reason, prior permission, in writing, shall be obtained from the architect / consultant. No wires shall be drawn into any conduit, until all work of any nature, that may cause injury to wires, is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits, the conduit shall be thoroughly cleaned of moisture, dirt, dust or any other obstruction by forcing compressed air through the conduit.
  
- Color code for the entire wiring installation shall be Red & Black.

### **3.00 Examination Of Work**

- Prior to laying and fixing of conduits, the Contractor shall carefully examine the drawings indicating the layout, satisfy himself about the sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of the Consultant. Any modifications suggested by the Contractor shall be got approved by the Consultant before the actual laying of conduits is commenced / completed.
  
- Before concealing of conduits the Contractor shall give due notice to the Consultant / Engineer-in-charge whenever any such work is ready for examination and the Consultant / Engineer-in-charge shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work.

## **VI. Measurement**

- 1.00 Conduit and Wiring shall be measured by length / enumerated.



<b>A.</b>	<b>Sub-Distribution Boards &amp; Distribution Boards</b>	
•	Main Panel / Sub main Panel	:
•	MCCB (3 Pole / 4 Pole)	:
•	MCB / ELCB / RCCB / EL+MCB / Isolators	:
•	Distribution Boards	:
•	Enclosure for MCB / ELCB / Isolator	:
•	On Load Change Over Switch	:
•	Meters (Digital Type) with / without built-in selector switch	:
•	Current Transformer	:
•	Push Buttons	:
•	Indication Lamps (LED type)	:
•	Selector Switches	:
•	Non Hygroscopic Insulated Supports	:
•	Terminal Blocks	:
<b>B.</b>	<b>LT Cables, Mains &amp; Sub-mains</b>	
•	Aluminum Conductor Armoured / Unarmoured Cable	:
•	Copper Conductor Armoured / Unarmoured Cable	:
•	Copper Conductor Armoured / Unarmoured Control Cable	:
•	Single core unsheathed copper cables	:
•	Thimbles & Lugs	:
•	Brass Glands	:
<b>C.</b>	<b>Cable Tray / Trunking</b>	
•	Perforated Power Cable Trays (Galvanised)	:

•	Ladder Type Power Cable Trays (Galvanised)	:
•	Telephone / Computer Cable Tray (Galvanised)	:
•	Power Trunking (Galvanised)	:
•	Telephone / Computer Under Floor Trunking (Galvanised)	:
<b>D.</b>	<b>Earthing</b>	
•	GI / Copper Earth Tapes	:
•	GI / Copper Earth Pipes	:
•	GI / Copper Plates	:
•	GI / Copper Pipes	:
•	FR-LSH PVC Insulated Green Copper Earth Wire	:
•	FR-LSH PVC Insulated Yellow + Green Dedicated Earth Wire	:
<b>E.</b>	<b>Lightning Protection</b>	
•	Earthing Rods	:
•	Exothermic Welding Joints	:
•	Ground Enhancing Material	:
•	Air Terminal	:
•	Down / Ring Conductor Accessories	:
<b>F.</b>	<b>Conduits and Wiring</b>	
•	MS Conduits	:
•	PVC Conduits	:
•	FR-LSH PVC Insulated Copper Wires	:
<b>G.</b>	<b>Receptacles</b>	

•	Switch, Socket Outlet and Receptacle	:
•	PVC Moulded Plug & Sockets IP 66	:
•	Industrial Sockets (IP 44)	:
<b>H.</b>	<b>Telephone / Computer System</b>	
•	Telephone Armoured Cable	:
•	Telephone Wires	:
•	Telephone Tag Boxes	:
<b>I.</b>	<b>Lighting Fixtures &amp; Lamps</b>	
•	Light Fixtures	:
•	LED Lamps	:
<b>J.</b>	<b>Fire Alarm System</b>	
•	Fire Alarm Panel (Analogue Addressable Type)	:
•	Smoke / Optical / Multi Criteria Detector / Control Module (Addressable Type)	:
•	Hooter / Strobe (Addressable Type)	:
•	Fault Isolator (Addressable Type)	:
•	Manual Call Point (Addressable Type)	:
<b>K.</b>	<b>IMPORTANT NOTES :</b>	
-	<b>Change of any make of material in case of its non avail of the Owner / Consultant. The Contractor shall not be permission in writing.</b>	
-	<b>In case more than one make is specified, choice of fina Consultant.</b>	
-	<b>In case of SDBs, LT Switchgear used shall be of the sa</b>	

Locally Fabricated to IS Specifications and Powder Coated (Panel manufacturer shall be approved by Consultant / Owner)
Siemens (3 VL Series) / Schneider (Compact NSX Range) / Mitsubishi (WS Series)
Siemens (5Sx) / Merlin Gerin (C60) / Legrand (Lexic) / L&T / Hager
Siemens / Schneider / Legrand / Hager
Siemens / Schneider / Legrand / Hager
L&T / HH Elcon
Conzerv / Equal
AE / Kappa / Precise
Siemens / L&T (ESBEE) / Vaishno
L&T (Essbee) / Telemecanique (France) / Siemens
Salzer / Kaycee
Powermat / Equal
Connect Well / Phoenix / Wago or Equal
Skytone / Universal / Gloster / KEI
Skytone / Universal / Gloster / KEI
Skytone / Universal / Gloster / KEI
Skytone / Finolex / Ecko / KEI
Dowells / Jainsons or Equal
Comet / Gripwell / Electromec or Equal
Profab / MEM / Equal

Profab / MEM / Equal
Profab / MEM / Equal
Profab / MEM / Equal
Profab / MEM / Equal
As per Specifications (Copper earth tapes to have conductivity not less than 85%)
As per Specifications (Copper earth tapes to have conductivity not less than 85%)
As per Specifications (Copper earth tapes to have conductivity not less than 85%)
As per Specifications (Copper earth tapes to have conductivity not less than 85%)
Skytone / KEI / Finolex or Equal (16.0 sq. mm. and above)
Skytone / KEI / Finolex or Equal (1.5 sq. mm. to 10.0 sq. mm.)
UL approved
Thermoweld / Cadweld / Equal
Duval Messien / Erico / Equal
Duval Messien / Furse / Dehn
Duval Messien / Furse / Dehn
BEC / STEEL KRAFT or Equal <b>(ISI Marked)</b>
BEC / Polypack / AKG or Equal <b>(Heavy Duty)</b>
Skytone / KEI / Finolex or Equal

Legrand (Myrius Series) / MK India (Wraparound Plus) / Clipsal (Sample to be approved by Owner / Consultant)
Clipsal / Legrand / SCAME (Sample to be approved by Owner / Consultant)
Clipsal / Legrand / SCAME (Sample to be approved by Owner / Consultant)
Skytone / Delton / KEI / Finolex or Equal
Skytone / Delton / KEI / Finolex or Equal
Krone in Metal Enclosure or Equal
Philips / Wipro / Legego or Equal
Philips / Wipro / Osram
Edwards / Notifier or Equal
Edwards / Notifier or Equal
Edwards / Notifier or Equal
Edwards / Notifier or Equal
Edwards / Notifier or Equal

**liability or any other such reason shall be at the discretion  
allowed to change the makes without their prior**

**al make shall be at the sole discretion of the Owner /**

**ime family.**

# **HVAC SYSTEM DESCRIPTION & TECHNICAL SPECIFICATIONS**

## **Section 1**

## **System Design Data**

### **Section - 1**

### **System Design**

#### **1. General**

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

- 1.1 Various options for energy efficiency and water conservation have been considered and will be adopted according to their benefits.

#### **2. Location :**

The proposed air-conditioning & ventilation work is to be carried out for **Administrative Building at Aviation Fuelling Station, Shahbad Mohammadpur, New delhi.**

#### **3. Scope of Work**

- 3.1 The work proposed under this tender includes providing and fixing, air-conditioning & ventilation systems for entire area of the building.
- 3.2 Providing and fixing at site all main equipments associated with air-conditioning & ventilation system asked under these technical specifications.
- 3.3 To execute all incidental work at site including material supply at site associated with air-conditioning & ventilation system asked in the technical specifications. Nature of such will be sheet metal duct/grill work., refrigerant piping and drain etc. foundation of equipments, making opening in walls and slabs and making them good, incidental electrical Engineering work, cables, control panels etc. erection work at site for all manufactured items at work and also items fabricated at site.
- 3.4 Routine testing, pressure testing of fabricated components, commissioning of complete system at site.
- 3.5 Performance testing of complete air-conditioning & ventilation system at site as per various technical requirements as stipulated in performance testing clause.



#### 4. **System Highlights**

- 4.1 The various strategies have been considered to make the HVAC system flexible and efficient at part load conditions. The different combinations are described later on.
- 4.2 The proposed air-conditioning systems are considered as
  - 4.2.1 Conventional VRV System for Administrative Building
  - 4.2.2 VRV System for Cafeteria Building.
  - 4.2.3 Smoke Extraction/Pressurization system will as per NBC 2016 guidelines.

#### 4.3 **System Description**

- 4.3.1 It is proposed to install air-cooled variable refrigerant volume (VRV) flow air-conditioning system to air-condition the above areas. This system is very popular these days because of its user-friendly attitude. This is very flexible in use, does not require permanent man power to run the system. It is totally dry consumes 25 – 30% less power compare to any conventional system. Smallest area can be air-conditioned running a smallest capacity of compressor at variable speed. This is most convenient and cost effective system.
- 4.3.2 Main outdoor unit shall be installed at terrace and refrigerant circuit along with control wiring shall be carried out upto each indoor unit.
- 4.3.3 A combination of Cassette, Ductable, Furredin units shall be used to air-condition the areas. Conditioned air from indoor units shall be supplied to various areas using G.I. ducting with nitrile rubber closed cell insulation over it. Powder coated Aluminium grills/diffuser shall be provided for air distribution.
- 4.3.4 Fresh Air to be supplied thru TFA units and Same to be added in space to achieve the positive pressure.
- 4.3.5 Smoke extraction/ pressurization system to be provided as per NBC guidelines.
- 4.3.6 System shall be complete with electric panel board with cabling and earthing.

## 5 Basis of Design

**Design is carried out based on following factors received from Green Building Consultant.**

5.1	Outside Conditions	Summer	:	43.3°C DB ;23.9°C WB
		Monsoon	:	35°C DB ;28°C WB
5.2	Inside Conditions (Summer & Monsoon)	General	:	23.0°C ± 01.0°C DB RH not exceeding 60% in all areas
5.3	Lighting Load	General	:	1.0 W/Sq.ft.
5.4	Equipment Load	General	:	1 W/Sq.ft..
5.5	Fresh Air	General	:	10 CFM /Person + 0.06 CFM/Sqft
5.6	Occupancy	General	:	As per architectural layout
5.7	Roof Insulation		:	The entire exposed roof shall be insulated with 2 layer 50 mm thick expanded polystyrene or equivalent insulation.
5.8	Glazing		:	All windows will have heat reflecting Double glass
5.10	General Ventilation	Toilets	:	10 air changes per hour

6. **Estimated Requirements with Equipment Selection:**

Based on the above design data, the estimated requirement of air-conditioning is as follows:

**Equipment selection:**

Equipment Electrical Data - R1							
S.	Name of Area	Equipment Selected			Outdoor Unit		
No.		Indoor Unit					
		IDU Capacity	Type of IDU	Qty	Capacity	Qty.	
	<b><u>First Floor</u></b>						
1	VP Room	3.18 TR, 1130 CFM	Ductable	1	40 HP	20 HP	
2	CEO Room	3.98 TR, 1377 CFM	Ductable	1			
3	HR Manager	1.59 TR , 812 CFM	Cassette	1			
4	IOCL Office	1.59 TR , 812 CFM	Cassette	1		20 HP	1
5	ITP Function	1.28 TR , 600 CFM	Cassette	1			
6	Meeting Room	1.59 TR , 812 CFM	Cassette	1			
7	GM (FF)	1.59 TR , 812 CFM	Cassette	1			
8	CH (F & A)	1.59 TR , 812 CFM	Cassette	1			
9	QC Lab	1.59 TR , 812 CFM	Cassette	1			
11	Open Area & Workstations	6.36 TR, 2295 CFM	Ductable	2			
11a	TFA	800 CFM	Ductable	1	6 HP	1	

11b	Server Room	1.42, 711 CFM	Cassette	2	1.42 TR	Inverter type	1
11 C	CH (E & P)	1.59 TR , 812 CFM	Cassette	1	to be connected with 40 HP ODU circuit		
	<b>Sub Total</b>			<b>15</b>			<b>5</b>
	<b><u>Second Floor</u></b>						
	-						
12	BSSPL	6.36 TR, 2295 CFM	Ductable	2	16 HP		1
13	HPCL	6.36 TR, 2295 CFM	Ductable	1	8 HP		1
14	BPCL	6.36 TR, 2295 CFM	Ductable	2	16 HP		1
15	Comman Area	3.98 TR, 1377 CFM	Ductable	1	6 HP		1
15a	TFA	900 CFM	Ductable	1	6 HP		1
15b	Server Room-1	1.42, 711 CFM	Cassette	2	1.42 TR	Inverter type	1
15c	Server Room-2	1.42, 711 CFM	Cassette	2	1.42 TR	Inverter type	1
15d	Server Room-3	1.42, 711 CFM	Cassette	2	1.42 TR	Inverter type	1
	<b>Sub Total</b>			<b>13</b>			<b>8</b>
	<b><u>Third Floor</u></b>						
	-						
16	Conference Room	5,48 TR, 2047 CFM	Ductable	2	44 HP	20 HP	1
17	Meeting Room	2.08 TR , 830 CFM	Cassette	1			
18	HR Manager	2.08 TR , 830 CFM	Cassette	1		12 HP	1
19	CEO Room	3.98 TR, 1377 CFM	Ductable	1			
20	CFO Room	3.98 TR, 1377 CFM	Ductable	1		12 HP	1
21	Open Workstations	6.36 TR, 2295 CFM	Ductable	2			
21a	TFA	950 CFM	Ductable	1	6 HP		1
21b	Server Room	1.42, 711 CFM	Cassette	2	1.42 TR	Inverter type	1
	<b>Sub Total</b>			<b>11</b>			<b>5</b>

	<b>Cafeteria</b>						
22	Officer's Café.	4.55 TR, 1624 CFM	Ductable	2	16 HP		1
23	Workers Café	5.48 TR, 2047 CFM	Ductable	1			
	<b>Sub Total</b>			<b>3</b>			<b>2</b>
	<b>Grand Total</b>			<b>45</b>	<b>220 HP</b>		<b>20</b>

7 **Smoke Extraction & Pressurization System :**

S.NO.	Name of Area	Description	Air Quantity
1	Staircase	Naturally Ventilated	NIL
2	Lift Lobby	Naturally Ventilated	NIL
3	Lift Well	Pressurized @ 50 Pa	6500

**Equipment Selection for Smoke Extraction System:**

**Liftwell Pressurization:**

Pressurization Fan: - 6,500 CFM x 1 Nos

8.. **Items to be provided by other Agencies**

The following items of works shall be provided by other agencies. The HVAC contractor shall be responsible for the adequacy and accuracy of these works and shall ensure that these are completed as per the required time schedule.

- 8.1 Provision of main 3 PH, 50 Hz, 415 volts A.C. main electric supply cables upto the HVAC main panel in A/C plant rooms and upto each AHU/TFA/ Ventilation fans panels in respective rooms on each floor. 1 Ph, 230 volts, 50 Hz AC Supply for all indoor units.
- 8.2 False ceiling to cover the ducts and drop ceiling as required.
- 8.3 Floor traps near all the Air Handling Units, blower, indoor units for drains.

9. **Drawings :**

The drawings forming part of these specifications provide a feasible scheme for locating the equipment. The contractor may re-arrange the equipment for improving the layout and meeting the site conditions. All such changes shall however be subject to the architect/consultants approval. These drawings are not meant to be working drawing which shall be prepared by the contractor as required.

10. **Test data :**

The plant whole system shall be tested as per specifications given elsewhere and complete test data shall be furnished on prescribed data sheet.

11. **Deviation from Specifications :**

Deviation from specifications may be accepted, provided such deviations are found necessary and appropriate. This may be subjected to confirmation from client.

12. **Technical Data :**

The contractor shall furnish complete "technical data" on the equipment offered by him as required under the heading "Technical Data".

13. **Performance Guarantee :**

- 13.1 The contractor shall guarantee that the air-conditioning system shall maintain the designed inside temperature within  $\pm 1^{\circ}\text{C}$  tolerance and the relative humidity shall not exceed the specified limit.
- 13.2 The contractor shall guarantee that the capacity of various components as well as the whole system shall not be less than specified.
- 13.3 The contractor shall ensure, that the system shall be free of vibrations and disturbing sounds.

## **End of Section 1**

### **Section 2 Aircooled Variable Refrigerant Volume System**

#### **1.1 SCOPE**

The scope of this section comprises the supply, erection testing and commissioning of Variable Refrigerant Volume System conforming to these specifications and in accordance with the requirements of Drawing and Schedule of Quantities

#### **1.2 TYPE**

Units shall be air cooled, variable refrigerant volume air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor units having capability to cool or heat independently for the requirement of the rooms.

It shall be possible to connect minimum 10 indoor units on one refrigerant circuit. The indoor units on any circuit can be of different type and also controlled individually. Following type of indoor units shall be connected to the system:

- Ceiling mounted cassette type (Double flow)
- Ceiling mounted cassette type (Multi flow)
- Ceiling mounted Low static Duct type
- Ceiling mounted Built In Ductable type
- Ceiling mounted Duct type
- Ceiling suspended type
- Wall mounted type
- Floor standing type

Compressor installed in outdoor unit shall be equipped with at least one inverter compressor up to 16HP and minimum two inverter compressors in bigger machines for higher reliability, improved life, better backup and duty cycling purpose. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

Outdoor unit shall be suitable for mix match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor unit shall be possible to extend up to 150m with maximum 50m level difference **without any oil traps.**

Both indoor units and outdoor unit shall be factory assembled, tested and filled with first charge of refrigerant before delivering at site.

### 1.3 **OUTDOOR UNIT**

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory wired, tested with all necessary controls :

- All outdoor units shall have minimum two scroll compressors and be able to operate even in case one of compressor is out of order.
- **In case of outdoor units above 16HP, the outdoor unit shall have compulsorily at least 2 separate inverter compressors so that the operation is not disrupted with failure of any inverter compressor and if one inverter compressor malfunctions, other continues to provide emergency operation smoothly till repair is effected.**
- It should also be provided with duty cycling for multiple inverter compressor switching starting sequence for better stability and prolonging equipment life.
- The outdoor unit shall be modular in design and should be allowed for side by side installation
- The unit shall be provided with its own microprocessor control panel.
- The outdoor units should have anti-corrosion paintfreegalbarium base plate for easy mounting of unit.
- The machine must have a sub cool feature to use coil surface more effectively thru proper circuit/bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.

The outdoor unit should be fitted with low noise, aero spiral design fan with aerofittinggrill for spiral discharge airflow to reduce pressure loss and should be fitted with DC fan motor for better efficiency. The unit should also be capable to deliver 55 Pa external static pressure to meet long exhaust duct connection requirement.

The condensing unit shall be designed to operate safely when connected to multiple fan coil units.

**NOTE :**        **The Outdoor machines shall be preferably compact machines for purpose of space saving and smaller foot print shall be preferred.**



#### 1.4 **COMPRESSOR**

The compressor shall be highly efficient scroll type and capable of inverter control. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement:

- All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.
- Oil heater shall be provided in the compressor casing.
- **The Inverter compressor shall preferably be Reluctance DC inverter compressor for higher efficiency and improved reliability .**

#### 1.5 **HEAT EXCHANGER**

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

- The aluminum fins shall be covered by anti-corrosion resin film.
- The unit should be with e-pass heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser.
- The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

#### 1.6 **REFRIGERANT CIRCUIT**

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end.

The equipment must have in built refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safely operation of the system.

#### 1.7 **SAFETY DEVICES**

All necessary safety devices shall be provided to ensure safe operation of the system.

Following safety devices shall be part of outdoor unit; high pressure switch, fuse, fan drive overload protector, fusible plug, over load relay, overload protection for inverter.

#### 1.8 **OIL RECOVERY SYSTEM**

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping lengths.

The system must be provided with oil balancing circuit to avoid poor lubrication.

## 1.9 **INDOOR UNIT**

This section deals with supply, installation, testing, commissioning of various type of indoor units conforming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in detailed Bill Of Quantities

### **GENERAL**

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

- a) The address of the indoor unit shall be set automatically in case of individual and group control.
- b) In case of centralized control, it shall be set by liquid crystal remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/mechanically expanded for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm air pressure under water.

Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The filter shall be slide away type and neatly inserted.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling or cooling and heating.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

1.9.1 **CEILING MOUNTED CASSETTE TYPE UNIT (MULTI FLOW TYPE)**

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners. The fan shall be aerodynamically designed diffuser turbo fan type.

Unit shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center. Each unit shall have high lift drain pump, fresh air intake provision (if specified) Low gas detection system and very low operating sound.

All the indoor units regardless of their difference in capacity should have **same decorative panel size** for harmonious aesthetic point of view. It should have provision of connecting branch ducts.

1.9.2 **CEILING MOUNTED DUCTABLE TYPE UNIT**

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX coil section .The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for Ductable arrangement.

1.9.3 **CEILING SUSPENDED TYPE**

Unit shall be suitable for ceiling suspended arrangement below false ceiling. The unit include pre filter , fan section & DX coil section . The housing of unit shall be light weight powder coated galvanized steel.

1.9.4 **HIGH WALL MOUNTED UNITS**

The units shall be wall-mounted type. The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. Unit shall have an attractive external casing for supply and return air.

1.9.5 **FLOOR STANDING TYPE**

Unit shall be suitable for floor standing arrangement. The unit include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

1.10 **CENTRALIZED TYPE REMOTE (TOUCH SCREEN TYPE) CONTROLLER**  
(Option if specified in BOQ)

A multifunctional compact centralized controller shall be provided with the system.

**The controller must be necessarily a graphic Controller type to act as an advanced airconditioning management system to give complete control of VRV airconditioning Equipment, It should have ease of use for the user and must have a user friendly colored touch screen, icon display and color LCD display.**

It shall be able to control up to 64 groups of indoor units with the following functions :-

- a) Starting/stopping of Airconditioners as a zone or group or individual unit.
- b) Temperature settling for each indoor unit or zone.
- c) Switching between temperature control modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.
- d) Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.
- e) Display of air conditioner operation history.
- f) Daily management automation through yearly schedule function with possibility of various schedules.

The controller shall have wide screen user friendly color LCD display and can be wired by a non polar 2 wire transmission cable to a distance of 1 km. away from indoor unit.

#### 1.11 **HEAT RECLAIM VENTILLATION UNIT**

In order to achieve the purpose of better indoor air quality, the Heat Reclaim ventilation (HRV) unit must exchange the heat between supplied fresh air and exhausted air in order to bring the outside air closer to indoor temperature and humidity conditions. Thus it must recover the thermal energy of exhaust air and reuse it for supplied fresh air. This must lead to ventilation without increasing the load and thus saving in running cost.

It shall be possible to interlock this HRV system with operation of VRV system to simplify installation and improving the efficiency of airconditioning. It shall be possible to set automatic ventilation mode so that heat exchange mode and ventilation mode can be automatically selected to enhance energy conservation.

The casing of the HRV unit shall be made of galvanized steel plate, insulation with self extinguishable polyurethane foam. The must have air filters of multi directional fibrous fleeces type.

The heat exchanger element must be designed without any moving parts for higher durability and reliability, It should have high permeability high efficiency specially processed paper which is flame retardant and fungi proof to keep air clean.

The unit must be provided with builtin multidirectional fibrous filter.

The Unit must have optimized design of fan and air flow passage to make it compact and supply air & exhaust air passage must be arranged in such pattern so as to prevent mixing of supply (fresh ) and exhaust air.

The unit must be suitable for single phase power supply and have their control panel.

## **End of Section 2**

### **Section 3**                      **Split System Airconditioners**

1.     **General :**

The contractor shall supply and install split system air conditioners wherever indicated. The system shall be complete in all respects and comply with the specifications as given.

2.     **Condensing Units :**

- 2.1    Each condensing unit shall be complete unit with hermetic reciprocating/scroll compressor/s, aircooled condenser, condenser fans with motors, internal piping, switches and internal wiring and shall be enclosed in a weather proof out door type housing.
- 2.2    The compressor shall be hermetic, with enclosed gas cooled motor. The compressor's shall be suitable for R-22.
- 2.3    The condenser coil shall be air cooled type with aluminium fins and copper tubes and necessary refrigerant connections. The copper tubes shall not be less than 1/2" O.D.
- 2.4    The condenser air fans shall be propeller type direct driven, each complete with motor. The air quantity and area of the condenser shall be adequate for working in the specified out door conditions.
- 2.5    The casing shall be fabricated from galvanised steel, zinc phosphated and finished with baked enamel paint. The casing shall make the whole unit fully weather proof, suitable for out door installation.
- 2.6    The unit shall include a remote control assembly with thermostat and speed switches.
- 2.7    The necessary charge of refrigerant gas and lubricated oil shall be provided to run the system.

### 3. **Indoor Units**

#### **General :**

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

#### 3.1 **Cassette Type Units :**

##### **Unit**

The units shall be ceiling mounted type. The housing of the unit shall be of powder coated galvanised steel and shall include pre filter, fan section, coil section, etc. The body shall be light in weight and shall be able to suspend from four corners.

The fan shall be Aerodynamically designed diffuser turbo fan type. The fan shall be mounted directly on motor shaft having supported from housing. The fan shaft shall be statically and dynamically balanced. The fan shall be direct driven type.

The cooling coil shall be of seamless copper tubes, and shall have continuous aluminium fins. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of air flow. The fins shall be uniformly bonded to the tubes by mechanical expansion of the tubes. The coils shall be tested against leaks.

Unit shall have filter cleanable type of resin net (with mold resistant) fixed to an intergrallymoulded plastic frame. The filter should be slid away type but neatly inserted.

Unit shall have a external attractive panel for supply and return air. Unit shall have two/four way supply air grilles on sides and return air grille in centre.

Each unit shall have high lift drain pump, fresh air intake provision (if required), low gas level detection system.

Each unit shall have an electronic expansion valve which control refrigerant flow rate in respond to load variatious of room (wherever specified).

The computerised PID control shall be used to maintain a correct room temperature. Each unit to be provided with microprocessor thermostat for cooling & heating. The unit shall be capable toprogramme its life cycle, through microprocessor based panel, for equal running and idle period of the unit.

##### **Control :**

Each unit shall be with corded remote controller to operate maintain inside conditions.

**Testing :**

The indoor unit shall be tested to measure air quantity and coil performance by measuring temperature difference, and then calculating the capacity.

3.2 **Ductable Unit :**

The units shall be ductable ceiling mounted type. The housing of the unit shall be powder coated galvanised steel and shall include pre filter, fan section, coil section, etc. The frame work shall be of extruded aluminium hollow section. All the frame shall be assembled using pressure die cast aluminium joints to make a sturdy, strong and self supporting frame work for various section. It shall follow manufacturer standard.

The fan shall be forward curved, double inlet double width type (Sirocco fan). The wheel & housing shall be fabricated from galvanised steel. The fan impeller shall be mounted on a solid shaft supported to housing. The impeller & fan shaft shall be statically and dynamically balanced. The fan outlet shall be connected to casing. The fan shall be direct driven type.

The cooling coil shall be of seamless copper tubes shall have continuous aluminium fins. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of air flow. The fins shall be uniformly bonded to the tubes by mechanical expansion of the tubes. The coils shall be tested against leaks at a hydraulic pressure.

Unit shall have filter cleanable type of synthetic material fixed to an intergrallymoulded plastic frame. The filter should be slid away type but neatly inserted.

The computerized PID control shall be used to maintain a correct room temperature. Each unit to be provided with microprocessor thermostat for cooling & heating.

**Control**

Each unit shall be with wired remote controller LCD type. The LCD remote controller shall memorize the latest malfunction code for easy maintenance.

**Testing :**

The fan coil unit shall be tested to measure air quantity and coil performance by measuring temperature difference, and then calculating the capacity.

4. **Refrigerant Piping :**

- 4.1 The condensing unit and evaporator unit shall be interconnected by type 'L' seamless copper refrigerant liquid and suction lines using flared or brazed fittings. Necessary accessories shall be incorporated in the circuit.
- 4.2 The suction line shall be insulated with two layers of 6 mm rubber foam insulation.

5. **Miscellaneous :**

- 5.1 The unit shall have control panel, housing the starting switches, contactor, relays etc.
- 5.2 Isolation pads shall be provided under the units.
- 5.3 Drain line shall be provided from fan coil unit upto drain trap. (To be priced separately).
- 5.4 Ductable unit shall have canvass connection at its outlet. The canvass connection shall be fire retardant, nonporous double layer.
- 5.5 Suitable M.S. angle iron supporting frame shall be provided for the condensing unit and supporting arrangement for the indoor units.
- 5.6 Interconnecting power and control cabling shall be provided between condensing unit and evaporator unit.

**End of Section 3**

**Section 4 Ventilation & Fresh Air System**

**General :**

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

1. **Exhaust Fan Section :**



- 1.1 The centrifugal fan section shall be double/single inlet, double/single width, non overloading type, be suitable G.S.S. construction. The blower performance must be rated in accordance with approved test codes and procedures.
- 1.2 The blower housing comprising of scroll & side plates shall be accurately cut, heavy gauge all welded sectional construction and reinforced with angle bracing. Outlets shall be flanged to assure proper duct connections. Inlet cones shall be spun venturi type or curved vane type to ensure smooth air entry. The base frame shall be of angle iron in bolted/welded construction.
- 1.3 Impeller shall be fabricated from sheet steel with forward curved, properly designed. Blades, heavy C.I. hub and shall be both dynamically and statically balanced, to a close tolerance for quiet and vibration free performance.
- 1.4 Shaft shall be hot rolled steel or forged steel, sized adequately, but in no case less than 40 mm diameter and shall be accurately ground and polished to a close tolerance.
- 1.5 Bearings shall be self aligning, heavy duty ball or tapered roller type with intergral dust and grease seals.
- 1.6 After assembly, the complete fan shall be painted with rust proof primer and two coats of synthetic enamel paint.
- 1.7 Fan having wheel diameter of 1220 mm or more, shall be supplied with split, bolted housing for convenience of handling and installation.

## 2. **Centrifugal Blowers :**

- 2.1 The centrifugal blowers shall be double/single inlet, double/single width, non overloading type, be suitable construction. The blower performance must be rated in accordance with approved test codes and procedures as per IS : 4894-1987 code of practice for centrifugal fan.
- 2.2 The blower housing comprising of scroll & side plates shall be accurately cut, heavy gauge all welded sectional construction and reinforced with angle bracing. Outlets shall be flanged to assure proper duct connections. Inlet cones shall be spun venture type or curved vane type to ensure smooth air entry. The base frame shall be of angle iron in bolted/welded construction.
- 2.3 Impeller shall be fabricated from sheet steel with backward curved, properly designed. Blades, heavy C.I. hub and shall be both dynamically and statically balanced, to a close tolerance for quiet and vibration free performance.
- 2.4 Shaft shall be hot rolled steel or forged steel, sized adequately, but in no case less than 40 mm diameter and shall be accurately ground and polished to a close tolerance.

- 2.5 Bearings shall be self aligning, heavy duty ball or tapered roller type with intergral dust and grease seals.
- 2.6 After assembly, the complete fan shall be painted with rust proof primer and two coats of synthetic enamel paint.
- 2.7 Fan having wheel diameter of 1220 mm or more, shall be supplied with split, bolted housing for convenience of handling and installation.

3. **Blower Drive Assembly :**

- 3.1 Drive assembly for each blower shall consist of blower pulley, motor pulley, a set of `V'belts, belts, guards and belt tension adjusting device.
- 3.2 Pulleys shall be selected to provide the required speed. They shall be multi-grove type, with section and grooves selected to transmit 33% more load than the required power and shall be statically balanced.
- 3.3 The belt guards shall be M.S. sheet with angle iron reinforcement and expanded metal screen.

4. **Motors and Starters :**

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

5. **Accessories :**

All necessary accessories shall be provide for proper operation and shall also include :

- 5.1 Vibration isolators for the blowers.
- 5.2 Double canvas connections at the outlet of each fan.
- 5.3 Nuts, bolts, shims etc. as required for the grouting of the equipment.
- 5.4 Slide rails for mounting the motor and belt adjustments.

## **End of Section 4**

### **Section 5 Treated Fresh Air Units**

#### 1. **Scope ;**

The scope of this section comprises of the supply of double-skin “Treated Fresh Air Units” conforming to the following specifications .

#### 2. **Capacity :**

The Treated Fresh Air units shall be of such capacities and static pressures as mentioned in the Bill of Quantities.

#### 3. **Casing :**

The units shall be made of extruded Aluminium hollow profile frames. 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 aluminium joints/corners to make a self-supporting frame .

The panels shall be of double skin construction with both inner and outer steel sheets being minimum 0.8mm thick pre coated & plasticized. 25 mm thick fire retardant, fibre glass insulation shall be sandwiched between the sheets. The fibre glass density shall be 48 kg/m<sup>3</sup>.

The Inspection and access panels shall be hinged type. The hinges shall be casted, powder coated Zinc alloy. Flushed Locks and Handles shall be of galvanized steel. 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 construction.

#### 4. **Supply Air Section :**

The supply air section shall comprise of the following:

##### 4.1 **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.

The cooling coil of evaporator / fan section shall have copper tubes of not less than 3/8" O.D. and continuous aluminium plate fins with integral collors, the tubes shall be staggered in the direction of the air flow.

#### 4.2 **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 protection. Motor shall be designed for quiet operation . Drive shall be provided through belt – drive arrangement. Belts will be of oil resistant type.

#### 4.3. **Filter Section**

The filter section shall be normally designed for deep folded disposable synthetic prefilters 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 .

#### 5. **Outdoor Unit :**

- 5.1 The compressor shall be hermetic reciprocating type, with enclosed gas cooled motor. The compressor's shall be suitable for R-22.
- 5.2 The condenser coil shall be air cooled type with aluminium fins and copper tubes and necessary refrigerant connections. The copper tubes shall not be less than 1/2" O.D.
- 5.3 The condenser air fans shall be propeller type direct driven, each complete with motor. The air quantity and area of the condenser shall be adequate for working in the specified out door conditions.
- 5.4 The evaporator shall consist of cooling coil, fan with motor, filter, drain pan, accessories etc.
- 5.5 The casing shall be fabricated from galvanised steel, zinc phosphated and finished with baked enamel paint. The casing shall make the whole unit fully weather proof, suitable for out door installation.
- 5.6 The unit shall include a remote control assembly with thermostat.
- 5.7 The necessary charge of refrigerant gas and lubricated oil shall be provided to run the system.

## End of Section 5

### Section 6                      Duct Work and Outlet

#### 1.     General :

- 1.1     The work under this part shall consist of furnishing labour materials, equipment and appliances as specified necessary and required to install all sheet metal and other allied work to make the air conditioning supply, ventilating, and exhaust system ready for operation as per drawings.
- 1.2     Except as otherwise specified all duct work and related items shall be in accordance with these specifications.
- 1.3     Duct work shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

#### 2.     Duct Materials :

- 2.1     The ducts shall be fabricated from galvanized steel sheets class VIII conforming to ISS:277-1962 (revised) or aluminium sheets conforming to ISS:737-1955 (wherever aluminium ducts are specified).
- 2.2     All duct work, sheet metal thickness and fabrication unless otherwise directed, shall strictly meet requirements, as described in IS:655-1963 with amendment-I (1971 edition)

The thickness of the sheet shall be as follows :-

Size of Duct	Sheet thickness		Type of Joint	Bracing if any
	G.I.	Aluminium		
2.2.1   Upto 750mm	0.63 mm	0.80 mm	G.I. Flange	--
2.2.2   751 mm to 1000 mm	0.80 mm	1.00 mm	25x25x3 mm angle iron frame with 8 mm dia nuts & bolts	25x25x3 mm angle iron frame at the rate of 1mt.
2.2.3   1001 mm to 1500 mm	0.80 mm	1.00 mm	40x40x5 mm angle iron frame with 8 mm dia nuts & bolts	40x40x3 mm angle iron frame at the rate of 1 mt.

2.2.4	1501 mm to 2250 mm	1.00 mm	1.50 mm	50x50x5 mm at angle iron with 10 mm dia nuts & bolts at 125 mm centre.	40x40x3 mm at the rate of 1.2 mt.to be crossed braced diagonally
2.2.5	2251 mm and Above	1.25 mm	1.80 mm	50x50x6 mm at angle iron the rate of frame with 1.6 10 mm nuts & bolts at 125 mm centre.	40x40x3 mm at the rate of 1.2 mt.to be crossed braced diagonally

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

2.4 Ducts larger than 450 mm shall be cross broken, duct sections upto 1200 mm length may be used with bracing angles omitted.

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

2.6 All ducts shall be supported from the ceiling/slab by means of M.S. Rods of 9 mm (3/8") Dia with M.S. Angle at the bottom. The rods shall be anchored to R.C. Slab using metallic expansion fasteners.

### 3. **Installations :**

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

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

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

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

- 3.4 All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration.
- 3.5 The duct work shall be varied in shape and position to fit actual conditions at building site all changes shall be subject to the approval of the Engineer-In-Charge. The contractor shall verify all measurements at site and shall notify the engineer-in-charge of any difficulty in carrying out his work before fabrication.
- 3.6 Sponge rubber or approved equal gaskets shall be installed between duct flanges as well as between all connections of sheet metal ducts to walls, floor columns, heater casings and filter casings. Sheet metals connections shall be made to walls and floors by means of wooden member anchored to the building structure with anchor bolts and with the sheet screwed to them.
- 3.7 Flanges bracings and supports are to be black, mild steel and are to be galvanised on all surfaces before erection. Accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.
- 3.8 Joints, seams, sleeves, splitters, branches, takeoffs and supports are to be as per duct.
- 3.9 Joints requiring bolting or rivetting may be fixed by Hexagon nuts and bolts, stove bolts or buck bolts, rivets or closed centre top rivets or spot welding. Self tappingscrews must not be used. All jointing material must have a finish such as cadmium plating or Galvanized as appropriate.
- 3.10 Flexible joints are to be fitted to the suction and delivery of all fans. The material is to be normally double heavy canvass or as directed by Engineer-In-Charge. On all circular spigots the flexible materials are to be screwed or clipband with adjustable screws or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat.
- 3.11 The flexible joints are to be not less than 75 mm and not more than 250 mm between faces.
- 3.12 The duct work should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling contractors.

#### 4. **Dampers :**

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

- 4.2 The volume dampers shall be of an approved type, lever operated and complete with locking devices which will permit the dampers to be adjusted and locked in any positions.
- 4.3 The dampers shall be of splitter, butterfly or louver type. The damper blade shall not be less than 1.25 mm (18) gauge, reinforced with 25 mm angles 3 mm thick along any unsupported side longer than 250 mm. Angles shall not interfere with the operation of dampers, nor cause any turbulence.
- 4.4 Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.6 mm steel sheets and blades shall not be over 225 mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8 mm thickness with fine mesh.
- 4.5 Wherever required for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.
- 4.6 After completion of the duct work, dampers are to be adjusted and set to deliver air flow as specified on the drawings.
- 4.7 Automatic fire dampers shall be provided wherever shown on the drawings. The damper shall be multiblade curtain type. The blades should be out of the air stream in open position and shall be constructed with minimum 1.8 mm thick aluminium sheets. The frame shall be of 1.6 mm thickness. Other materials shall include return spring, locking device, solenoid actuator, etc.

The fire dampers shall be capable of operating automatically with the actuation of smoke/heat detector. Units fans shall be interlocked with the damper.

5. **Access panel :**

- 5.1 A hinged and gasketed access panel measuring at least 450 mm x 450 mm shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

6. **Miscellaneous :**

- 6.1 All duct work joints are to be true right angle and with all sharp edges removed.
- 6.2 Sponge rubber gaskets also to be provided behind the flange of all grilles.
- 6.3 Each shute from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the shoot.



- 6.4 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.
- 6.5 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by Engineer-In-Charge.
- 6.6 The ducts should be routed directly with a minimum of directional change.
- 6.7 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the Engineer-In-Charge, at no extra cost.
- 6.8 All angle iron flanges to be welded electrically and holes to be drilled.
- 6.9 All the angle iron flanges to be connected to the GSS ducts by rivets at 100 mm centres.
- 6.10 All the flanged joints, to have a sponge rubber packing stuck to the flanges with suitable adhesive.
- 6.11 The G.S.S. Ducts should be lapped 6 mm across the flanges.
- 6.12 The ducts should be supported by approved type supports at a distance not exceeding 2.4 metres.

7. **Standard Grilles :**

- 7.1 The supply and return air grilles shall be fabricated from extruded aluminium sections. The supply air grilles shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall of aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers. The grilles may or may not be with an outer frame.
- 7.2 The damper blades shall also be of extruded aluminium sections. The grill flange shall be fabricated out of aluminium extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

8. **Diffusers/Slot Diffusers :**

- 8.1 The ceiling type square diffusers shall be of aluminium extruded sections with flush or step down face, as specified with fixed pattern and neck.
- 8.2 All supply diffusers shall be provided with extruded aluminium dampers, with arrangement for adjustment from the bottom.

8.3 The slot diffusers shall be of Aluminium extruded sections with diffusion plate and sliding damper.

9. **Linear Diffusers/Grilles :**

9.1 The linear diffusers/grilles shall be fabricated from Aluminium extruded sections.

9.2 The diffusion blades shall be extruded, flush mounted type with single or double direction air flow.

9.3 The frame shall be of aluminium extruded section and shall hold the louvers tightly in fixed position.

9.4 The dampers as described under grilles shall be provided wherever specified.

10. **Painting :**

10.1 All grilles, and diffusers shall be powder coated, before installation, in approved colour.

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

11. **Testing :**

11.1 After completion, all duct system shall be tested for air leakage.

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

**End of Section 6**

**Section 7 Specifications for Sheet Metal Duct Work**  
**Applications Rectangular**

1. **Scope :**

The scope of this section comprises supply fabrication, installation and testing if all sheet metal / aluminum ducts.

2. **Governing Standards :**

Unless otherwise specifications here, the construction ,testing and performance of the ducting system shall conform to the SMACNA-1995 standards (“HVAC Duct Construction Standard – Metal and Flexible – Second Edition 1995” – SMACNA)

3. **Raw Material :**

3.1 **Ducting :**

3.1.1 All ducting shall be fabricated of LFQ (Lock Forming Quality) grade prime G.I. raw material furnished with accompanying Mill Test Certification.

3.1.2 Galvanizing shall be of 120 gms/sqm (total coating on both sides)

3.1.3 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

3.1.4 The G.I. raw material should be used in coil-form (instead of sheets) so as to limit the longitudinal joints at the edges only irrespective of cross-section dimensions.

3.2 **Duct Connectors and Accessories :**

3.2.1 All transverse duct connectors (flanges/cleats) and accessories/related hardware are such as support system shall be zinc-coated(galvanized)

4. **Fabrication Standards :**

All ductwork including straight sections, tapers, elbows, branches, showpieces, colors, terminal boxes and other transformation pieces must factory-fabricated or by equivalent technology. Equivalency will require fabrication by utilizing the following machines and processes to provide the requisite quality of ducts and speed of supply.

4.1 Coil lines to ensure location of longitudinal seams at comers / folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along with any face side of the duct.

4.2 All ducts, transformation pieces and fittings to be made on CNC profile cutters for required accuracy of dimensions.

4.3 All edges to be machine treated using lock formers, flangers and roller for turning up edges.

4.4 Sealant dispensing equipment for applying built in sealant in Pittsburgh lock where sealing of longitudinal joints are specified.

5. **Selection of G.I. Gauge and Transverse Connector :**

5.1 Duct construction shall be in compliance with 1" (250 pa) w.g. static norms as per SMACNA.

- 5.2 All transverse connectors shall be the 4-bolt slip-on flange system or 4 bolt system with TDC flange or equivalent imported makes of similar 4-bolt system with built in sealant.
- 5.3 The specific class of transverse connectors and duct gauges for a given duct dimensions will be as per table 1 below for the 1” (250 pa) pressure class.
- 5.4 Non-toxic, AC –applications grade P.E. or P.V.C Gasketing is required between all running flange joints. Gasket sizes should confirm to flange manufacturer’s specifications.

**Table1:**

<b>For selection of flange class and duct gauges at 1200 mm spacing</b>						
<b>Duct Dimension</b>	<b>Duct pressure in inches</b>					
	<b>1”(250)*<sup>5</sup></b>	<b>2”(500)</b>	<b>3”(750)</b>	<b>4”(1000)</b>	<b>6”(1500)*<sup>4</sup></b>	<b>10”(2500)</b>
<b>In mm</b>	<b>Reinforcement Class – Duct Gauge</b>					
<b>Upto 250</b>	<b>*<sup>3</sup>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>
<b>251 – 300</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-24</b>
<b>301 – 350</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-22</b>
<b>351 – 400</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-22</b>
<b>401 - 450</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>H-20</b>
<b>451 – 500</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-24</b>	<b>E-24</b>	<b>H-20</b>
<b>501 – 550</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-24</b>	<b>H-24</b>	<b>H-20</b>
<b>551 – 600</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-24</b>	<b>H-22</b>	<b>H-20</b>
<b>601 – 650</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>E-24</b>	<b>H-22</b>	<b>H-20</b>
<b>651 – 700*<sup>2</sup></b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>H-24</b>	<b>H-22</b>	<b>H-18</b>
<b>701 – 750</b>	<b>E-26</b>	<b>E-26</b>	<b>E-24</b>	<b>H-24</b>	<b>H-22</b>	<b>J-18</b>
<b>751- 900</b>	<b>E-26</b>	<b>E-24</b>	<b>E-24</b>	<b>H-22</b>	<b>H-20</b>	<b>J-18</b>
<b>901 – 1000</b>	<b>E-26</b>	<b>H-24</b>	<b>H-22</b>	<b>H-20</b>	<b>J-18</b>	<b>J-16</b>
<b>1001 – 1200</b>	<b>E-24</b>	<b>H-22</b>	<b>H-20</b>	<b>J-18</b>	<b>J-18</b>	
<b>1201 – 1300</b>	<b>*<sup>3</sup>H-24</b>	<b>H-20</b>	<b>J-18</b>	<b>J-18</b>	<b>J-16</b>	
<b>1301 – 1500</b>	<b>H-24</b>	<b>H-18</b>	<b>J-18</b>	<b>J-16</b>		
<b>1501 – 1800</b>	<b>H-22</b>	<b>J-18</b>	<b>J-16</b>			

1801 - 2100	*3J-20	*3J-20	
2101 – 2400	J-18	J-18	
2401 - 2700	J-18		

**Notes:**

- \*1- SMACNA- Sheet Metal and Air Conditioning Contractor’s Association Inc-“HVAC Duct Construction Standards- Metal and Flexible” – 1995 U.S.A
- \*2- **Reading Guide-** for duct size between , say 651m and 700mm, when the pressure class is 1” w.g. static we require a “E” class flange and duct gauge of 26 . For the same size range but with static pressure at 4” w.g. a ‘h’ Class flange with duct gauge of 24 should be used
- \*3- The flange classes available are designated e, hand j .For E and H class of flange use gasket size 10 mm wide and 45 mm thick. For J Class use 15 mm wide and 6 mm thick gasket.
- \*4- For pressure Class 6” w.g. static and above contact manufacture to confirm the gasket type & size.
- \*5- (Not Applicable for current Specifications) For non-critical comfort cooling applications (1” w.g. pressure class) optional “C & S” or “C & SS” cleat joints can be used.

Upto 450 mm duct size use”C& S” Cleats

415 to 750 m duct size use “C & SS” Cleats

Over 750 mm duct size use flanges as specified or as per manufacturer’s standard.

All higher class flang can always be substituted for a lower class( e.g. class “J” for class “H”. class “H” for Class “E”)

- \*6- The TDC flange classes remain same in all sizes, use gasket size 12 mm wide and 4 mm thick in all sizes.

**1.0 Duct Construction :**

- 6.1 The fabricated duct dimensions should be as per approved drawings and al connecting sections are dimensionally matched to avoid any gaps.
- 6.2 Dimensional Tolerance :Al fabricated dimensions will be within +/- 1.0 mm of specified dimensions . To obtain required perpendicularity. Permissible diagonal tolerance shall be +/- 1.0 mm per meter.
- 6.3 Each and every duct pieces should be identified by colour coded sticker which shows specific part numbers, job name, drawing number, duct size and gauge.

- 6.4 Duct shall be straight and smooth and the inside. Longitudinal seams shall be airtight and at comers only which shall be either Pittsburgh or Snap Button Punch as per SMACNA practice , to ensure air tightness.
- 6.5 Change in dimensions and shape of ducts shall be gradual ( between 1:4 and 1:7). Turning vanes or air splitter shall be installed in all bends and duct colors designed to permit the air to make the turn without appreciable turbulence.
- 6.6 Plenums shall be shop/factory fabricated panel type and assembled at sight.
- 6.7 The deflection of transverse joints should be within specified limit for rectangular duct deflection as given in SMACNA. Page No, 7.6
- 6.8 Reinforcement of duct shall be achieved by either cross breaking a straight beading depending on length of ducts.

As per SMACNA Page No.1.74, fig 1-8

“Duct Size 19” (483 mm) wide and larger which have more than 10sqft of unbraced panel shall be beaded or cross broken unless duct will have insulation covering or acoustical liner. This requirement is applicable to 20 g(1.00 mm) or less and 3” w.g(750 pa) pressure or less. Duct for 4” w.g. (1000 pa) or more do not require beads or cross-breaks”.

7. **Support System :**

- 7.1 A completely galvanized system consisting of fully threaded rods, slotted angles or double L bottom brackets (made out of 5.0 mm thick M.S. angle) nuts, washer and anchor bolts confirming to SMACNA standards should be used.

Sr. No.	Maximum Duct Size(mm)	Hanger Road Diameter	Interval (mm)
1.	Up to 700	6mm	2400
2.	701 – 1200	8 mm	2400
3.	1201 – 2000	10 mm	2400
4.	Above 2000	12 mm	2400

- 7.2 As an alternative, slotted galvanized brackets attached to the top two bolts of the system may also be used as appropriate for the site condition.
- 7.3 To provide the required thermal brake effect, Neoprene or equivalent material of suitable thickness shall be used between duct support and duct profiles in all supply air duct does not enclosed by return air plenums.

## 8. **Installation :**

### 8.1 **Tools and tackles for site work**

The duct installation shall conform to SMACNA norms. For duct assembly and installation the use of suitable tools and tackles should be used to give the required duct quality and speed of installation including (but not restricted to)

- a) Electric Pittsburgh seamer - used for closing Pittsburgh joints
- b) Electric Slitting Shear - to make cut – outs
- c) Drilling machine and drill - for drilling holes sheet metal work  
bits
- d) Hammer drill machine - for drilling holes in building structure for  
anchor  
with drill bits
- e) Hoisting system - for lifting the duct assembly up to  
mounting heights

### 8.2 **Installation Practice**

All ducts shall be installed as per tender drawings and in strict accordance with approved shop drawing to be prepared by the Contractor

- 8.2.1 The contractor shall provide any neatly erect 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.
- 8.2.2 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 there is interference /fouling with other beams, structural work, plumbing and conduits, the ducts shall be suitably modified as per actual site conditions.
- 8.2.3 Ducting over false ceiling shall be supported from the slab above , or from beam, 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.
- 8.2.4 Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick appropriate insulation around the duct and totally covered with fire barrier mortar for complete sealing.
- 8.2.5 All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blowers coil unit that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge.

9. **Documentation & Measurement for Ducting :**

- 9.1 For each drawing, all supply of duct work must be accomplished by computer generated detailed bill of material indicating all relevant duct sizes, dimensions and quantities .In addition, summary sheets are also to be provided showing duct area by gauge and duct size range as applicable.
- 9.2 Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.
- 9.3 All duct pieces to have a part 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, verification and approvals.

10. **Testing :**

After duct installation, a part of duct section (approximately 5% of total ductwork) may be selected at random and tested for leakage. The procedure for leak testing should be followed as per SMACNA – “ HVAC Air Duct Leakage Test Manual” ( First Edition)

11. **Dampers :**

- 11.1 At the junction of each branch duct with main duct and split of main duct, volume control dampers must be provided. Dampers shall be two gauges heavier than the gauge of the large duct and shall be rigid in construction.
- 11.2 The volume control dampers shall be of an approved type, lever operated and complete with locking devices which will permit the dampers to be adjusted and locked in any positions. Dampers shall be provided with suitable links levers and quadrants as required for their proper operation.
- 11.3 The dampers shall be of splitter, butterfly or louver type. The damper blade shall not be less than 1.25 mm (18) gauge, reinforced with 25 mm angles 3 mm thick along any unsupported side longer than 250 mm. Angles shall not interfere with the operation of dampers, nor cause any turbulence.
- 11.4 Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings. Dampers and frames shall be constructed of 1.6 mm steel sheets and blades shall not be over 225 mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8 mm thickness with fine mesh.
- 11.5 Wherever required for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.



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

12. **VAV Box :**

12.1 Terminal shall be certified under the ARI standard 880 certification program and carry the ARI seal. Noncertified terminals may be submitted after testing at an independent testing laboratory under conditions selected by the engineering consultant in full compliance with ARI standard 880. These tests must be witnessed by the engineering consultant with all costs to be borne by the terminal manufacturer. Testing does not ensure acceptance.

12.2 The terminal casing shall be minimum 22 gauge galvanized steel, internally lined with ½-inch dual density insulation which complies with UL 181 and NFPA 90A. All exposed insulation edges shall be coated with NFPA 90 A approved sealant to prevent entrainment of fibers in the airstream. The discharge connection shall be slip and drive construction for attachment to metal ductwork. The casing shall be constructed to hold leakage to the maximum values shown in the casing leakage table.

12.3 The damper shall be heavy gauge steel with shaft rotating in self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent overstroking and a synthetic seal to limit close-off leakage to the maximum values shown in the damper leakage table.

12.4 Actuators shall be of modulating type and capable of supplying at least 35 inch lbs. of torque to the damper shaft and shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access pane, removable without disturbing ductwork. Casing with access panel shall be constructed to hold leakage to the maximum values shown in the casing leakage table.

12.5 At an inlet velocity of 2000 fpm, the minimum static pressure required to operate any terminal size shall not exceed 0.13-inch wg for the basic terminal.

12.6 Sound ratings for the terminal shall not exceed \_ NC at \_ static pressure. Sound performance shall be ARI certified.

12.7 Providing and fixing modulating type thermostat alongwith necessary wiring etc.

12.8 Actuator and thermostat should be inter link effectively.

12.9 VAV box shall be atleast 10% open in case of minimum requirement.

13. **VFD for AHU's**

Speed controller for induction motors with built in RFI filter, EMC and LVD complaint. The inverters are suitable for High/Low overload (constant/variable torque) applications. Following are feature required in VFD's

- AC choke included for protection against over voltage.
- With internal RFI filter.
- Flexible I/O configuration .
- Compact Housing.
- Power module with metal chassis for compliance with RFI regulation and safety.
- Detachable multilingual HMI – panel for parameter setting alarms start/stop functions.
- CE – Mark declaration enclosed in manual .

Power Supply	:	200-240 Volt,45.66 Hz
Output Frequency	:	0....320 Hz
Frequency Resolution	:	0.01 Hz
Serial Communication	:	Optional : Interbus-S, Modbus, Echelon, Profibus.
Immunity	:	EN 50062-1 : EN61800-3
Emissions	:	EMC level I EN 50081-2,EMC level C,EN 50081-1,2 and EN61800-3
Safety	:	EN 50178, CE, UL, C-UL, FI, GOST R
Protection Class	:	IP21

#### 14. **Fire & Smoke Dampers**

##### **Combination Fire Smoke Damper –**

- 14.1 Combination Fire Smoke Dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules. Dampers shall meet the requirements of the latest edition of NFPA 90A, 92A, and 92B.
- 14.2 **Dampers shall be tested, rated and labeled in accordance with the latest edition of UL Standards 555 and 555S.** Dampers shall have a UL555 fire rating of 1 1/2 hours. Each damper shall be equipped with a heat responsive device which has been tested and approved for use with the damper assembly in accordance with UL555. The heat responsive device shall have a temperature rating of (specifier select one of the following) 74 C or 100 C. Dampers shall be UL labeled for use in dynamic systems. The damper shall have a dynamic closure airflow rating equal to or greater than the airflow at the damper's installed location and a dynamic closure pressure rating of 101.6 mm H2O.
- 14.3 Dampers shall have a UL555S Leakage rating of Class I and a Temperature rating of 177 C. Dampers shall have a UL555S operational airflow rating equal to or greater than the airflow at its installed location and an operational pressure rating of 101.6 mm H2O.

Damper actuators shall be factory mounted and qualified for use with the damper in accordance with UL555S. Damper actuators shall be electric type for 220 /24 volt operation. Actuator shall be of Honeywell or Belimo make.

- 14.4 All UL555 and 555S Dynamic Closure Ratings, Operational Ratings and Leakage Ratings shall be qualified for airflow and pressure in either direction through the damper. UL ratings shall allow for mounting damper vertically (with blades running horizontal) or horizontally.
- 14.5 The Damper Manufacturer's submittal data shall certify all air performance pressure drop data is licensed in accordance with the AMCA Certified Ratings Program. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.
- 14.6 Damper blades shall be 1.6 mm galvanized steel 3 Vee type with three longitudinal grooves for reinforcement. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow and operation in either direction through the damper (blades that are non-symmetrical relative to their axle pivot point or utilize blade stops larger than 13 mm are unacceptable).
- 14.7 Damper frames shall be galvanized steel formed into a structural hat channel shape with reinforced corners. Bearings shall be sintered bronze sleeve type rotating in extruded holes in the damper frame. Jamb seals shall be stainless steel compression type.

15. **Actuators**

The actuator used shall be maintenance free direct coupled spring return suitable to work on 24 V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open/close the damper. The selection of actuator size shall be the responsibility of the manufacture of the fire damper. Spring return time shall be 20 seconds or less at ambient temperature other features of the damper actuator shall be as under.

- a) Ithave tamper proof housing with IP-54 protection rating.
- b) Shall have mechanical integrity of at least one hour at 900<sup>0</sup> C.
- c) Shall have minimum 60000 safe position at rated torque. It shall be capable to withstand temperature of 75<sup>0</sup> C for 24 Hrs.
- d) Shall have electronic over load or digital sensing circuit to prevent damage to actuator.
- e) Should be capable of changing direction of rotation by changing mounting orientation.
- f) Shall have manual over ride facility.

16. **Control Panel**

The control panel shall be supplied by damper manufacturer fitted on damper compatible with damper actuators. The control panel shall have at least following features.

- i. Power on indicating lamps with 230 V/24 V transformer.
- ii. Damper close & open indication.
- iii. Reset push button.
- iv. Push button for manual running of actuator for periodic inspection.
- v. Auxiliary contacts 24 V & 230 V.
- vi. Contact points to receive signal from smoke defector/fire alarm panel.

The control panel shall receive 230 V A/C supply & interconnecting wiring between control panel & actuator shall be done using fireproof cables.

Access door will be provided in the duct before each fire damper.

17. **Access panel :**

- 17.1 A hinged and gasketed access panel measuring at least 450 mm x 450 mm shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

18. **Miscellaneous :**

- 18.1 All duct work joints are to be true right angle and with all sharp edges removed.
- 18.2 Sponge rubber gaskets also to be provided behind the flange of all grilles.
- 18.3 Each shoot from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the shoot.
- 18.4 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.
- 18.5 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by owner/owner engineer consultant/architect.
- 18.6 The ducts should be routed directly with a minimum of directional change.
- 18.7 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the owner/owner engineer consultant/architect, at no extra cost.
- 18.8 All angle iron flanges to be welded electrically and holes to be drilled.

- 18.9 All the angle iron flanges to be connected to the GSS ducts by rivets at 100 mm centres.
- 18.10 All the flanged joints, to have a sponge rubber packing stuck to the flanges with suitable adhesive.
- 18.11 The G.S.S. Ducts should be lapped 6 mm across the flanges.
- 18.12 The ducts should be supported by approved type supports at a distance not exceeding 2.4 metres.

19. **Standard Grilles :**

- 19.1 The supply and return air grilles shall be fabricated from extruded Aluminium sections. The supply air grilles shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall of Aluminium extruded sections and adjustable type. The return air grille shall be have single horizontal extruded section fixed louvers. The grilles may or may not be with an outer frame.
- 19.2 The damper blades shall also be of extruded Aluminium sections. The grill flange shall be fabricated out of Aluminium extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

20. **Diffusers/Slot Diffusers :**

- 20.1 The ceiling type square diffusers shall be of Aluminium extruded sections with flush or step down face, as specified with fixed pattern and neck.
- 20.2 All supply diffusers shall be provided with extruded Aluminium dampers, with arrangement for adjustment from the bottom.
- 20.3 The slot diffusers shall be of Aluminium extruded sections with diffusion plate and sliding damper.

21. **Linear Diffusers/Grilles :**

- 21.1 The linear diffusers/grilles shall be fabricated from Aluminium extruded sections.
- 21.2 The diffusion blades shall be extruded, flush mounted type with single or double direction air flow.
- 21.3 The frame shall be of Aluminium extruded section and shall hold the louvers tightly in fixed position.

21.4 The dampers as described under grilles shall be provided wherever specified.

22. **Fresh Air / Exhaust Louvers :**

22.1 Louver frame shall be duly painted and made of 16 gauge square MS section and louver made of 18 gauge G.I sheet at an angle of 45 Deg..

22.2 The thickness of the frame shall be 100 mm and spacing between the 2 louvers shall be 75 mm.

23. **Painting :**

23.1 All grilles, and diffusers shall be powder coated, before installation, in approved colour.

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

24. **Testing :**

24.1 After completion, all duct system shall be tested for air leakage.

24.2 The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final tabulation of air quantity through each outlet shall be submitted to the owner/owner engineer consultant/architect for approval.

24.3 All sample required to approved by the Architect/client.

**End of Section 7**

**Section 8**

**Flexible Duct**

1. **General :**

The scope of this section comprise supply, installation, testing and commissioning of flexible ducting conforming to these specification and in accordance with requirements of drawings and schedule of quantities.

2. **Duct Materials :**

- 2.1 Wherever specified, uninsulated flexible duct shall be made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix. Duct shall be in tear and puncture resistant construction.
- 2.2 Wherever insulated flexible duct are specified inner core for the same should be made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix. Fibre glass insulation of minimum 14 kg/cu.meter density, having R-value  $4.2^{\circ} \text{ F-FT}^2\text{-hr/Btu}$  and 25 mm thickness shall be wrapped over the inner core & covered with strong outer jacket cum vapour barrier made of fibre glass reinforced metalized polyester film laminate.

Duct should conform to fire rating standards AS 4254.

### 3. **Installation :**

Care must be taken to install all the flexible duct in fully extruded position and bends made with adequate radius as per manufacturer recommended practices.

#### 3.1 **Hangers and Supports**

The flexible duct must be installed fully extended to produce optimum results. The maximum allowable sag, between any two adjacent suspension points, should not exceed 50 mm per meter.

The distance between any two adjacent suspension points may vary from 1.50 to 3.00 meter, depending upon the type of flexible duct in use.

Flexible ducts mounted above suspended ceiling should always be independently supported. Ducts mounted in these locations are susceptible to damage whenever ceiling panels need to be periodically interchanged, unless they are separately supported.

#### 3.2 **Bending Radius**

All bends should be made as large as possible and should have a radius of not less than the diameter of the duct in use. This reduces un-favourable pressure losses and is particularly important for metal based products which are more susceptible to stress rupturing. Double bends should be avoided, however if un-avoidable, ensure that each radius is not less than  $R = 2 \times D$ .

#### 3.3 **Straps**

Ideally the hanging straps should supports the flexible duct with a minium of half the circumference surface in contact, and without reducing the effective inside diameter of the duct. It is also recommended that the minimum width of material to be used for the hanging straps should be at least 25 mm.

#### 3.4 **Flexible Duct to Conventional Duct Connection**

Extra care should be taken when making connection to fixed conventional ducts, etc., and ensure that they do not become too stressed. An additional support is recommended to obviate this potential problem.

Metal based flexible duct products are particularly prone to fracturing due to stress caused as a result of sharp connection.

Connections to ceiling illumination “troffer boxes” should be served in the most direct manner similar to that described for conventional ducts.

Too many bends, when connecting to “troffer boxes” and / or any other type of air supplying component, may result in excessive pressure loss and the generation of noise.

### 3.5 **Longer Length Installation**

In the event where extreme length of flexible duct is to be installed, round duct connectors made of galvanised sheets of at least 30 cm long should be used to connect the duct at every distance of 10 meters. Use metal or galvanised hangers as recommended (point 3) to support the point where connections are made. Light railing is a good alternative hanging support when using long length of flexible duct.

### 3.6 **Direct Contact**

It should be emphasized that the flexible duct must not be in direct physical contact with un-insulated heating or hot process pipes. If in the event where such situation can not be avoided, additional 1” thick insulation should be wrapped around pipes that are in contact with the duct.

## **End of Section 8**

## **Section 9**

## **Pipe Work**

### 1. **General :**

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

### 2. **Piping :**

#### 2.1 **Drain Piping :**

2.1.1 The drain piping shall be PVC .

2.1.2 The fittings shall be of ‘R’ brand of equal forged with screwed connections.

2.1.3 The gate valves shall be of gun metal as described earlier.



- 2.1.4 Pipe crosses shall be provided at bends, to permit easy cleaning of drain line.
- 2.1.5 The drain line shall be provided upto the nearest drain trap and pitched towards the trap.
- 2.1.6 Drain lines shall be provided at all the lowest points in the system, as well as at equipment, where leakage of water is likely to occur, or to remove condensate and water from pump glands.
- 2.1.7 The drain pipe shall be insulated with two layer of Kinni foam insulation.

## 2.2 **Copper Piping :**

- 2.2.1 Seamless soft copper tubing, type L shall be used to make connections to equipment, wherever required or specified.
- 2.2.2 Flare fittings e.g. flare nuts, tees, elbows, reducers etc. shall all be of brass.

## 2.3 **Refrigerant Piping :**

All refrigerant piping for the air conditioning system shall be constructed from soft seamless upto 19.1mm and hard drawn copper refrigerant pipes for above 19.1mm with copper fittings and silver-soldered joints. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and are to include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be sweat joints using low temperature brazing and or silver solder. Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 20Kg per sq.cm and 10 Kg per sq.cm (lowside). Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum if 700mm hg and held for 24 hours.

The air-conditioning system supplier shall be design sizes and erect proper interconnections of the complete refrigerant circuit.

The thickness of copper piping shall not be less than mentioned below:

### **Pipe Size in mm( OD)Wall Thickness in mm**

a) 54.1	1.5
b) 41.3	1.3
b) 34.9	1.3
c) 28.6	1.2
d) 25.4	1.2
e) 22.2	1.0
f) 19.1	1.0
g) 15.9	1.0
h) 12.7	0.8
i) 9.5	0.8
j) 6.4	0.8

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

### 3. **Pipe Insulation :**

#### a. Refrigerant Pipe Insulation

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm /13 mm thick elastomeric nitrile rubber as specified in BOQ.

#### b. Drain Pipe Insulation

Drain pipes carrying condensate water shall be insulated with 6 mm thick elastomeric nitrile rubber insulation.

For proper drainage of condensate, U Trap shall be provided in the drain piping (wherever required). All pipe supports shall be of pre fabricated & pre painted slotted angle supports, properly installed with clamps etc.

## **End of Section 9**

### **Section 10**            **Insulation**

#### 1.    **General :**

The Insulation of refrigerant piping, drain piping, ducting, etc., shall be carried out as per specifications given below :

#### 2.    **Materials :**

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

#### 2.1   **Duct Insulation :**

The insulation for duct shall be carried out from elastomeric closed cell nitrile rubber having a 'K' value of 0.034 W/(M.K) at mean temperature of 23<sup>o</sup> C. and a density of not less than 33 kgs/cubm. Water vapour permeability 4000 U and above. Fire rating class I/O as per British standard BS 476 part VII/- - 1997 building regulation. Approval of sample to be obtained in writing prior to execution.

#### 2.2   **Other Insulation :**

2.2.1 The material for acoustic treatment of ducts, rooms, roofs etc. shall be resin bonded fibre glass, as described earlier, conforming to I.S. 8183 of 1976. The density of fibre glass shall be 32 kg/cub.m and the material shall be in the form of rolls of uniform density. The 'k' value at 10<sup>o</sup>C. shall not be less than 0.028 kcal/mhr/<sup>o</sup> C. Wherever insulation is to be carried out inside the duct, fibre tissue is to be installed and contractor to ensure that no fibres of insulation material get mixed up with supply/return air.

#### 3.    **Drain Piping :**

3.1 Insulation of drain piping shall be carried out using 6 mm thick insulation tube of closed cell nitrile rubber having a 'K' value of 0.034 W/(M.K.) at mean temperature of 10<sup>o</sup> C and a density of not less than 80 kg/cubm.

#### 3.2   **Installation**

- 3.2.1 The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.
- 3.2.2 Cut insulation tube longitudinally and put on pipe and sealed the joints with adhesive and Aluminium tape (as approved by manufacturer).

4. **Refrigerant Piping :**

- 4.1 The suction line of refrigerant piping shall be insulated with 19/13 mm thick insulation as specified for refrigerant pipe lines.

5. **Ducting :**

- 5.1 The ducts shall be insulated with the insulation sheets as follows.

- 5.2 Duct insulation thickness shall be as follows :

Duct in conditioned space - 13 mm thick

Duct in unconditioned space - 19 mm thick

Duct with treated fresh air - 19 mm thick

6. **Acoustic Lining :**

- 6.1 The acoustic lining shall with Open Cell cross linked polyethylene/nitrile rubber density 30kg/m<sup>3</sup> ,Adhesive ,nut & bolt complete as per specifications.

6.2 **Insulation**

- 6.2.1 The duct surface shall first be cleaned from inside.

- 6.2.2 Then the insulation shall be fixed inside the duct.

**End of Section 10**

**Section 11 Ventilation & Fresh Air System**

## **VENTILATION FANS :**

### 1. **Scope :**

Scope of this section comprises of supplying, erection, testing and commissioning of following type of fans.

- Axial Flow Fans
- Centrifugal Fans
- Propeller Fans
- Inline Fans

The above fans shall be as indicated on drawings and mentioned in schedule of quantities.

### 2. **Axial Flow Fans :**

Axial flow fan shall be of vane axial type and shall be suitable for mounting in duct or floor/slab as required/indicated on the tender drawings.

#### 2.1 **Impellers :**

Single piece cast aluminium or steel impeller shall be with blades of aerofoile design to give maximum efficiency and shall vary in twist and width from hub to tip to effect equal air distribution along the blade length. Single piece fan and hub shall be statically and dynamically balanced. Maximum clearance between blade tip and the fan housing at the specified speed shall be 5 mm. Impellers blades shall be whirl tested to a speed 25% above the design operating speed. Extended grease leads for external lubrication shall be provided. The fan blade shall be adjustable type so that actual air flow can be achieved at site as per indicated in Drawings & BOQ.

#### 2.2 **Casing :**

Casing shall be constructed of 14 gauge sheet steel, properly reinforced for rigidity. Fan casing, motor mount and straightening vanes shall be of welded steel construction motor mounting plate shall be minimum 20 mm thick and machined to receive motor flanges. Casing shall be provided with two nos. wide, hinged doors which open easily. Inspection doors with handle and neoprene gasket shall be provided. Casing shall have flanged connection on both ends for ducted applications. Support brackets for ceiling suspensions shall be welded to casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bondorized, primed and finish coated with enamel paint.

#### 2.3 **Motor :**

Motor shall be squirrel cage, totally enclosed, fan cooled, constant speed, suitable for 415  $\pm$  10% volts, 50 Hz, 3 phase power supply, motor nameplate horsepower shall be more than brake horse power by a minimum of 10%. Motor speed shall not exceed 1450 R.P.M (4 pole). The fan and motor combination selected for particular requirement shall be of the most efficient type so that sound level and energy consumption is minimum. Motor conduit box shall be mounted on exterior of the casing. Wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible metal conduit. The motor shall have 'H' class insulation.

#### 2.4 **Drive :**

- **For Duct/Wall Mounted Fan:**

For duct/wall mounted fans the impeller shall be mounted directly on the motor. Drive unit and impeller shall be totally enclosed inside the duct.

- **For Floor/Ceiling Mounted Fan:**

The fan shall be provided with belt drive and adjustable motor sheave, standard sheet steel belt guard with vented front for heat dissipation. Belt shall be of the oil resistant type.

- **Vibration Isolation:**

Base shall be provided for each fan. Base for both fan and motor shall be built as an integral part and shall be mounted on a concrete foundation through spring type of vibration isolators. The concrete foundations shall be at least 15 cm above the finished floor level and shall be further isolated from the structural floor through 5 cm. Thick layers of sand all around, topped with bitumen. In case ceiling hung fan within the ceiling shall be provided Vibration Isolation Suspension (VIS) shall be provided in each of string.

#### 3. **Centrifugal Fans :**

##### 3.1 **Scroll :**

Casing shall be welded construction fabricated with 14 gauge M.S. Sheet with spray galvanization. Minimum zinc deposition shall conform to class 375 of IS:277.

The minimum thickness of casing shall not be less than 3 mm. The fan scroll shall be attached to the side plate by means of continuous lock seam. 18 gauge galvanized wire mesh inlet screens of 50 mm sieves shall be provided on both inlets. Housing shall be provided with standard clean out and door with quick locking tension handles and neoprene gasket. Rotation arrow shall be clearly marked on the housing.

##### 3.2 **Impeller :**

The impeller shall have die-formed, forward/backward curved blades, welded to the rim and back plates to have a non-over loading characteristic of the fan. Rim shall be spun to have a smooth contour if required, intermediate stiffening rings shall be provided. Shaft sleeves shall be furnished wherever required. The impeller, pulley and housing shall be statically and dynamically balanced. Fan velocity shall not exceed 1800 FPM.

3.3 **Shaft :**

Shaft shall be constructed of SAE 1040 steel turned, ground and polished. Shaft sizes shall be

3.4 **Bearings :**

The bearing shall be self-aligning, heavy duty ball, roller or sleeve bearings. Bearing shall be selected for quiet operation and shall be grease pack, pillow block type. Bearings shall be maintenance free with permanently lubricated sealed ball bearing type.

3.5 **Inlet Guard :**

Inlet guard shall be spun to have a smooth contour. Inlet screen if provided shall be of galvanized wire mesh of 25 mm square.

3.6 **Base Plate :**

Base plate shall be provided for each fan. Base for both fans and motor shall be built as an integral part and shall be mounted on a concrete foundation through cushy foot mountings for vibration isolation. The concrete foundation shall be at least 150 mm above the finished floor level and shall be further isolated from structural floor through 50 mm thick layers of sand all around, topped with bitumen.

3.7 **Motor :**

Fan motor shall be of squirrel cage type totally enclosed fan cooled motor, suitable for  $415 \pm 10\%$  volts, 50 Hz, 3 phase. Horse power indicated on the name plate of motor shall be more than brake horse power by at least 10% and shall have sufficient torque available for starting and continuous operation. Motor R.P.M. shall not exceed 1450 R.P.M. The fan motor combination selected for the particular requirement shall be of the most efficient type (i.e smallest horse power) so that power consumption and noise level may be minimized. The motor shall have 'F' class insulation and four pole.

3.8 **Drive :**

These fan shall be provided with V-belts. All belt shall be selected for 150% rated HP. All V-belt shall be supplied with removable belt guards that do not impede the air flow to the fan inlet. There shall be a minimum of two belts per drive.

3.9 **Vibration Isolation :**

Fan with motor shall be mounted on a concrete foundation through spring type of spring isolators vibration.

4. **Propeller Fans :**

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

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

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

4.4 The fan motor shall be totally enclosed squirrel cage type.

5. **Inline Fans :**

The fan shall be complete with centrifugal impeller, casing, direct driven motor, vibration isolators.

5.1 **Housing**

The housing shall be constructed of hot rolled GSS sheet metal construction. Housing metal parts shall be either spot welded or screwed or mounted together with Rivets. The housing shall indicate arrow showing rotation, make, model and duty conditions.

5.2 **Fan Wheel**

Fan wheel shall be forward/backward curved type, fan wheel shall be statically and dynamically balanced.

5.3 **Ball Bearing**

The ball bearing shall be completely maintenance free and can be used in any mounting position, at maximum indicated temperature. The bearing lubricant shall be suitable for a minimum ambient temperature of minus 15<sup>o</sup> C. For application at maximum indicated ambient temperature life expectancy L10 is 40,000 hours minimum.



#### 5.4 **Fan Motor**

Fan shall be supplied with built in Thermal contact (TK). At the critical high temperature point ('B' = 130<sup>0</sup> C or 'F' = 155<sup>0</sup> C) the Thermal contact will open and break the power supply to the fan. Fan motor shall have insulation class 'B' or class 'F' and protection class IP44 or IP54.

#### 5.5 **Fan Drive**

The fan shall be direct driven type.

#### 5.6 **Painted**

Complete fan assembly and other steel components shall either be GSS and epoxy painted.

#### 6. **Miscellaneous :**

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

- a) Necessary GI piping for water circulation
- b) Vibration isolations pads for the blowers and pumps
- c) Canvas connections at the outlet of each fan
- d) Nuts, bolts, shims etc. as required for the grouting of the equipment
- e) Float valves in the air washer tank, along with quick fill connection

#### 7. **Limitations :**

The air velocity limits are as follows:

- a) Average velocity across air washer filters shall not exceed 2.6 m/sec (500 FPM)
- b) Velocity at blower outlet shall not exceed 9 m/sec (1800 FPM).

#### 8. **Accessories :**

All necessary accessories shall be provide for proper operation and shall also include :

- 8.1 Vibration isolators for the blowers.
- 8.2 Double canvas connections at the outlet of each fan.

- 8.3 Nuts, bolts, shims etc. as required for the grouting of the equipment.
- 8.4 Slide rails for mounting the motor and belt adjustments.
- 8.5 Nuts, bolts, shims etc. as required for the grouting of the equipment.
- 8.6 Slide rails for mounting the motor and belt adjustments.

### **End of Section 11**

## **Section 12**                      **Control Panel, Motors and Switchgears**

### **1. General :**

- 1.1 The motor and switchgears required for various items shall generally be as per specifications given below all electric motors shall be suitable for 3 phase, 50 cycles, 415 volts A.C. Supply +/- 10%.

### **2. Switch Panel Board :**

- 2.1 The main L.T. Panel board shall be extendible type on both sides, having in it all switches, starters and accessories and completely factory prewired. It shall be suitable for voltage systems upto 500 volts, 3 phase, 50 Hz, 4 wire supply capable of functioning satisfactorily in temperatures of 45°C and rupturing capacity not below 35 MVA.
- 2.2 The boards shall be fabricated from 2.0 mm thick, cold rolled M.S. sheets. The front opening door panels shall be from 2 mm thick, cold rolled M.S. Sheets. Suitable stiffeners shall be used in fabricating the housing. A clear space of 450 mm shall be left at the bottom. All steel members shall first be degreased, then descaled using dilute sulphuric acid and a suitable phosphating process then the boards shall be given 2 coats of red oxide primer and finished with stove enamel finish. The switch board shall be dust proof and vermin proof. The panel shall generally conform to IS 8623 (fully conformity not called for). It shall be flush in front and back. The panel shall have front and rear access.
- 2.3 Cable compartment of adequate size shall be provided in the main distribution board for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in cable compartment to support cables. All incoming and outgoing switch terminals shall be brought out to terminal blocks in cable compartments.
- 2.4 Air break draw out type circuit breakers shall be conform to IS : 2516
- 2.5 All switches below upto 32 Amps. shall be MCB of required rating and all switches 63 Amps and above shall be MCCB.

- 2.6 No MCCB/MCB, starter or accessories shall be provided in the bottom 450 mm of the panel.
- 2.7 The bus bars shall be of aluminium strips of minimum specified ratings with PVC sleeves of appropriate colour. There shall be adequate clearance between phase to phase and phase to neutral strips.
- 2.8 Items such as ammeters, switches etc shall be located close to the corresponding switchgear, and otherwise all items shall be arranged in a neat symmetrical pattern.
- 2.9 Every starter/contactors etc. shall be controlled by a switch of adequate rating as listed above.
- 2.10 A voltmeter and ammeter shall be provided to indicate incoming voltage alongwith a rotary phase selection switch.
- 2.11 Ammeters shall be provided for all motors of 10 HP and higher ratings. An ammeter to measure total current consumption should also be provided in such cases.
- 2.12 Each switch, ammeter etc. shall be provided with a name plate to indicate controlled items.
- 2.13 Panel fabrication drawings shall be got approved before fabrication.
- 2.14 All ammeters and voltmeters where specified shall be of 144 x 144 mm size.
- 2.15 Neon type indicating lamps in approved colours shall be provided for the 3 phases and for on status of all controlled devices.
- 2.16 All the switches/breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in off position.
- 2.17 Defeat arrangement shall be provided for deliberate inspection of switch/breaker without having to switch off the unit.
- 2.18 All the units pertaining to a motor shall be incorporated in one cabin i.e. switch, starter, cts ammeter single phasing preventor, indicating lamps, etc.
- 2.19 All the switch gear shall be earthed to the earth bus.
- 2.20 Earth shall be extended to each compartment to the door by means if a flexible, insulated copper conductor with crimped legs on either side.

- 2.21 Etched plastic name plates shall be provided for all the incoming, outgoing switch gears etc.
- 2.22 The doors of the switch compartments and cable access shall be hinged type and that of busbars shall be fixed type.
- 2.23 The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.
- 2.24 All panel doors shall have rubber gasket.
- 2.25 All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code.
- 2.26 Ammeters for all the motors upto 50 HP shall be direct reading type.
- 2.27 Ammeters for motors of 50 HP and above and for incoming current shall be operated with a selector switch.
- 2.28 Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.
- 2.29 Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.
- 2.30 The power wiring from the switches/unit breakers to the starters shall be carried out using colour coded, PVC insulated copper conductors crimped with lugs.
- 2.31 The out going of starter shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.
- 2.32 A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enamelled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.

3. **Subsidiary Panels (With Multiple Switches) :**

- 3.1 Subsidiary panels shall be provided for equipment located away from the plant room, such as air handling units, cooling towers etc.
- 3.2 The construction of these panel should be similar to the main panel.
- 3.3 The sub panel shall be wall hung type and as compact as possible.

- 3.4 The bus bars shall be of aluminium strips of minimum specified ratings with PVC sleeves of appropriate colour. There shall be adequate clearance between phase to phase and phase to neutral strips.
- 3.5 Every starter/contactors etc. shall be controlled by a switch of adequate rating.
- 3.6 Digital type multi function meter shall be provided to indicate incoming voltage, current drawn as well as unit consumption ( kWh ).
- 3.7 Each selector switches shall be provided with a name plate to indicate controlled items.
- 3.8 Panel fabrication drawings shall be got approved before fabrication.
- 3.9 All ammeters and voltmeters ( multi function type ) where specified shall be of 96 x 96 mm size.
- 3.10 All the switches/breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in off position.
- 3.11 Defeat arrangement shall be provided for deliberate inspection of switch/breaker without having to switch off the unit.
- 3.12 All the switch gear shall be earthed to the earth bus.
- 3.13 Etched plastic name plates shall be provided for all the incoming, outgoing switch gears etc.
- 3.14 The doors of the switch compartments and cable access shall be hinged type and that of busbars shall be fixed type.
- 3.15 The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.
- 3.16 The doors shall have rubber gasket.
- 3.17 All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code.
- 3.18 Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.
- 3.19 Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.

- 3.20 The power wiring from the switches/unit breakers to the starters shall be carried out using colour coded, PVC insulated copper conductors crimped with lugs.
- 3.21 The out going of starter shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.
- 3.22 A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enamelled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.
- 3.23 Neon type indicating lamps in approved colours shall be provided for the 3 phases and for on status of all controlled devices.

4. **Subsidiary Panels (With Single Switch) :**

- 4.1 Subsidiary panels shall be provided for equipment located away from the plant room, such as air handling units, cooling towers etc.
- 4.2 The construction of these panel should be similar to the main panel and shall have all related accessories.
- 4.3 The sub panel shall be wall hung type and as compact as possible.
- 4.4 Every starter shall be controlled by a switch of adequate rating.
- 4.5 A voltmeter shall be provided to indicate incoming voltage alongwith a rotary phase selection switch.
- 4.6 Each switch, voltmeter etc. shall be provided with a name plate to indicate controlled items.
- 4.7 Panel fabrication drawings shall be got approved before fabrication.
- 4.8 The voltmeter where specified shall be of 96 x 96 mm size.
- 4.9 All the switches shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch is in off position.
- 4.10 Defeat arrangement shall be provided for deliberate inspection of switch without having to switch off the unit.
- 4.11 All the switch gear shall be earthed to the earth bus.
- 4.12 Etched plastic name plates shall be provided for all the incoming, outgoing switch gears etc.

- 4.13 The doors of the switch compartments and cable access shall be hinged type and that of busbars shall be fixed type.
- 4.14 The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.
- 4.15 The doors shall have rubber gasket.
- 4.16 All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code.
- 4.17 Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.
- 4.18 Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.
- 4.19 The power wiring from the switches/unit breakers to the starters shall be carried out using colour coded, PVC insulated copper conductors crimped with lugs.
- 4.20 The out going of starter shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.
- 4.21 A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enamelled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.
- 4.22 Neon type indicating lamps in approved colours shall be provided for the 3 phases and for on status of all controlled devices.

5. **Squirrel Cage Motors :**

- 5.1 The squirrel cage motors shall be either screen protected or totally enclosed fan cooled, depending on the application and as stated in “schedule of equipment” all motors shall conform to IS 325/1978 motors shall also conform to IS=1231 for foot mounted motors and IS:2223 for flange mounted motors.
- 5.2 The stator windings shall be with class b insulation.
- 5.3 Motors shall be provided with ball/roller bearings. Bearings shall have ample capacity to deal with any axial thrust. Suitable grease nipple shall be provided for regreasing the bearings.

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

6. **Starters :**

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

6.1.1 Squirrel cage motors upto 7.5 HP : direct on line

6.1.2 Squirrel cage motors above 7.5 HP:automatic star delta. (Except compressor motor)

6.1.3 Compressor motor: automatic auto transformer starter.

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

6.1.5 All starters shall be provided with separate single phasing preventors.

6.2 **Direct On-Line Starters**

6.2.1 These starters shall have heavy duty air break contactors of suitable rating.

6.2.2 These starters shall be complete with adjustable overload relays on all three phases, single phase preventing device and under voltage release. The starters should be "hand reset" type.

6.2.3 The "No Volt Coil " of these starters shall be 220 volts whenever any controls on safety devices are connected in the starters circuits, otherwise standard 415 volts coils may be used. There shall be on-off push button for each starter unless remote operation of the starter is required.

6.3 Motor starter shall be in accordance with IS 1882 the starter shall be totally enclosed metal clad , dust and vermin proof construction. The starter shall be of continuous rating.

6.4 Contactors shall have the number of poles as required for appropriate duty. The making capacity of the starters shall be as per AC 23 of ISS.

6.5 **Installation of Motor**

6.5.1 Installation of the motor shall be in accordance with IS-900.

6.5.2 The motor along with its driven machine or equipment shall be provided with vibration isolation arrangement motors shall generally be provided with slide rails fixed to the base units nuts and bolts to facilitate belt installation and subsequent belt tension.



6.5.3 Motors shall be wired as per the detailed specifications and drawings all the motor frame shall be earthed with 2 Nos. of earthing conductors.

6.5.4 Motors shall be tested at works in accordance with the relevant Indian standard specifications and test certificates shall be furnished in tripartite.

Note : Rubber mats of 1100 volts capacity shall be laid in front of panel as per site requirement, and no extra shall be paid.

7. **Control Console :**

A floor mounting control and indication console shall be provided, in the main control room, as shown on the plans.

	<b><u>Equipment</u></b>	<b><u>Push Buttons</u></b>		<b><u>Lamps</u></b>	
		<b><u>ON</u></b>	<b><u>OFF</u></b>	<b><u>Green</u></b>	<b><u>Red</u></b>
7.1	Ventilation fans/Axial	X	X	X	X
7.2	Lift pressurization fan	X	X	X	X
7.2	The console shall contain ON/OFF push buttons and indication lamps for all the items as listed in “Schedule of Equipment”.				
7.3	Indicating light for strip heaters, if any shall be provided on the switch board, in the respective unit room.				
7.4	The requirements given for the main panel are for one unit only. The actual number of switches and lights shall correspond to the number of units being installed. All controls and alarms shall be suitable for 230 volts on the panel.				
7.5	The alarms shall be with reset buttons.				
7.6	All controls circuits shall be functionally tested.				
7.7	The red indicating lamps should switch on only in case of fault. In the controlled items and not during normal automatic shut off. Thus E.G. in case as starters the red light should come on in case of tripping of starter on overload or single phasing.				
7.8	A common alarm shall be connected to all red indicating lamps through individual relays.				
7.9	Lamp testing arrangements shall be provided in console.				

8. **Painting :**

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating and then sprayed with a high corrosion resistant primer.

The primer shall be baked in oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade and stoved.

## **End of Section 12**

### **Section 13**

### **Electric Wiring**

#### **1. General :**

The electric wiring of motors for compressors, pumps, air handling units etc. As well as controls, heaters etc. and earthing of all equipment shall be carried out as per specifications given hereunder.

#### **2. Wiring for Motors, Heaters etc :**

2.1 The wiring for above equipment shall be carried out in conduits or using PVC armoured cables.

2.2 The PVC armoured power cable for use on 415 volts system shall be 3 or 3.5 core with aluminium conductors and be of 1100 volts grade, as per IS 1554 part I-1964. The cross section of the cable shall be to suit the load or rating of the equipment. The cable shall be aluminium conductor PVC insulated single wire/strip armoured with overall PVC sheathing.

2.2.1 The cables shall be laid as per IS-1255/1967, Indian Standard Code of Practice.

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

2.2.3 The radius of bends of the cable should not be less than 12 times the radius of cable to prevent undue stress and damage at the bends, the cables should be supported with wooden cleats fixed on M.S. Supports, when running in trenches, wall or ceiling suspended hangers. When laid under ground the cables should be covered with fine soft earth and protected with cement concrete covering. Suitable G.I. Pipe shall be used wherever the cable comes out of the connected surface and clamped properly.

2.2.4 Wooden bushes shall be provided at the ends of pipes through which cables are taken in walls and floors.

2.2.4 All cables shall be terminated using suitable size cable glands and packing.

2.3 The wiring in conduits shall be 1100 volts grade.

2.3.1 The conduits used shall be of high quality, all joints shall be made with sockets. The bends and elbows shall have inspection covers fixed with grease free screws. The joints shall be water tight. Approved metal saddles shall be used to secure the exposed conduits at a space of 1 meter or less. The connection of the conduit to switches etc., shall be secured by a check nut and ebonite bushes provided at the ends of conduits.

2.3.2 Flush inspection covers shall be provided in case of concealed, recessed conduits. The staples for the conduits shall not be spaced more than 0.60 meters apart. Before filling up the chase with concrete the conduits should be given a coat of rust proof paint.

2.3.3 The wires shall be drawn only after all the conduits have been properly fixed in position.

### 3. **Control Wiring :**

3.1 Control cables shall be 650 volts grade as per IS 1554 made from copper conductor of 1.5/2.5 sq. mm PVC insulated single multi core unarmored with an overall PVC sheathing.

3.2 The cables and conduits wiring shall be carried out as per details given under 2.2 and 2.3 above.

### 4. **Earthing :**

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

Size of phase wire sq.mm	size of copper conductor
Aluminium	tape/wire (swg)
300	25 mm x 6 mm (strip)
185	20 mm x 3 mm (strip)
150	20 mm x 3 mm (strip)
120	12 mm x 3 mm (strip)
95	4 Swg
70	4 Swg

50	6 Swg
35	8 Swg
25-6	8 Swg
4	8 Swg

Note :- GSS earthing conductors of equivalent size may be used in lieu of copper earth mentioned above.

5. **Miscellaneous :**

- 5.1 The final connections to the equipment shall be through flexible connections in case of conduit wiring and also where the equipment is likely to be moved back and forth, such as on slide rails.
- 5.2 An isolator switch shall be provided at any motor which is separated from the main switch panel by a wall or partition or other barrier or is more than 15 metres away from the main panel.
- 5.3 Two separate and distinct earthing conduits shall be connected from the equipment upto the main switch board panel.
- 5.4 The branch lines from the main panel to each equipment shall be separated and should not criss cross other lines.
- 5.5 The entire installation shall be tested as per electricity rules and I.S.S 732-1973 with amendments 1,2 & 3 prior to the commissioning of the plant and a suitable test report furnished by a competent and authorized person. The test report will be obtain by contractor himself at his own expenses.
- 5.6 All exposed switch board panels, conduits, hangers etc. shall be given 2 coats of suitable paint of approved colour, when all work has been completed.

**End of Section 13**

**Section 14**                      **Testing, Balancing & Commissioning**

1. **General :**

The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the CHC, in accordance with the provisions of the applicable ASHRAE standards or approved equal.

2. **Compressors/Condensers/Evaporators etc.**

Complete unit shall be factory tested for leaks.

Complete unit shall be factory tested for performance at rated conditions.

All controls shall be tested for proper functioning and set for design value.

3. **Indoor Units :**

3.1 **Blowers**

Dynamic/static balancing of impeller.

Performance test as per applicable codes.

3.2 **Coils**

Pneumatic test or as per manufacturer.

3.3 **Instruments and Controls**

Visual examination.

4. **For Associates Works at Site :**

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

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

Pressure testing, leak testing of complete piping network. Condenser for refrigerant/services.

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

Checking of calibration of controls and instrumentation

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

Inspection of complete electrical installation at site.

Installation of main equipments like compressor, condenser, evaporator.

Performance testing of complete A.C. system as per specifications.

5. **Duct Work :**

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

Volume dampers shall be tested for proper operation.

6. **Balancing and Adjustment :**

Indoor unit, duct work and outlets shall be adjusted and balanced to deliver the specified air quantities as indicated, at each outlet, on the drawings and shall be recorded and submitted to the CHC. If these air quantities cannot be delivered without exceeding the speed range of the sheaves or the available horse power, the CHC shall be notified before proceeding with the balancing of air distribution system.

7. **Electrical Equipment :**

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

The following tests shall be carried out :

Wire and cable continuity tests.

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

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

Phasing out and phase rotation tests.

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

Operating tests on all MCB's.

8. **Performance Tests :**

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

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

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

Static pressure in each air duct.

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

Continuous recording over a specified period, of ambient wet and dry bulb temperatures under varying degrees of internal heat loads and use and occupation, in each zone of each part of the building.

Daily records should be maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream "on coil" of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine.

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

9. **Miscellaneous :**

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

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

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

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

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

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

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

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

### **End of Section 14**

## **Section 15**    **Mode of Measurements**

### **1.    Unit Prices in the Schedule of Quantities :**

- 1.1    The item description in the schedule of quantities is in the form of a condensed resume. The unit price shall be held to include every thing necessary to complete the work covered by this item in accordance with the specifications and drawings. The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over.
- 1.2    The unit price of the various items shall include the following :
  - 1.2.1    All equipment, machinery, apparatus and materials required as well as the cost of any tests which the consultant may request in addition to the tests generally required to prove quality and performance of equipment.
  - 1.2.2    All the labour required to supply and install the complete installation in accordance with the specifications.
  - 1.2.3    Use of any tools, equipment, machinery, lifting tackle, scaffolding, ladders etc. Required by the contractor to carry out his work.
  - 1.2.4    All the necessary measures to prevent the transmission of vibration.
  - 1.2.5    The necessary material to isolate equipment foundations from the building structure, wherever necessary.
  - 1.2.6    Storage and insurance of all equipment apparatus and materials.



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

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

2.1 **Sheet Metal Ducts**

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

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

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

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

2.2 **Grilles/Diffusers :**

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

2.2.1 All measurements of grilles/diffusers shall be the Actual outlet size excluding the outer flanges.

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

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

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

3. **Measurements of Piping, Fittings, Valves, Fabricated Items :**

3.1 **Pipe**

(Including water piping, steam piping, oil piping, IP gas piping, air piping, vacuum piping) etc.

- 3.1.1 All pipes shall be measured in linear metre (to the Nearest cm) along the axis of the pipes and rates shall be inclusive of all fittings e.g. Tees, bends, reducers, elbows etc. Deduction shall be made for valves in the line.
- 3.1.2 Exposing reinforcement in wall and ceiling and floor of possible and making good the same or installing anchor fasteners and inclusive of all items as specified in specifications and schedule of quantities.
- 3.1.3 Rates quoted shall be inclusive of providing and fixing Vibration pads and wooden pieces, wherever specified or required by the project co-ordinator.
- 3.1.4 Flexible connections, wherever required or specified shall be measured as part of straight length of same diameter, with no additional allowance being made for providing the same.
- 3.1.5 The length of the pipe for the purpose of payment will be taken through the centreline of the pipe and all fittings (e.g. Tees, bends, reducers, elbows, etc.) as through the fittings are also presumed to be pipe lengths. Nothing extra whatsoever will be paid for over and above for the fittings for valves and flanges, section 3.2 below applies.

### 3.2 **Valves and Flanges**

- 3.2.1 All the extra CI & cm flanged valves shall be measured according to the nominal size in mm and shall be measured by number. Such valves shall not be counted as part of pipe length hence deduction in pipe length will be made wherever valves occur.
- 3.2.2 All gun metal (gate & globe) valves shall include two Nos. of flanges and two numbers 150 mm long ms nipples, with one side threaded matching one of the valves, and other welded to the M.S. Slip-on-flange. Rate shall also include the necessary number of bolts, nuts and washers, 3 mm thick insertion gasket of required temp. grade and all items specified in the specifications.
- 3.2.3 The rates quoted shall be inclusive of making connections to the equipment, tanks, pumps etc. And the connection made with an installed pipe line shall be included in the rates as per the B.O.Q.

### 3.3 **Structural Supports**

Structural supports including supports fabricated from pipe lengths for pipes shall be measured as part of pipe line and hence no separate payment will be made. Rates

shall be inclusive of hoisting, cutting, jointing, welding, cutting of holes and chases in walls, slabs or floors, painting supports and other items as described in specifications, drawings and schedule of quantities or as required a site by project co-ordinator.

### 3.4 **Copper Connections for Fan Coil Units**

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

## 4. **Insulation :**

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

### 4.2 **Pipes, Ducts & Vessels**

#### 4.2.1 **Pipes**

The measurements for installation of piping shall be made in linear metres through all valves, flanges, and fittings. Pipes/bends shall be measured along the centreline radius between tangent points. If the outer radius is R1 and the inner radius is R2. The centre line radius shall be measured as  $(R1+R2)/2$ . Measurement of all valves, flanges and fittings shall be measured with the running metre of pipe line as if they are also pipe lengths. Nothing extra over the above shall be payable for insulation over valves, flanges and fittings in pipe line/routings. Fittings that connect two or more different sizes of pipe shall be measured as part of the larger size.

#### 4.2.2 **Ducts**

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

#### 4.2.3 **Vessels**

The area of standard dished and flat ends of vessels shall be the square of the diameter of the uninsulated body of the shell. Areas for other shapes shall be the actual calculated area. There shall be no deduction or additions for nozzles, handles ribs, dampers,

expansion joints etc. All projections on vessels or tanks shall be measured separately as pipe/duct.

#### 4.3 **Accessories Insulation**

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

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

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

#### 4.4 **Acoustic Duct Lining**

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

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

#### 4.5 **Roof and Wall Insulation & Acoustic Treatment**

4.5.1 The unit of measurement for all underdeck roof insulation, wall insulation, wall/roof acoustic panel shall be the uninsulated area of walls, roofs, to be treated, in square metres.

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

### **End of Section 15**

## **Section 16**

## **Schedule of Equipments Proposed**

**S.No.Description**

**Unit**

**Condition of Services**

1. **Variable Refrigerant Volume Aircooled Unit**

1.1 **Outdoor Unit (Inverter Compressor is must for VRV Outdoor)**

1.1.1	Type	--	VRV Heat Pump Type
1.1.2	Permissible refrigerant pipe	Length	----- 100metres -----
1.1.3	Capacity (each)	HP (Nominal)	6 HP to 60 HP
1.1.4	Quantity	Nos.	as mentioned in BOQ
1.1.5	Air entering condenser	Deg CDB	----- 43.3 -----
1.1.6	Inside conditions	Deg C	----- 18.0 -----
1.1.7	Sound level (out door units)		----- 60db - Max.-----

1.2 **Indoor Units**

1.2.1	Type	--	As per detail for indoor units
1.2.2	Capacity	Tons	As per detail for indoor units
1.2.3	Air quantity	cfm	As per detail for indoor units
1.2.4	Quantity of units	No.	As per detail for indoor units
1.2.5	Control of refrigerant in VRV indoor unit by		Electronic expansion valve
1.3	Centralized controller	yes.	One Required for VRV system of specified Area
1.4	Local remote controller (corded)	yes.	One for each unit

**S.No.** **Description**                      **Unit**                      **Condition of Services**

2. **Split Unit Airconditioners** ----- **Hi-wall**-----

2.1	Capacity (nominal)	Tons	1.5	
2.2	Air quantity (evaporator)	cfm	600	
2.3	Quantity	Nos.	as mentioned in BOQ	
2.4	Air entering condenser	<sup>o</sup> CDB	----- 43 -----	
2.5	Air out evaporator	<sup>o</sup> CDB	----- 12.2 -----	
2.6	Type of compressor	--	----- Scroll / Rotary -----	
2.7	Current characteristics	--	3 Ph, 415 V, 50 Hz supply	
3.	<b><u>Treated Fresh Air Unit DX Type</u></b>			
3.1	Type	--	Floor/ceiling mounted double skin	
3.2	Air quantity	cfm	2800	6000
3.3	Coil area	sqm	as per details submitted by OEM	
3.4	No. rows (min.)	No.	8	
3.5	No. of fins/cm (min.)	No.	5	
3.6	Static pressure	mmwg	as mentioned in BOQ	
3.7	Fan motor rating	kw	2.2	5.5
3.8	Outdoor unit	HP	22	46
3.9	Type of motor enclosure	--	TEFC	
3.10	Standard filters	--	MERV 13	
3.11	Quantity	Nos.	as mentioned in BOQ	
3.12	Sound Pressure	DB	should not exceed 75 DB	

<b><u>S.No.</u></b>	<b><u>Description</u></b>	<b><u>Unit</u></b>	<b><u>Condition of Services</u></b>
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4. **Fan Section (Centrifugal Blower)**

4.1	Type	--	DIDW Backward Curved
-----	------	----	----------------------

4.2	Capacity	cfm	2800	6000
4.3	Quantity	No.	as mentioned in BOQ	
4.4	Motor rating	kw	as mentioned in BOQ	
4.5	External static pressure	mmwg	as mentioned in BOQ	
4.6	Filters Velocity	fpm	500	
4.7	Current characteristics	--	3 Ph, 415 Volts, 50 Hz A.C. supply	

**End of Section 16**

**Section 17**                      **Technical data**

**S.No.**    **Description**    **Unit**                                      **Condition of Services**

1.    **Variable Refrigerant Flow Aircooled units**
- 1.1    **Outdoor units(Heat Pump Type)(HP)58 46 34 24 22 20 14 12 8 HP**
- 1.1.1    Make and model
- 1.1.2    HP of outdoor Unit
- 1.1.3    Capacity (each)    Tons (Nominal)
- 1.1.4    Quantity                      Nos.
- 1.1.5    Type                              --
- 1.1.6    Permissible length of

	refrigerant piping	
1.1.7	Type of compressor	--
1.1.8	No. of compressor (each unit)	No.
1.1.9	No. of inverter compressor	
1.1.10	Air entering temp. on condenser	Deg C
1.1.11	Dimension of Machine (H x W x D )	mm
1.1.12	Current characteristic	--
1.1.13	Power input (Total) as per specified IDU connection	kw

## 1.2 **Indoor Units**

1.2.1	Manufacturer	--
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<b><u>S.No.</u></b>	<b><u>Description</u></b>	<b><u>Unit</u></b>	<b><u>Condition of Services</u></b>
---------------------	---------------------------	--------------------	-------------------------------------

1.2.1.1	Type	--	
1.2.1.2	Capacity	Tons	
1.2.1.3	Airflow Min/Max.	Cfm	
1.2.2	Sound level	Hi/Lo	
1.2.3	Overall Dimensions	l x w x h	
1.2.4	Unit weight	kg	
1.2.5	Is remote controller (corded) provided for each indoor unit		Yes/No.

## 1.3 **Centralized Controller**



**( 1 No. For complete VRV System  
of Club House)**

Detail of operation --

**1.4 Local Remote Controller**

Detail of operation --

**2. Split Unit Airconditioner**

2.1 Capacity (nominal) Tons

2.2 Capacity at 43<sup>0</sup> CDB  
air entering condenser  
and 12.2<sup>0</sup>CWB air  
out evaporator Tons

2.3 Air quantity cfm

2.4 Evaporator coil area sqm

2.5 No. of rows of  
evaporator No.

**S.No. Description Unit Condition of Services**

2.6 Condenser coil area sqm

2.7 No. of rows of  
condenser No.

2.8 Air quantity at  
condenser cfm

2.9 Condenser fan dia and  
No. of fans mm/No.

2.10 Size of evaporator mm

2.11 Size of condenser mm

2.12 Static pressure of  
evaporator mmwg

2.13 Make and model --

of the unit

2.14 Current characteristic --

2.15 Control panel included/  
not included --

3. **Treated Fresh Air Unit DX Type**

3.1 Type --

3.2 Air quantity cfm

3.3 Coil area sqm

3.4 No. rows (min.) No.

3.5 No. of fins/cm (min.) No.

3.6 Static pressure mmwg

3.7 Fan motor rating kw

3.8 Outdoor unit Tons

**S.No. Description Unit Condition of Services**

3.9 Type of motor enclosure --

3.10 Filters --

3.11 Quantity Nos.

4. **Centrifugal Fan**

**DIDW**

4.1 Make

4.2 Air quantity at  
operational speed cfm

4.3 Operational speed rpm

4.4 Static pressure mm

4.5 Diameter/size mm

4.6 Type --

- 4.7 Current characteristic --
- 4.8 Motor rating kw
- 4.9 Type of motor --

**End of Section 17**

**Section 18 List of Approved 'Makes'**

NOTE: The tenderer must indicate the makes he has used to cost his tender. An alternate make may be indicated as a substitute to be used if the offered make become unavailable. More than (2) two makes are Not to be indicated.

The Tenderer shall confirm make of the items he intends to use, however the Project-In-Charge reserves the right to approve / reject any of the make specified.

The contractor shall get the samples of all other items, not covered in the below mentioned list, approved from the Project-in-Charge.

S. NO.	ITEMS	APPROVED MAKES
1	VRV UNITS (OUTDOOR & INDOOR)	Mitsubishi Electric/ Daikin/ O-General/Toshiba/LG/Samsung/Hitachi/Bluestar/Carrier/Voltas
2	Air Handling Units	System Air/ Zeco/ Edgetech/VTS
3	Treated Fresh Air Units	Mitsubishi Electric/ Daikin/ O-General/Toshiba/LG/Samsung/Hitachi/Bluestar/Carrier/Voltas
4	Centrifugal Fan for AHU	Kruger/Greenheck/Nicotra/Humidin/Airflow
5	Air Filters (Pre/fine/Hepa etc.)	Camfil/Mechmark/Thermodyne
6	Heat Recovery Wheel (HRW)	DRI/Flaktwood
7	Variable Frequency Drive (VFD)	Danfoss/ABB
8	Ventilation Fans (Centrifugal / Axial)	Kruger/ Greenheck/ Systemair/Humidin/Airflow
9	Propeller Fan	Marathan/Havells/Crompton
10	Inline Fan	Kruger/ Greenheck/ Systemair/Humidin/Airflow

11	Refrigerant Copper Pipe	Mandev/Totaline/Rajco Metals/Jindal/Maxflow
12	uPVC Drain Pipe	Finolex /Polypack/Supreme/Prince
13	Nitrile Rubber Insulation	Armaflex/ K-flex/ Armasound
14	Crossed linked Polyethylene	Torcellene/ Thermobreak/ Armaflex/Paramount/Supreme
15	Glass Wool (Prelaminated/Plain)	Owens Corning/ UP Twiga
16	Factory Fabricated rectangular Duct	Ductofeb/ Rolastar/ Zeco
17	Factory Fabricated Spiral/Oval/Round Duct	GP Spiro/ Caryaire
18	Vibration Isolators/ Rubber Pad	Resistoflex
19	CO2 Sensor	Danfoss/ Honeywell/ Siemens
20	Volume Control Dampers	Tristar/ Systemair/ Airflow
21	Fresh/Exhaust Air Louvers	Tristar/ Systemair/ Airflow
22	Grill/ Diffuser/ Jet Nozzles	Tristar/ Systemair/ Airflow
23	Fire Dampers	Tristar/ Systemair/ Airflow/Greenheck
24	Smoke Dampers	Tristar/ Systemair/ Airflow/Greenheck
25	Actuators for Fire/Smoke Dampers	Danfoss/ Honeywell/ Siemens
26	Fastner	Hilti/ Cannon/ Fisher
27	Electrical Panel	Tricolite/Adlec
28	Motor for AHU & Ventilation Fans	ABB/Bharat Bijli/ Siemens
29	Starter	Schenider/ L&T
30	Single Phase Preventer	Minilec
31	MCB/MCCB	ABB/ L & T/ Schenider
32	Ammeter/ Voltmeter (Digital Type)	Conserve/ AE
33	LED Indicating Lamp/ Push Button	Siemens/ ABB/ L&T/ Schenider
34	Perorated Cable Tray	MM Enterprises
35	Power Cable	Skytone/Universal//NICCO/RPG /Polycab/Glostar/Havells
36	Control Cable	Universal / Gloster / Polycab /Skytone/Finolex/ Bonton

37	Cable Gland Double Compression with Earthing Links	Commet/Gripwell/ Dowell's Electromech
38	PVC Insulated Copper Conductor Stranded Flexible Wires	Finolex / polycab/ Skytone
39		Havells,Bonton
40	PVC Conduit & Accessoires (ISI Approved)	BEC/ Precision/ D Plast/ Polypack/ AKG
41	Bimettalic Cable Lugs	Hax (Brass copper Alloy India Ltd)/ Dowell's (Biller india Pvt. Ltd.)

**End of Section 18**

Design, Fabrication, Supply, Installation &  
Commissioning of Passenger Lift

for DAFFPL Building

at Aviation Fuelling Station, Shahbad  
Mohammadpur, IGI Airport, New Delhi

## **Annexure - I**

### **1. Introduction**

The required passenger lift as per Table-1 will be installed DAFFPL building at Admin Building, Aviation Fuelling Station, Shahbad Mohammadpur, IGI Airport, New Delhi. The technical specifications of passenger lift are given in tender document. The detailed view of DAFFPL building where the lift will be installed is as shown in annexure-II

### **2. Type of lift**

8 Passenger lift with machine room.

### **3. Service condition**

The proposed passenger lift will be installed close to a class 1,00,000 clean room. Hence any part of the lift material should not become the source of contamination to hamper the integrity of the clean room facility. The design of the elevators shall take into consideration fire prevention, elimination of dust and dirt traps, and easy accessibility for cleaning and routine maintenance. Ambient Temperature & Relative Humidity : 4 Deg C(Min)- 50 Deg C(Max) & up to 95% RH

### **4. Scope of Supply**

**Scope of work:** Design, Fabrication, Supply, Installation, Commissioning, packing, forwarding, transportation to DAFFPL site, unloading, furnishing of final drawings and manuals ,handling at site, performance demonstration and performance acceptance etc. of 8 passenger capacity lift (AS PER THE TABLE 1), , to make the system complete in all respects and required civil work as per technical Specification & as per the tender document.

**TABLE 1**

CAPACITY (kgs)	8 persons.
SPEED (mps)	1 mps
RISE (m)	14.50m
STOPS	4 Stops With (all opening on the same side)
CONTROLLER TYPE	ACD3-MR
DRIVE	VF Regenerative (Closed Loop)
POWER SUPPLY	400/415 Volts (3 Phase AC) / or as per man specs.
OPERATION	Full collective operation
MACHINE	PM Gearless (Located above shaft)
TRACTION MEDIA	Flat Coated Steel Belt / or as per manufacturers specification
CAR FINISH	· Rear Panel =SS Hairline finish · Side Panels = SS Hairline finish · Front Panels = SS Hairline finish
FALSE CEILING TYPE	metallic with LED light fixtures
FALSE CEILING FINISH	Black Powder coated
VENTILATION	Cross flow fan
HAND RAILS	Stainless Steel Mirror Finish Handrails on rear car panels
FLOORING	Heavy duty Vinyl Tiles
CAR DOOR FINISH	Stainless steel - Hairline finish
LANDING DOORS FINISH	Stainless steel - Hairline finish
FIRE RATED DOORS	Fire rating-60mins
HOISTWAY DIMENSIONS	(W x D – mm) 2.1 m x 2.1m
CAR DIMENSIONS	(W x D x H - mm) As per manufacturer specs
CAR & HOISTWAY DOOR TYPE	Central opening (CO) doors



DOOR OPENING (W x H - mm)	800 mm W x 2100 mm H
DOOR OPERATOR	DC Door Operator
COP	Gien Buttons in Stainless Steel #4(Hairline)
CAR POSITION INDICATOR	(RED LED) Scrolling Display
HALL FIXTURES	to
HALL FIXTURE FACE PLATE	Stainless Steel #4(Hairline)
HALL BUTTON ARRANGEMENT	Hall Button with HPI
STANDARD FEATURES	Anti-nuisance Car Call Protection, Independent Service, Overload Device, Nudging, Emergency Firemen's Service, Emergency Car Light Unit, Infrared Curtain Door Protection, Door Time Protection, Emergency Alarm Button, Extra Door Time of Lobby & Parking, Door Open/Close Button, Manual Rescue Operation, Belt Inspection Drive, Auto Fan Cut Off
OPTIONS REQUIRED	Automatic Rescue operation, Voice Synthesizer
OPTIONS REQUIRED	Mirror on rear side wall

## **Annexure - II**

### **5. Standards**

The following Indian Standard Specifications and Codes of Practice, currently applicable and updated as of date irrespective of dates given below, shall apply to the equipments and the work covered by this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended up to date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable

1. Code of Practice for installation, operation and maintenance of electric passenger & goods lifts.IS-14665 (Part 2) Sec-1 :2000
2. Code of practice for installation, operation and maintenance of electric service lift.IS-14665 (Part 2) Sec-2 : 2000
3. Safety Rules Section-1 Passenger and Good lifts IS-14665 (Part 3) Sec-1 : 2000
4. Safety Rules Section-2 – Service Lifts IS-14665 (Part 3) Sec-2 : 2000
5. Outline dimension for electric lifts. IS-14665 (Part-1) : 2000
6. Inspection Manual for Electric Lifts IS-14665 (Part 5) : 1999
7. Electric Traction Lifts – Components
8. Installation And Maintenance of Lifts For Handicapped Persons (Code of Practice) IS-14665 (Part 4) Sec-1 to 9 :2001IS 15330 :2003
9. Specification for lifts cables. IS-4289 (Par-1) : 1984 Reaffirmed 1991
10. Specification for hot rolled and slit steel tee bars. IS-1173-1978 Reaffirmed 1987
11. Method of loading rating of worm gear. IS-7443-1974 Reaffirmed 1991
12. Code of practice for selection of standard worn and helical gear box.IS-7403-1974 Reaffirmed 1991
13. Isometrics screw threads. IS-4218-(Part-II)1976 Reaffirmed 1996
14. Degree of protection provided by enclosure for low voltage switchgear and control gear. IS-2147-1962
15. Classification of insulating materials for electrical machinery and apparatus in relation to their thermal stability in service. IS-1271- 1985 Reaffirmed 1990
16. Code of practice for earthing. IS-3043-1987

17. Electrical installation Fire Safety of Building. IS-1646-1997
18. PVC insulated electric cable for working voltage up to and including 1100 volts.IS-694-1990
19. Code of practice for electrical wiring and installation IS-732-1989
20. PVC insulated (Heavy Duty) electric cables for working voltage up to and including 1100 volts. IS-1554-1988 (Part-1)
21. Flexible steel conduits IS-3480-1966
22. Accessories for rigid steel conduit for electrical wiring IS-3837-1976
23. Boxes for the enclosure of electrical accessories IS-5133-1969 (Part 1)
- 24 Guide for safety procedures and practices in electrical work. IS-5216- 1982 (Part-1)
25. Conductors for insulated electric cables and flexible cordes IS-8130- 1984
26. Miniature Circuit Breakers IS-8828-1996
27. Rigid steel conduits for electrical wiring (Second revisions) IS-9537- 1981
- 28 Methods of test for cables IS-10810-1998
29. Earth Leakage Circuit Breakers. IS-12640-1988
30. Moulded Case Circuit Breakers IS-13947-1993
31. General requirement for switchgear and control gear for voltage not exceeding 1000 volts.IS-13947-1993
32. 1100 volt grade XLPE insulated armoured cables IS 7098
33. Specifications for hoistway door-locks IS 7754-1975
34. Rules for design, installation, testing and operation of lifts, escalators and moving parts.IS 1735-1975 In addition the relevant clauses of the following, as amended upto date shall apply. -  
The Indian Electricity Rules 1956
  - The Indian Electricity Act 1910
  - Fire safety regulations pertaining to lifts

The tenderers shall also take into account local and State regulations as in vogue for the design and installation of lifts.

## **6. Technical Specifications - General**

### **1. GENERAL REQUIREMENTS**

The Elevators shall include all elements confirming to specifications or as amended herein. Elevators covered by these specifications shall be provided, installed, tested, commissioned, certified and approved as per statutory requirements of Lift Inspectorate. Elevator shall have its own driving machine.

The method of drive shall be Electric Traction with Gear less motor having VVVF Control.

The design of the Elevators shall take into consideration fire prevention, elimination of dust and dirt traps, and easy accessibility for cleaning and routine maintenance.

### **2. ELECTRIC TRACTION DRIVE SYSTEM**

#### **2.1 Traction Machine**

The construction of all Elevator machines shall conform with IS-14665

#### **2.2 Brake**

- a) The Electro-magnetic brake with non-asbestos lining shall be spring applied and electrically released type having noiseless operation.
- b) The brake shall be capable of stopping and holding the Elevator car in its downward travel to rest with 125% of its rated load from the maximum governor tripping speed. In this condition the retardation of the Car shall not exceed that resulting from the operation of the Safety gear or stopping on the buffer.
- c) Springs used to apply the brake shoes (two nos.) shall be in compression and adequately supported.
- d) Brake linings shall be of renewable incombustible materials and shall be secured to the brake shoes such that normal wear shall not weaken their fixings. Band brakes shall not be used.
- e) No earth fault, short circuit or residual magnetism shall prevent the brake from being applied in the event of loss of power supply to the Elevator motor and control circuit.
- f) A means of adjusting the brake plunger stroke and releasing the brake in emergency shall be provided.
- g) The Elevator machine shall be fitted with a manual emergency device capable of having the brake released by hand and requiring a constant effort to keep the brake open.

h) The fail safe break shall incorporate an approved design of brake switch i.e. pick up, hold, discharge. Brake coil shall be wired in series & their respective switches in parallel. The operation of brake shall be thyristor controlled from solid state drive in order to effect minimum pick up time and synchronized start.

## **2.3. Driving Mechanism**

### **2.3.1 Lift Machine**

The lift machine shall be suitable for 415 volt 3 phase 50 Hz AC supply with a voltage variation of +10% and -20% and shall be placed directly above the hoist way on steel beams resting on machine room floor slab. The lift machine shall have high efficiency and low power consumption and shall be designed to withstand peak currents in lift duties.

Means for manual operation of the lift car shall be made by providing winding wheel suitably marked to indicate the direction of the movement to enable the lift car to be brought to the nearest landing. There shall be a warning display for switching off electrical supply before the manual operations.

### **2.4 Driving Sheaves**

a) The sheaves shall be manufactured in steel or SG iron and fitted with sealed for life lubricated bearings.

b) The sheaves shall have machined rope grooves that can be reworked for future wear.

c) Adequate provision shall be made to prevent any suspension ropes leaving groove due to rope slack or introduction of foreign objects.

### **2.5 Alignment**

a) The brake plunger, collar, sleeve, motor, sheaves and all bearings shall be mounted and assembled so that proper alignment of these parts is maintained.

b) The assembly shall be reviewed and rectified when excessive noise is emitted during operation.

### **2.6 Gearless Machines**

The gearless machine shall consist of a motor traction sheave and brake drum or brake disc completely aligned on a single shaft. Gearless machine shall be AC gearless with VVVF drive.

### **2.7 Anti-Vibration Supports**

The whole traction machine shall be mounted on appropriate anti-vibration supports to minimize noise and vibration.

### **3. CONTROL SYSTEMS**

#### **3.1 Description**

The Lifts shall have state of art microprocessor based AC variable voltage variable frequency (ACVVVF) drive. Some of the technical parameters required are innumerate below.

- a) Starting current 1.2 - 1.5 times full load running current
- b) Power saving 50 - 55%
- c) Leveling accuracy  $\pm 3$  mm
- d) Acceptable voltage fluctuation +10 to - 20%

The controller shall be mounted on the side of the top of lift shaft, vertical, totally enclosed cubicle type with hinged doors on the front provide easy access to all components in the controller. Cubicle shall be well ventilated such that the temperature inside never exceeds the safe limits of the components at ambient room conditions. The controller shall operate within the supply voltage variation of plus 10% to minus 20% of the nominal voltage.

The Controller shall be include protection against the following abnormalities and shall cut off the power supply, apply the brake and bring the car to a rest in the event of any of the abnormalities occurring.

- a) Over current
- b) Under voltage
- c) Overvoltage
- d) Single phasing
- e) Phase reversal
- f) Earth leakage

#### **3.2 Features**

Control system features are detailed as below.

##### **• Attendant Operation**

lift shall be provided with attendant control facilities. A key switch for change of operation mode shall be provided in a lockable recess panel on the car operation panel. After gaining control on the lift, the attendant can direct the car to stop at any storey. The attendant can also by pass the landing calls (but not cancel them) or reverse the direction of travelling.

- **Automatic By-pass**

Load weighing devices located either on car top or under the car cage shall be provided for all lifts. Whenever the load exceed 60-70% of the capacity load of the lifts, the lifts shall ignore all landing calls and only respond to car calls.

- **Over load device**

A load weighing devices shall operate when the load in the car exceeds the rated capacity. The operation of the device shall activate buzzer sound and flashing 'overload' signals. At the same time the car doors shall be prevented from closing. When the excess load has been removed from the car, the buzzer alarm shall be muted automatically and the car shall function normally. The sensitivity shall be 30 kg for Passenger lift.

- **Automatic self-levelling**

All lifts shall be provided with automatic self-levelling feature that shall bring the lift car level to within  $\pm 3$  mm for passenger elevators of the landing floor regardless of load or direction of travel. The automatic self levelling feature shall correct for over travel and rope stretch.

- **Possible future requirement of access control and BMS integration of the controller.**

## **7. TECHNICAL SPECIFICATIONS - LIFTS,LIFT CAR, DOORS AND SAFETY DEVICES**

### **1 CAR ENCLOSURES**

#### **1.1 General Requirements**

- **Frame**

Every lift car body shall be carried in a steel car frame assembly which shall have sufficient mechanical strength to resist the forces applied by the safety gear or impact of the car on the buffers. The deflection of the steel members carrying the platform shall not exceed 1/1000 of their span under static conditions when the rated load is evenly distributed on the platform At least four renewable guide shoes or shoes with renewable linings or sets of guides rollers shall be provided two at the top and two at the top and two at the bottom of the car frame assembly.

- **Enclosure finishes**

The car enclosure, doors etc. shall be as per Table-1 enclosed. The following are to be provided.

- Alarm System : An emergency alarm buzzer, including wiring shall be provided and connected to a plainly marked push button in the car operating panel. The alarm bell shall be located in central security room. The alarm unit shall be solid state siren type, to give a waxing and waning siren when the alarm button in the car is pressed momentarily

- Sealed Maintenance Free Nickel Cadmium Batteries capable of maintaining the following in each lift for 2 hrs after mains failure.
- Emergency light of adequate illumination in car
- Car Ventilation
- Intercommunication System
- Alarm bell
- One no. 16 amp switch socket outlet to IP 54 and a permanent weatherproof type luminaries to IP54 (with lighting switch ) adequately protected shall be provided on the top of the lift car for maintenance
- One no. 16 amp switch socket outlet to IP 54 at bottom of lift car for maintenance

## **1.2 Operation Panel**

A full length car operating panel incorporating following control/indications shall be provided on the return panel

- LCD Illuminated touch push buttons of micro pressure type corresponding to the floors served at Ground floor and Inside Car. For Other floors LED Illuminated touch push buttons of micro pressure type to be provided.
- Door open and door close button
- Emergency stop button with Alarm
- Two position key operated switch for 'with attendant' and 'without attendant' operation.
- Ventilation fan ON/OFF switch with auto OFF when there is no call after 120 seconds (Two Speed & concealed vents).
- Built in intercom of the hands free type as well as space for providing EPABX telephone instrument and 5 pair telephone trailing cable to communicate from car to Two Locations i.e. Operator's Room (at remote location) & Security Guard Room and vice-versa.
- Dynamic car direction display
- Car position indicator (digital)
- Audio/Visual overload warning indicator
- Digital voice synthesizer (Optional) for announcing special messages with background music.



### **1.3 Landing fixture**

The landing fixtures shall be recess mounted on a base junction box in the wall by the side or on top of landing doors as required. Each landing fixtures shall consist of micro touch type landing call buttons with illuminated call acknowledge signal and illuminated digital type car position indicators on separate stainless steel face panels with hairline finish.

## **2. CAR AND LANDING DOORS**

### **2.1 General requirements**

All car doors shall extend to the full height and width of landing opening unless otherwise specified and shall be operated with variable frequency door operator. A similar imperforate door shall be provided for every landing opening in the lift hoistway enclosure. The top track of the landing and car doors shall not obstruct the entrance to the lift cars. All car and landing doors shall have a fire resistance of not less than 1 hours. In addition, all the car and landing doors shall meet the following general requirements.

#### a) Car door locking devices

Every car door shall be provided with an electrical switch to prevent the lift car from being started or kept in motion unless the car door is closed. A mechanical locking device shall also be provided to prevent door opening from inside the car whilst the car is in motion.

#### b) Landing door locking devices

Every landing door shall be provided with a mechanical locking device to prevent opening of the door from the landing side in normal cases unless the lift car is in that particular landing zone.

#### c) Projections and recesses

Sliding car and landing doors shall be guided on door tracks and sills for the full travel of the doors.

#### d) Door locking devices

All doors locking devices, door switches and associated actuating rods, levers or contracts, shall be inaccessible from the landing or the car.

#### e) Protective devices

Protective devices shall be fitted to the leading edges of both car door panels. It shall automatically initiate reopening of the door in the event of a passenger being struck (or about to be struck) by the door in crossing the entrance during the closing movement. The obstruction of either leading edge when closing shall actuate the protective device to function.

f) “Door open” alarm

“Door open” alarm shall be provided in the car to initiate alarm and a continuous buzzer if a car or landing door has been mechanically kept open for a present period. The period shall be adjustable from 0-10 minute.

g) Emergency landing door unlocking devices and key

- Every landing door shall be provided with an emergency landing door unlocking device. When operated by an authorized person with the aid of a key to fit the unlocking triangle, the landing door shall be unlocked irrespective of the position of the lift car for rescue purpose. When there is no “unlocking” action, the key shall only be able to stay in the locked position.

- In the case of coupled car and landing doors, the landing doors shall be automatically closed by means of weight or springs when the car is outside the unlocking zone.

## **2.2 Door Hangers and Tracks**

The car and the landing doors shall be provided with two point suspension sheave type hangers complete with tracks. Sheaves and rollers shall be steel with moulded nylon collar and shall include shielded ball bearings. Tracks shall be of suitable steel section with smooth surface. The landing doors shall be complete with headers, sills, frames etc. as required.

## **2.3 Lift Door Protection**

Multiple-Infra red door protection and mechanical shoes shall be provided for lift to control door movement which shall cover the entire door opening effectively.

## **2.4 Protective Hand Rail in the Car (Optional)**

## **2.5 CABIN FAN**

A noiseless pressure fan shall be provided in the lift cabin.

## **3. HOIST ROPES**

Hoist way material shall be non-flammable (02 hrs fire rated) except travelling cables which shall be flame resistant.

### **Lift Ropes – IS 14665 (Part 4 / Sec 8)-2001**

Round strand steel wires ropes made from steel wire ropes having a tensile strength not less than 12.5 tonnes/cm<sup>2</sup> and of good flexibility shall be used for lift. Lubrications between the strands shall be achieved by providing impregnated hemp core. The lift ropes shall conform to IS 14665- (Part-4-Sec. 8):2001 and the required factor of safety shall be adhered to. The minimum diameter of rope for cars and counter weight of passenger and goods lift shall be 8mm.

## **Rope fastenings**

The ends of lift ropes shall be properly secured to the car and counter weight hitch plates as the case may be with adjustable rope shackles having individual tapers babbitt sockets, or any other suitable arrangement. Each lift rope shackle shall be fitted with a suitable shackle spring, seat washer, shackle nut & lock & shackle nut split pin.

## **Guards for Lift Ropes**

Where lift ropes run round a sheave or sheaves on the car and/ or counterweight of geared/ gearless machine suitable guards shall be provided to prevent injury to maintenance personnel.

## **Number & Size of Ropes**

The contractor must indicate the number and size of lift ropes and governor ropes proposed to be used, their origin, type, ultimate strength and factor of safety. The contractor should furnish certificate or ropes from the rope manufacturers issued by competent authority.

## **4. COUNTER WEIGHT**

The counter weight for lift cars shall be in accordance with clause 6 of IS 14665 (Part 4-Sec-3) : 2001 and shall be designed to balance the weight of empty lift car plus approximately 50 percent of the rated load. It shall consist of cast sections firmly secured in relative movement by at least two numbers steel tie rods having lock nuts/split pins at each end and passing through each section and Housed in a rigid steel frame work. Cracked and broken sub weights shall not be accepted. Counter weight for passenger lifts should be able to accommodate suitable weight Interior finishes. In case interior finishes material exceeds this provision, then the elevator contractor shall adjust the Counter Weight accordingly, however this will be decided and intimated much before the delivery of the elevators.

## **Counter Weight Guards**

Guards of wire metal / mesh shall be provided in the lift pit to a suitable height above the pit floor to eliminate the possibility of injuries to the maintenance personnel.

## **5. GUIDES / Guide Rails**

Car and counterweight guide shall be machined T section as per relevant Indian Standards IS-14665 of 2000 revised up to date. The guides shall be capable of withstanding forces resulting from the application of the car or counter weight safety devices The guide rails shall be minimum 16mm Tongued & Grooved type.

## **6. TRAILING CABLES**

A single trailing cable for lighting control and signal circuit is permitted, if all the conductors of this trailing cables are insulated for maximum voltage running through any one conductor of this cable. The lengths of the cables shall be adequate to prevent any strain due to movement of the car. All cables shall be properly tagged by metallic / plastic tags for identification. Cable jacket should be suitable for immersion in water, salt water & oil etc.

## **7. SAFETY DEVICES**

Safety devices shall be capable of operating only in the downward direction and stopping fully loaded car, at the tripping speed of the over speed governor, even if the suspension devices break, by gripping the guides, and holding the car there. Governor sheave in elevator pit shall be enclosed in a wire cage to a height of 2.40 mtr. All safety devices statutorily required by Lift Inspector, including but not restricted to the following shall be provided.

- **Terminal slow down switches**

These shall be provided and installed to slow down the lift car when approaching the top and bottom landings. The slow down switches shall act independently from the normal car operating device.

- **Over travel limit switches**

These shall be provided and installed to stop the car within the top and bottom clearance, independent of the normal car operating device. The bottom over travel limit switch shall become operative when the bottom of the car touches the buffer. When the over travel limit switches are operative, it shall be impossible to operate the car until the car has been hand would to a position within the normal travel limits.

- **Pit Switch**

An emergency stop switch shall be located in the pit which when operated shall stop the car regardless of the position of hoist way.

- **Terminal Buffers**

Suitable spring buffers mounted on RCC foundation blocks shall be provided in the pit in compliance with ANSI/ASME/CENEN-81 /JIS codes for stopping the car in case of mal-operation. Dowels for the purpose shall be left while casting the pit floor alternatively floor reinforcement could be exposed by chipping for welding additional reinforcement for Dowels. However clearance from underside of the car resting on a fully compressed buffer shall not be less than 1.20 mtr. Buffers shall be designed for a design speed + 15%. Oil buffers shall be provided for the passenger elevators for speed of more than 1.75 mps and spring buffers for lower speed.

- **Interlocking**

Adequate interlocking is to be provided so that the car shall not move if the landing doors are even partially open and also the lift is overloaded.

• **Over speed governor**

Over speed governor shall be of centrifugal type and shall operate the safety gear at a speed at least equal to 115% of the rate speed and less than the over speed governors shall be driven by flexible wire ropes with the following requirements.

- The breaking load of ropes shall be related to the force required to operate the safety gear by the safety factor of at least 8
- The nominal rope diameter shall be at least 7 mm
- The ratio between the pitch diameter of the over speed governor pulley and the nominal rope diameter shall be at least 30 The over speed governors shall be sealed after setting the tripping speed. The breaking or slackening of the governor rope shall cause the motor to stop by an electric safety device.

• **Alarm bells**

A Concealed 200 mm diameter alarm bell shall be installed in the main security area. The alarm bell shall sound when the alarm bell button in the car operating panel is pressed. The bell shall mute when the pressure on the alarm bell button is released.

• **Emergency Stop Switches**

An emergency stop for use by maintenance personal shall be provided in each lift car.

**8 FIREMAN SWITCH**

Lift shall have a Fireman switch with glass front for access by the Firemen. The operation of this switch shall cancel all calls to this lift and shall stop at the next nearest landing if traveling upwards. The doors shall not open at this landing and the lift shall return to the ground floor. In case the lift is traveling downwards when the fireman's switch is operated it shall go straight to the ground floor bypassing all calls enroute. The emergency stop button inside the car shall be rendered inoperative. The fireman's switch shall be located adjacent to the lift opening at the terminal floor and shall be at a height of approximately 2 m above the floor level. For easy identification of firemen's lift which conform to the local authorities requirements, a red and white diagonal striped backing shall be provided behind the glass of the firemen's switch.

A permanent notice of prominent size indicating the floors served shall be provided and displayed adjacent to the firemen's lift at the terminal floor. The notice shall be made of laminated plastic sheet or other approved materials with red letters on white background. Details of the notice shall be submitted to the Engineer-in-Charge for approval prior to fabrication.

## **9. CONTROL OF NOISE AND VIBRATION**

### **9.1 General**

The whole of the lift assembly, including the opening and closing of the car and landing doors shall be quiet in operation and shall be free of rattling or squeaking noises. Lift doors operation shall be smooth to avoid the transmission of impact noise to the surrounding structure. Noise level resulting from the operation of the lifts, including direct sound transmission, breakout noise and re-radiation of structure borne noise, shall not exceed the specified noise criteria of the adjacent spaces. Vibration resulting from operation of lifts of escalators shall not be perceptible in any occupied areas.

### **9.2 Car construction**

All elements of the lift car construction shall be sufficiently rigid to avoid generation of noise by panel excitation as a result of movement. The total noise level in a moving lift car shall not exceed 45 dBA with the ventilation system operating.

### **9.3 Machinery**

The gearless traction machine and compact PM motor are installed within the hoist way and the slim control panel is located on the shaft side wall. Provision shall be made for the control vibration isolation measures employed to ensure that structure borne noise resulting from the operation of the lift machinery is not audible in any occupied area. Lift machinery noise levels under normal operating conditions shall not exceed 70 dBA at 1 m from the equipment in free field.

### **9.4 Arrival chimes**

Noise from arrival chimes shall not exceed 60 dBA. The above levels shall be measured at 3 m from the arrival chimes using a noise meter set to 'fast' response. Chimes with adjustable loudness shall be provided.

## **10. FIRE SAFETY REQUIREMENTS**

General requirements of lifts shall be as follows :

10.1 Landing doors in lift enclosures shall have a fire resistance of not less than one hour.

10.2 Lift car door shall have a fire resistance rating of one hour.

10.3 Grounding switch (es), at ground floor level, shall be provided on all the lifts to enable the fire services to ground the lifts.

## **8. TECHNICAL SPECIFICATIONS - LIFTS-ASSOCIATED WORKS**

## **1. ASSOCIATED ELECTRICAL WORKS**

### **1.1 Scope**

Based on power requirements of lifts furnished by the lift contractor, power supply for the lifts machines, terminating in a Switchboard located at a desired location, shall be provided by IIA. The earth bar provided on this Switchboards shall be connected to the building earthing system also by Engineer-in-charge. All cabling /wiring/loop earthing beyond this Switchboard for interconnection with the lift controllers / motors/ indicators / push buttons / safety devices etc. shall be provided by the lift contractor and its cost shall be deemed to be included in the quoted rates.

### **1.2 Cabling**

Cabling between switchboard and the controller /lift motor shall be with XLPE insulated HR PVC sheathed 1100 volt grade aluminium conductor armoured cables conforming to IS 7098 or PVC insulated, PVC sheathed, 1100 volt grade al conductor armoured cables conforming to IS 1554. Cables shall be terminated in glands fitted with armour clamps the gland body shall be provide with an internal conical sating to receive the armour clamping cone and clamping nuts which shall secure the armour wires. A PVC shroud shall be fitted to cover the gland body and exposed armour wires Trailing cables for the lifts shall be EPR insulated stranded copper conductor flexible cables conforming to IS 9968 Control cabling shall be with multi core stranded copper conductor PVC insulated and sheathed 1100 volt grade cables conforming to IS 8130. Minimum size of the cable shall be 2.5 sq mm. Where cables pass through walls or floor slabs, pieces of GI sleeves shall be provided for cast into the wall / floor and cable shall be drawn therein.

### **1.3 Wiring**

All wiring shall be carried out with FRLS PVC insulated 1100 volt grade stranded copper conductor wires conforming to IS 694 drawn in MS rigid / flexible conduiting system and / or MS raceways. Minimum 2.5 sq mm size wires shall be used. Wires shall be cut only at terminations. Intermediate jointing shall not be permitted. Drawing, cutting and terminating of the wires shall comply with the relevant Indian standard specifications and shall be carried out in the most workman like manner as per standard practice. All normal care like cutting the insulation with a pencil edge, taking care not to cut the strands and proper tightening of terminal connector screws to avoid loose connection or breaking of conductors etc. shall be taken. Heavy gauge black enameled screw type ISI embossed MS conduits with superior quality accessories approved by Engineer-in-Charge shall be used in the work. Conduits could either be recessed in floors / walls or fixed on surface with saddles and clamps. Final connections to vibrating the equipment shall be made with metal flexible conduits. Entire work shall be carried out in work man like manner as per standard practice

## **1.4 Earthing**

Metal enclosures of all electrical equipment and devices including frames of motors, controllers, switchgear, conduits and raceways etc. shall be properly earthed so as to form an equi-potential zone. Loop earthing of vibrating equipment shall be done with flexible copper earthing braid or flexible cables. The lift motor frame shall be connected to the building earthing system termination at the switchboard by duplicate loop earthing conductors of appropriate size. 2. ASSOCIATED CIVIL & STRUCTURAL ITEMS All civil and structural items of work associated with erection and operation of lifts shall be provided by the Contractor at his cost including (but not restricted to) the following.

- \_ Hook for lifting lift equipments in the top of shaft.
- \_ Temporary scaffoldings and safety barricades during lift installation in and around lift Lift wells
- \_ Sill angels
- \_ Bearing plates
- \_ Buffer supports
- \_ Checqured plates
- \_ Fascia plates
- \_ Ladders in pits (MS)
- \_ Safety railing on car top
- \_ Separator /stretcher beams if required .
- \_ Dowels for terminal buffers in pit floor during casting.

The Contractor shall ensure erection and fixing of steel work in such a manner that no RCC wall or any other structural member is damaged.

## **9. Note to the Vendor**

1. The following Drawings of passenger lift is provided with lift shaft details
2. Power supply would be provided at one Point. The Lift vendor needs to provide us the details of specific Power requirement.
3. Materials should be offered strictly conforming to the specifications within acceptable tolerance level given in specifications / drawings given in tender document. Deviations, if any, should be clearly indicated by the bidder in their bid. The supplier should also indicate the



Make/Type number of the materials offered and catalogues, technical literature and samples, wherever necessary should accompany the quotation.

4. Any fittings or accessories which may not be specifically mentioned in the Specifications or Particulars but which are usual or necessary for proper and efficient functioning of the Stores as per the specifications of the tender shall be supplied by the Contractor without extra charge to the Purchaser; the Stores supplied shall be complete in all respects.

5. DAFFPL has the right to ask for the minor modifications at any stage even after the design is mutually agreed.. As from the date, the Stores shall be in accordance with the specifications, patterns and drawings so altered, which the contractor is bound to comply with. In the event of such alteration involving a revision in the cost, or in the delivery period, the same shall be discussed and mutually agreed to, taking into account the unit rates of similar items in the Contract. In case of disagreement, the decision of DAFFPL, in the cost or the delivery period, shall be final and conclusive.

6. Minor modifications / Additional Scope of Work: Minor modifications /additional scope of work to the tune of 2% of the total contract value shall be carried out by the contractor without any extra cost to DAFFPL.

7. Subletting or Assignment of Contract: The Contractor shall not sublet, transfer or assign the Contract or any part thereof or bills or any other benefits, accruing there from or under the contract without the prior written consent of DAFFPL (All Subcontractors are required to be appraised and approved by DAFFPL before placement of orders by the Contractor/Supplier). However, such consent shall not be unreasonably withheld by DAFFPL, if such stores are not normally manufactured by the Contractor, such assignment or subletting shall not relieve the Contractor from any contractual obligation or responsibility under the Contract. Any breach of this condition shall entitle DAFFPL to cancel the Contract or any part thereof and to purchase from other sources at the risk and cost of the Contractor and shall recover from the Contractor damages arising from such cancellations. In case the Contractor sublets, transfers or assigns any part of the Contract with the prior written consent of the Purchaser, all payments to the Sub-Contractor shall be the responsibility of the Contractor and any requests from such sub-Contractor shall not be entertained by DAFFPL.

8. Past performance: In case the past performance of the tenderer is not found to be satisfactory with regard to quality, delivery, warranty obligation and non-fulfillment of terms and conditions of the contract, their offer is liable to be rejected by DAFFPL.

9. Primarily this lift will be used to handle delicate optics. Hence designer should consider the best quality materials with required factor of safety with maximum possible compactness. Design should reflect the delicate handling of these optics. Fast movements, jerks etc are not permitted during any lifting/movement. These cranes will be used inside the clean rooms. It

should not become the source of contamination inside the facility like particulate or molecular. Care shall be taken while deciding the secondary process like painting etc.,

10. Bidder should be a manufacturer and should have ISO Certificate and satisfactory evidence to show that they are licensed manufacturer, has adequate plant and manufacturing capacity and has a quality assurance programme. Copy of valid ISO certificate and manufacturing licence issued by the competent authority & company profile should be submitted as a proof.

Vendor must submit the following documents, without which, their bid will not be considered.

a.. Registration Certificates.

b. Factory License.

c. Purchase Order Copies for 4 Ton and above capacity Single Girder EOT Cranes along with the Commissioning Certificates & Performance Certificates.

d. Appreciation Letters from the Clients.

e. ISO Certificate

11. Bidders should have prior work experience of similar kind of work and must have supplied and commissioned at least 1 lift of 8 people capacity or more in the past three years (2016--2019) and such lift is presently working satisfactorily for more than one year after commissioning. Copies of Purchase order with technical details along with work completion/installation certificate/performance certificate should be submitted as a proof.

12. Vendor may visit the project site to evaluate site requirements after obtaining prior permission from DAFFPL.

13. Vendor shall arrange required lifting equipments, tools etc required during the installation. Transportation from factory to site is in vendor scope.

14. Vendor shall take responsibility of material stores at site.

15. Vendor shall provide safety devices (helmets, safety belts, gloves etc.) for personnel carrying out installation as per the safety standards.

16. Vendor shall give the schedule for Procurement of raw materials, Testing, manufacturing, Assembly, Factory acceptance test, transportation to site, installation & commissioning at site, etc.,

17. The bidder is required to submit all supporting documents as proof for the compliance. Bids received without valid documents and/or incomplete and irrelevant documents are likely to be rejected.

18. DAFFPL's decision to consider as to whether a vendor has met with the eligibility criteria or not is final.

19. The Equipment should be completely designed and made as per the relevant I.S.Specifications. IS 3177/807/800 , AGMA / DIN Stds

20. Testing Testing for the various items of equipment shall be performed at the contractor's cost and test certificate to be furnished by the contractor (for Motor, Machine Break-tests Controller & Steelwire Ropes). If required by the Engineer, the Contractor shall permit the Owner's authorized representative to be present during any of the tests. After notification to the Owner that the installation has been completed the contractor shall make under the direction and in the presence of the Engineer such test and inspections as have been specified or as the Engineer shall consider necessary to determine whether or not the full intent of the requirements of the plans and specifications have been fulfilled. In case the work does not meet the full intent of the specifications and further tests shall be considered necessary the contractor shall bear all the expenses thereof.

21. Compliance of statutory observation. Complying with observations, if any, of Lift/Electrical Inspector and/or any other Statutory Authority after completion of work in order to obtain a categorical clearance to start beneficial use.

22. Manuals, drawings etc.

### **1. Along with the tender**

Technical Parameters enclosed as Annexure-I duly filled in by the Tenderers along with technical catalogue etc. of the equipment offered.

### **2. Shop drawings on award of work before commencement**

The Contractor shall submit GA drawings of Lift System to Architects/Owners for approval before commencement of work at site/fabrication/ manufacture.

### **3. Operation and maintenance manuals**

Three sets of operation and maintenance manual with support drawings shall be submitted to the Owners after completion of work.

### **4. Training**

Training of Owners personnel in operation, handling and maintenance of equipment.

### **5. The Contractor shall submit following documents**

3 sets of operation and maintenance manual with support drawings shall be submitted to the owner after completion of work.

3 sets of test results of pre-commissioning test carried out at site.

3 sets of as built GA drawings.

**23. Maintenance**

Quoted rates shall be deemed to be inclusive of, free comprehensive maintenance (including spares) of lifts for a period of Two year from the accepted date of completion of the contract.

**24. COMPLETION CERTIFICATE**

On completion of the electrical installation a certificate shall be furnished by the Contractor countersigned by the Licenced Supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local supply authority. The Contractor shall be responsible for getting the electrical installation inspected and approved by the local and statutory authorities concerned and expenses if any shall be borne by the contractor.

**25. WORKMANSHIP**

Good workmanship is an essential prerequisite to be complied for this work. Entire work shall be carried out in the most workmanlike manner by skilled workers under competent supervision.

LIST OF MAKES			
•	Lift	:	Schindler, OTIS, Johnson (Shop drawing to be approved by Consultant / Owner)

**TECHNICAL SPECIFICATIONS**

**PLUMBING WORKS**

**&**

**FIRE FIGHTING SYSTEM**

# **TECHNICAL SPECIFICATIONS-PLUMBING WORKS**

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# **TECHNICAL SPECIFICATIONS-PLUMBING WORKS**

## **SECTION - 01 :: BASIS OF DESIGN**

### **1. BASIS OF DESIGN**

The Plumbing, Sanitary, Drainage & Fire Protection System for the project is designed keeping in view the following:

- 1.1 Requirement of adequate and equal pressure availability of cold & Hot water lines in Toilets, Pentry/Kitchen and Cold makeup water supply etc.
- 1.2 Adequate storage of water in under ground raw + treated domestic water tanks.
- 1.3 Provision of fire fighting appurtenance such as sprinklers, fire hydrants, hose reel, and portable extinguishers.
- 1.4 Levels of roads / pavements and other services in the area.
- 1.5 Landscape layout.

The execution of works and materials used shall be as per the latest relevant I.S. specifications.

The extension of work shall in stick compliance to the Enviromental Clearance granted by MoEF, Govt. of India & NOC issued by Fire Department.

Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

### **2. CONCEPT OF THE SYSTEM**

The following services are envisaged for the complex:

- 2.1 Water Treatment System for meeting the domestic water quality requirement with chemical parameters in acceptable limits as per SP:35(S & T) 1987 which is considered safe for human consumption, and other standards such as IS 10392 for boiler feed water quality.
- 2.2 Domestic (Cold) & Hot water supply through Gravity System.
- 2.3 Sewage and Sullage collection system based on IS: 1742 and applicable standards for domestic drainage.
- 2.4 Sewer connection to existing sewer manhole.
- 2.5 Storm / Rain water drainage system from various levels of the building and disposal rain water harvesting pit & is overflow to available municipal storm water disposal.
- 2.6 Fire Fighting system for the Complex comprising of Hydrant, Hose Reels, Sprinklers and portable fire extinguishers.

### **3. WATER STORAGE & DISTRIBUTION SYSTEM**

#### **3.1 Water Requirement**

The water requirement for the project is proposed to be based on the provisions of IS:1172 and prevalent practice. The estimated requirement of water per day for the Complex is based on the number of users and other services.

#### **3.2 Source of Water**

The daily domestic water requirement for the Complex shall be through existing water supply system.

#### **3.4 Water Distribution**

Domestic & flushing water supply to toilets will be provided through gravity. Separate water supply connection shall be taken( from overhead domestic water tank of main building) for cafeteria building.

#### **3.5 Appurtenant**

Following components shall be included in the water supply system for efficient functioning:

- i). Flow meter.
- ii). Pressure Gauge.
- iii). Isolation valve for toilet /pantry/ kitchen

### **4. SEWAGE, SULLAGE AND STORM WATER**

The soil and waste shall be carried down in separate independently vented pipes. Two pipe drainage systems shall be adopted as per NBC (Part-IX). Grease trap shall be provided for Cafeteria building. Sewage from last sewer manhole shall be connected to existing sewer manhole.

#### **4.1 Design Limitations**

The system is designed considering the following:

1. High thrust developed at soil & water pipe connections.
2. Termination of vent cowl at terrace level.
3. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.
4. Provision of cleanout plugs.

### **5. WORKMANSHIP**

The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Owner's Site Representative. All materials and/or Workmanship which in the opinion of the Owner's Site Representative / Architect / Consultant is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith.

### **6. MATERIALS**

All materials shall be best of their kind and shall conform to the latest Indian Standards. All materials shall be of approved quality as per samples and origins approved by the Owner's Site Representative / Architect / Consultants.

As and when required by the Owner's Site Representative / Consultant, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions of work are found defective or unsound by the Owner's Site Representative / Consultant, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Owner's Site Representative / Consultant. To prove that the materials used are as specified the contractor shall furnish the Owner's Site Representative with original vouchers on demand.

## **SECTION - 02 :: SANITARY FIXTURES & FITTINGS**

### **1. SCOPE**

The scope of this section consists of but is not necessarily limited to supply, installation, testing and commissioning of following items:

- a. Sanitary appliances and fixtures for toilets.
- b. Chromium plated brass fittings
- c. Stainless steel sinks
- d. Accessories e.g. towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails, coat hooks etc.
- e. Hand driers, drinking water fountains etc.

Whether specifically mentioned or not the Contractor shall provide for all appliances and fixtures all fixing devices, nuts, bolts, screws, hangers as required.

All exposed pipes within toilets and near appliances/fixtures shall be of chromium plated brass or copper unless otherwise specified.

### **2. GENERAL REQUIREMENT**

Sanitary appliances and fixtures for toilets, chromium plated brass fittings, stainless steel sinks, bathroom accessories like towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails coat hooks etc and mirrors, hand driers, drinking water fountains etc as listed in the relevant items in the Schedule of Quantities shall be supplied free of cost by the Owner's Site Representative. The rates shall be inclusive of accessories (in such case) required for installation. All sanitary fixtures and fittings shall be received from the Owner's Site Representative and thereafter be stored under covered roof and handled carefully to prevent any damage by the Contractor.

All appliances, fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, drawings. Accessories shall include proper fixing arrangements, brackets, nuts, bolts, washers, screws and required connection pieces.

The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Architect / Owner's Site Representative and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Architect / Interior Designer

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architect requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.

Fixing screws shall be half round head chromium plated (CP) brass screws, with CP brass washers unless otherwise specified.

Fixtures shall be installed by skilled workman with appropriate tools according to the best trade practice.

All appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and to heights shown on the drawings and in accordance with the manufacturers recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling, plaster, paint, insulation or terrace shall be made good by the Contractor at his own cost. Fixtures shall be mounted rigid, plumb and true to alignment.

All materials shall be rust proofed; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

Wall flanges shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pierce through them. These wall caps shall be or chromium plated brass fittings and the receiving pipes and shall be large enough to cover the punctures properly.

Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards and the following:

- i. Contractor shall, during the entire period of installation and afterwards protect the appliances by providing suitable cover or any other protection so as to absolutely prevent any damage to the appliances until handing over (The original protective wrapping shall be left in position for as long as possible)
- ii. The appliances shall be placed in correct position or marked out in order that pipe work can be fixed or partially fixed first.
- iii. The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.
- iv. The appliance shall be securely fixed. Manufacturer's brackets and fixing methods shall be used wherever possible. Compatible rust-proofed fixings shall be used. Fixing shall be done in a manner that minimizes noise transmission.
- v. Appliances shall not be bedded (e.g. WC pans, pedestal units) in thick strong mortar that could crack the unit (e.g. ceramic unit)
- vi. Pipe connections shall be made with demountable unions. Pipe work shall not be fixed in a manner that it supports or partially supports and appliance.
- vii. Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.

Sizes of sanitary fixtures given in the Specifications or in the Schedule of Quantities are for identification with reference to the catalogues of make considered. Dimensions of similar models of other makes may vary within  $\pm 10\%$  and the same shall be provided and no claim for extra payment shall be entertained NOR shall any payment be deducted on this account.

The contractor shall fix all plumbing fittings such as water faucets, shower fittings, mixing valves etc. in accordance with manufacturer's instructions and connect to piping system. The contractor shall supply all fixing materials such as screws, rawl plugs, unions, collars, compression fittings etc., as required.

Joints / gaps between all sanitary appliances / fixtures and the floor / walls shall be caulked with an approved mildew resistant sealant, having antifungal properties, of colour and shade to match that of the appliances / fixture and the floor / wall to the extent possible.

## **2.1 Water Closet**

Water Closet shall be wash down or symphonic wash down type floor or wall mounted set, as shown in the drawings, designed for low volume flushing from 3-6 litres of water, flushed by means of a porcelain flushing cistern or an exposed or concealed type (as detailed in the drawings or as directed by the Owner's Site Representative). Flush pipe / bend shall be connected to the WC by means of a suitable rubber adaptor. Wall hung WC shall be supported by CI floor mounted chair which shall be fixed in a manner as approved by the Owners Site Representative.

Each WC set shall be provided with approved quality of seat, rubber buffers and chromium plated hinges. Seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC.

Each WC shall be provided with 110 mm dia (OD) PVC Pan connector connecting the ceramic outlet of WC to pipe.

## **2.2 Urinals**

Urinals shall be lipped type half stall with glazed vitreous China of size as called for in the Bill of Quantities.

Half stall urinals shall be provided with 15mm dia CP spreader, 32mm dia CP domical waste and CP cast brass bottle trap with pipe and wall flange and shall be fixed to wall by CI brackets, CI wall clips and CP brass screws as recommended by manufacturer complete as directed by the Owner's Site Representative.

Flushing for urinals shall be by means of no hand operation, infrared electric flush valve with complete kit of plumbing, electrical and electronic items, infrared photo cells, solenoid valve transformer and electrical connection. The automatic flush sensor plate shall be flush and press fitted and be of high quality mirror polish finish. Each urinal shall be provided with one flush valve unit.

Flush pipes shall be concealed in wall chase but with chromium plated bends at inlet and outlet.

### **Urinal Partitions**

Urinal partitions shall be white glazed vitreous china of size specified in the Schedule of Quantities.

Porcelain partitions shall be fixed at proper heights with CP brass bolts, anchor fasteners and MS clips as recommended by the manufacturer and directed by the Owner's Site Representative.

## **2.3 Cisterns**

Low level flushing cistern (exposed or concealed) shall be provided for WC in specified toilets. Contractor shall install cistern in accordance to the manufacturer's specification to the satisfaction of the Owner Site Representative.

## **2.4 Wash Basin**

Wash basins shall be white glazed vitreous china of size, shape and type specified in the Schedule of Quantities.

Each basin shall be provided with painted MS angle or CI brackets and clips and the basin securely fixed to wall/counter slab. Placing of basins over the brackets without secure fixing shall not be accepted. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's Site Representative. The cost of fixing the basin shall be inclusive of supply and installation of brackets as described above.

Each basin shall be provided with 32mm dia CP waste with overflow, CP waste as specified in the Schedule of Quantities.

Each basin shall be provided with hot and cold water mixing fitting or as specified in the Schedule of Quantities.

## **2.5 Sinks**

Sinks shall be stainless steel or any other material as specified in the Schedule of Quantities.

Each sink shall be provided with painted MS or CI brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable painted angle iron brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40mm dia CP waste and rubber plug with CP brass chain as given in the Schedule of Quantities. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's site representative.

Sanitary fittings for sinks shall be deck mounted or wall mounted CP swivel faucets with or without hot and cold water mixing fittings as specified in the Schedule of Quantities. Installation of fittings shall be measured and paid for separately.

## **2.6 Toilet Paper Holder**

Toilet paper holder shall be white glazed vitreous china or chrome plated of size, shape and type specified in the Schedule of Quantities.

Porcelain toilet paper holder shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand) and fixed in relation to the tiling work.

The latter (chrome) shall be fixed by means of screws/capping having finish similar to the toilet paper holder in wall/temper partitions with raw l plugs or nylon sleeves. When fixed on timber partition, it shall be fixed on a solid wooden base member provided by the Owner's Site Representative.

## **2.7 Towel Rail**

Towel rail shall be chromium plated brass or of stainless steel or powder coated brass of size, shape and type specified in the Schedule of Quantities.

Towel rail shall be fixed with screws/capping having finish similar to the towel rail in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by the Owner's Site Representative.

## **2.8 Liquid Soap Dispenser**

Liquid Soap Dispenser shall be wall/counter mounted suitable for dispensing liquid soaps, lotions, detergents. The cover shall lock to body with concealed locking arrangement, opened only by key provided.

Liquid soap dispenser body and shank shall be of high impact resistance material. The piston and spout shall be stainless steel with 1 litre capacity polyethylene container.

The valve shall operate with less than 2.27 Kg (5 lbs) of force.

## **2.9 Hand Drier**

The hand drier shall be no touch operating type with solid state time delay to allow user to keep hand in any position.

The hand drier shall be fully hygienic, rated for continuous repeat use (CRU).

The rating of hand drier shall be such that time required to dry a pair of hands up to wrists is approximately 30 seconds.

The hand drier shall be of wall mounting type suitable for 230 V, single phase, 50 Hz, AC power supply.

## **3. TOILETS FOR THE DISABLED**

Where specified, in washroom facilities designed to accommodate physically disabled, accessories shall be provided as directed by the Owner's Site Representative.

Stainless steel grab bars of required size suitable for concealed or exposed mounting and opened non-slip gripping surface shall be provided in all washroom. The flushing cistern/valve shall be provided with chromium plated long handles.

## **4. MOCKUP AND TRIAL ASSEMBLY**

The installation of the Sanitary fixtures and fittings shall be as per the shop drawings approved by the Architect/Consultant.

The contractor shall have to assemble at least one set of each type of sanitary fixtures and fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Architect / Interior Designer.

The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

## **5. SUPPORTING AND FIXING DEVICES**

The contractor shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly. Where the location demands, the Architect may



instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply the fixing devices and shall be installed complete with appropriate vibration isolating pads, washers and gaskets.

## **6. FINAL INSTALLATION**

The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

## **7. PROTECTION AGAINST DAMAGE**

The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

## **8. MEASUREMENT**

- 8.1 Rate for fixing only of sanitary fixtures accessories, CP fittings shall etc. include all items, and operations stated in the respective specifications and bill of quantities and nothing extra is payable.
- 8.2 Rates for all items under specifications para above shall be inclusive of cutting holes and chases and making good the same, CP screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning and making good to the satisfaction of the Owner's Site Representative.

## **9. TESTING**

All appliances, fixtures and fittings shall be tested before and after installation. Water seals of all appliances shall be tested. The contractor shall block the ends of waste and ventilation pipes and shall conduct an air test.

## **SECTION - 03 :: WATER SUPPLY (COLD)**

### **1. SCOPE**

The scope of this section comprises the supply, installation, testing and commissioning of piping network for water supply for internal & external services as follows:

- a Water supply from existing water supply system.

- b. Drinking Water Supply.
- c. External water supply to cater for Horticulture .
- d. Connection to various mechanical equipments to be supplied and installed by the other specialist contractors.
- e. Water supply to airconditioning ststem.

The Contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities.

The Contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete water supply / distribution installation to the Owner.

## **2. PIPING MATERIALS**

The piping system shall consist of CPVC SDR 11.0 piping from 15 mm to 50 mm & Schedule 40 from 65 mm to 150 mm for cold water supply & schedule 80 from 65 mm to 150 mm for hot water supply.

The piping system shall also consist of heavy class galvanized iron pipes and fittings conforming to IS:1239. The sizes and makes is specified in the Schedule of Quantities.

For any internal works, the CPVC pipes and fittings shall be embedded in the wall chase or run on the floor/ceiling unless otherwise specified. No unsightly exposed runs shall be permitted.

### **A. CPVC Pipes & Fittings**

The pipes shall be CPVC (Chlorinated Poly Vinyl Chloride) material for hot & cold water supply piping system with pipes as per CTs SDR -11 at a working pressure of 320 PSI at 23 deg C and 80 PSI at 82 deg.C, using solvent welded CPVC fittings i.e. Tees, Elbows, Couples, Unions, Reducers, Brushing etc. including transition fittings (connection between CPVC & Metal pipes / GI) i.e. Brass adapters (both Male & Female threaded and all conforming to ASTM D-2846 with only CPVC solvent cement conforming to ASTM F-493, with clamps / structural metal supports as required /directed at site including cutting chases & fitting the same with cement concrete / cement mortar as required, including painting of the exposed pipes with one coat of desired shade of enamel paint. All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of manufacturer & Project Manager.

### **i).Joining Pipes & Fittings**

1. Cutting: Pipes shall be cut either with a wheel type plastic pipe cutting or hacksaw blade and care shall be taken to make a square cut which provides optimal bonding area within a joint.
2. Deburring / Beveling: Burrs and fittings should be removed from the outside and inside of pipe with a pocket knife or file otherwise burrs and fittings may prevent proper contact between pipe and fittings during assembly.
3. Fitting preparation: A clean dry rag/cloth should be used to wipe dirt and moisture from the fitting sockets and tubing end. The tubing should make contact with the socket wall 1/3 or 2/3 of the way into the fitting socket.

4. Solvent Cement Application: Only CPVC solvent cement conforming to ASTM-F493 should be used for joining pipe with fittings. An even coat of solvent cement should be applied on the pipe end and a thin coat inside the fitting socket, otherwise too much of cement solvent can cause clogged water ways.
5. Assembly: After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 30 seconds, and rotating the pipe ¼ to ½ turn while inserting so as to ensure even distribution of solvent cement with the joint. The assembled system should be held for 10 seconds (approximately) in order to allow the joint to set up.

An even bed of cement should be evident around the joint and if this bed is not continuous then remake the joint to avoid potential leaks.

Set & Cure times: Solvent cement set and cure times shall be strictly adhered to as per the below mentioned table.

Minimum Core prior to pressure testing at 150 PSI

Ambient Temperature during Core period	Pipe Size	
	½ " - 1"	1.¼" - 2"
Above 15 deg. C	1 Hr	2 Hrs
4-15 deg.C	2 Hrs	4 Hrs
Below 4 deg C	4 Hrs	8 Hrs

Special care shall be exercised when assembling flow guard systems in extremely low temperature (below 4°C) or extremely high temperature (above 45°C) In extremely hot temperatures, make sure that both surfaces to be joined are till wet with cement solvent when putting them together.

6. Testing

- i. Once an installation is completed and cored as per above mentioned recommendations, the system should be hydrostatically pressure tested at 150 psi(10 Bar) for one hour. During pressure testing, the system should be fitted with water and if a leak is found, the joint should be cut out and replacing the same with new one by using couplers.

ii. Transition of Flow guard CPVC to Metals

When making a transition connection to metal threads, special Brass / plastic transition fitting (Male and female adapters) should be used. Plastic threaded connections should not be over torqued Hard tight puts one half turn should be adequate.

iii. Threaded Sealants

Teflon tape shall be used to make threaded connections leak proof.

iv. Solvent Cement

Only CPVC solvent cement conforming to ASTM F 493 should be used for joining pipe with fittings and valves. Flow guard CPVC cement solvent have a minimum shelf life of 1 year. Aged cement solvent will often change colour or being to thicken and become gelatinous or jelly like and when this happens, the cement should not be used. The cement solvent should be used within

30 days after opening the company's seal and tightly close the seal after using in order to avoid its freezing. The frozen cement solvent should be discarded immediately and fresh one should be used. The CPVC solvent cement usage should be adhered to as given in table below

Diameter of pipe in inch ( flow guard)	½"	¾"	1"	1¼"	1½"	2"
Approx. nos. of joints which can be mode per litre of solvent cement.	200 Nos	180 Nos	150 Nos	130 Nos	100 Nos	70 Nos

#### v.Hangers and supports

For Horizontal runs, support should be given at 3 foot ( 90 cm) intervals for diameters of one inch and below and at 4 foot (1.2m) intervals for larger sizes. Hangers should not have rough or sharp edges which come in contact with the tubing.

Supports should be as per the below mentioned table:

Size of Pipe	21°C	49°C	71°C	82°C
Inch	Ft.	Ft.	Ft.	Ft.
½"	5.5	4.5	3.0	2.5
¾"	5.5	5.0	3.0	2.5
1"	6.0	5.5	3.5	3.0
1¼"	6.5	6.0	3.5	3.5
1½"	7.0	6.0	3.5	3.5
2"	7.0	6.5	4.0	3.5

<b>SCHEDULE - 40</b>							
Recommended Support spacing (in feet)							
Nom. Pipe Size		Temperature °C					
(In)	(mm)	23	38	49	60	71	82
2 ½	65	7 ½	7	7	6 ½	6	3 ½
3	80	8	7	7	7	6	3 ½
4	100	8 ½	7 ½	7 ½	7	6 ½	4
6	150	9 ½	8	8	7 ½	7	4 ½
8	200	9 ½	8	8	7 ½	7	5

### B.Galvanised Iron Pipes & Fittings

The pipes shall be galvanised mild steel welded (ERW) or (HFW) screwed and socketed conforming to the requirements of IS:1239. The Galvanising shall conform to IS:4736, the zinc coating shall be uniform, adherent reasonably smooth and free from such imperfections as flux, ash and drop inclusions, bare patches, black spots, pimples, lumpiness, runs, rust strains, bulky white deposits and blisters. The pipes and sockets shall be cleanly finished, well galvanised in and out and free from cracks, surface flaws laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly, and square with the axis of the pipe.

The fittings shall be malleable iron and comply with all the requirements of the pipes. The size of pipes and fitting is specified in the schedule of quantities.

### **Laying And Jointing Of GI Pipes**

The galvanised pipes and fittings shall run in wall chase or ceiling or as specified. The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5 cm clear of the wall where to be laid on surface. Where it is specified to conceal the pipes, chasing may be adopted for pipes fixed in the shafts, ducts etc. there should be sufficient space to work on the pipes with the usual tools. As far as possible, pipes may be buried for short distances provided adequate protection is given against damage and where so required special care to be taken at joints. Where directed by the Owner's Site Representative, pipe sleeves shall be fixed at a place the pipe is passing through a wall or floor for reception of the pipe and allow freedom for expansion and contraction and other movements. In case of pipe is embedded in walls or floors it shall be painted with anticorrosive bitumastic paints of approved quality. Under the floors the pipes shall be laid in layer of sand filling.

Galvanised iron pipes shall be jointed with threaded and socket joints, using threaded fittings. Care shall be taken to remove any burr from the end of the pipes after threading. Teflon tape, White lead or an equivalent jointing compound of proprietary make shall be used, according to the manufacturer's instructions, with a grommet of a few strands of fine yarn while tightening. Compounds containing red lead shall not be used because of the danger of contamination of water. Any threads exposed after jointing shall be painted with bituminous paint to prevent corrosion.

### **3. PIPING INSTALLATION SUPPORT (VALID FOR GI PIPING ONLY)**

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. All accessories and ancillaries of support system such as brackets, saddles, clamps, hangers etc. shall be hot dip galvanized after fabrication. Further 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:

<b>Pipe Dia (mm)</b>	<b>Hanger Rod Dia (mm)</b>	<b>Spacing between Supports (m)</b>
Up to 25	6	2
32 to 50	10	2.7
80 to 100	12	2.7
125 to 150	16	3.6
200 to 300	19	5.3

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

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 fiberglass 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.

All buried pipes for CWS shall be cleaned and coated with two coats of bitumen and then wrapped with two layers of 400 micron polythene sheet coating.

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 isolation ball valve. Automatic air valves shall also be provided on hot water risers.

Discharge from the air valves shall be piped through a galvanized steel 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 and include in Bill of Quantities. Care shall be taken to protect pressure gauges during pressure testing.

Temperature gauge as specified shall be provided at the hot water supply and return and as shown on drawings and included in Bill of Quantities.

#### **4. FERRULES**

The ferrules for connection with main shall generally conform to IS:2692. It shall be of non-ferrous materials with a bell mouth cover and shall be of nominal bore as specified. The ferrule shall be fitted with a screw and plug or valve capable of completely shutting of the water supply to the communication pipe, as and when required.

##### **4.1 Fixing Ferrules**

For fixing ferrule in cast iron mains, the empty main shall be drilled and tapped at 45 deg to the vertical and the ferrule screwed in. The ferrule must be so fitted that no portion of the shank shall be left projecting within the main into which it is fitted.

#### **5. WATER METERS**

Water meters of approved make and design shall be supplied for installation at locations as shown. The water meters shall meet with the approval of local supply authorities. Suitable valves and chambers or wall meter box to house the meters shall also be provided along with the meters.

The meters shall conform to Indian Standard IS:779 and IS:2373. Calibration certificate shall be obtained and submitted for each water meter.

Provision shall also be made to lock the water meter. The provision shall be such that the lock is conveniently operated from the top. Where the provision is designed for use in conjunction with padlocks, the hole provided for padlocks shall be a diameter not less than 4mm.

### **5.1 Installation Of Water Meter And Stop Cock**

The G.I. lines shall be cut to the required lengths at the position where the meter and stop cock are required to be fixed. Suitable fittings shall be attached to the pipes. The meter and stop cock shall be fixed in a position by means of connecting pipes, jam nut and socket etc. The stop cock shall be fixed near the inlet of the water meter. The paper disc inserted in the ripples of the meter shall be removed. And the meter installed exactly horizontal or vertical in the flow line in the direction shown by the arrow cast on the body of the meter. Care shall be taken that the factory seal of the meter is not disturbed. Wherever the meter shall be fixed to a newly fitted pipe line, the pipe line shall have to be completely washed before fitting the meter.

## **6. TESTING**

The Contractor shall notify the Architect three days in advance of any test so that the Architect can witness the tests if he so wishes.

All water supply system shall be tested to hydrostatic pressure test of at least one and a half (1.5) times the maximum pressure but not less than 10Kg/Sq.cm for a period of not less than 8 hours. All leaks and defects in joints revealed during the testing shall be rectified and got approved at site by retest. Piping required subsequent to the above pressure test shall be retested in the same manner.

System may be tested in sections and such sections shall be entirely retested on completion.

The Contractor shall make sure that proper noiseless circulation of fluid is achieved through the entire piping network of the system concerned. In case of improper circulation, the contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectifications including the tearing up and refinishing of floors and walls as required.

In addition to the sectional testing carried out during the construction, contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good by the contractor during the defects liability period without any cost.

After commissioning of the water supply system, contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and Owner's site representative.

## **7. DISINFECTION OF PIPING SYSTEM AND STORAGE TANKS**

Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water.

If ordinary bleaching powder is used, the proportions will be 150 gm of power to 1000 liters of water. The power shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the manufacturer. When the storage tanks is full, the supply shall be stopped and all the taps on the distributing pipes are opened successively working progressively away from the storage tank. Each tap shall be closed when the water discharged begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.

The pipe work shall be thoroughly flushed before supply is restored.

## **8. STERILIZATION OF MAIN**

After the pipe work has been tested and approved, but before it is coupled, it shall be sterilized with a solution of chloride of lime.

## **9. CUTTING CHASES IN MASONARY WALLS**

Cold water distribution pipes to fixtures and equipment exposed to view in the bathrooms, kitchens, and sanitary compartments shall be chased into walls or floors or placed in wall cavities. The Contractor shall be responsible for cutting all notches, chases, and recesses in walls and floors and only a diamond cutter shall be used. The maximum size of conduit or pipe permitted to be concealed in floor slabs shall be 32 mm diameter unless otherwise approved by the Architect.

The chases upto 7.5 x 7.5 cm shall be made in the walls for housing GI pipes etc. These shall be provided in correct positions as shown in the drawings or directed by the Architects. Chases shall be made by chiselling out the masonry to proper line and depth. After the pipes etc are fixed in chases, the chases shall be filled with cement mortar 1:2:4 or as may be specified, and made flush with the masonr surface. The concrete surface shall be roughened with wire brush to provide a key for plastering.

Where pipes pass through beams or structural walls, subject to the approval of the Structural Consulting Engineer, the Contractor shall ensure that sizes and locations of openings required are formed in when the relevant beams or walls are cast.

## **10. VALVES**

All valves (gate, globe, check, safety) shall be of gun metal suitable for the particular service as specified. All valves shall be of the particular duty and design as specified. Valves shall either be of screwed type or flanged type, as specified, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to Indian Standard IS:776 and non-return valves and swing check type reflux to IS:5312.

Sluice valves, where specified shall be flanged sluice valves of cast iron body. The spindle, valve seat and wedge nuts shall be gunmetal. They shall generally have non-rising spindle and shall be of the particular duty and design as specified. The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fibre gaskets. Sluice valves shall conform to Indian standard IS:780 and IS:2906.

Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system. Where called for brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect to supply pipe.



Globe valves on Hot-water line shall be union bonnet with stem/disc and body seat ring of SS. Suitable for temperature upto 80° C.

S. No	Type of Valve	Size	Construction	Ends
a.	Isolating Valve	15 mm to 50 mm 65 mm and above	Gun Metal Gun Metal	Screwed Flanged
b.	Sluice Valve & Butterfly Valve	65 mm and above	Cast Iron	Flanged
c.	G.M. non return valve	15 mm to 50 mm 65 mm above	Gun Metal Gun Metal	Screwed Flanged
d.	Flap Type – Non return valve	65 mm and above	Cast Iron	Flanged

All valves shall be suitable for the working pressure involved.

### 1013 Pressure Gauge

The pressure gauge shall be constructed of die cast aluminium and stove enamelled. It shall be weather proof with an IP 55 enclosure. It shall be a stainless steel Bourden tube type pressure gauge with a scale range from 0 to 16 Kg / cm square and shall be constructed as per IS:3524. Each pressure gauge shall have a siphon tube connection. The shut off arrangement shall be by Ball Valve.

Calibration certificate shall be obtained and submitted for each pressure gauge.

## 11. WATER FITTINGS

Unless otherwise specified all Gunmetal fittings such as gate, globe, check & safety valves shall be fitted in pipe line in workman like manner. Necessary unions shall be provided on both ends of the valves for easy replacement. The joints between fittings and pipes shall be leak-proof when tested to desired pressure rating. The defective fittings and joints shall be replaced or redone.

## 12. CONNECTIONS TO VARIOUS MECHANICAL EQUIPMENT SUPPLIED BY OTHER AGENCIES

All inlets, outlets, valves, piping and other incidental work connected with installation of mechanical equipment supplied by other agencies all be carried out by the contractor in accordance with the drawings, requirements for proper performance of equipment, manufacturers instructions and the directions of the Owner's site representative / Architect. The equipments to be supplied by the other agencies consist mainly for Kitchen, Back-of-the-House area and other similar areas. The work of connections to the various equipments shall be effected through proper unions and isolating valves. The work of effecting connections shall be executed in consultation with and according to the requirement of equipment suppliers, under the directions of the Owner's site representative / Architect. The various aspects of connection work shall be executed in a similar way to the work of respective trade mentioned elsewhere in these specifications.

## 13. CONNECTIONS TO RCC WATER TANKS

The contractor shall provide all inlets, outlets, washouts, vents, ball cocks, overflows control valves and all such other piping connections including level indicator to water storage tanks as called for. All pipes crossing through RCC work shall have puddle flanges fabricated from MS/GI pipes of required

size and length and welded to 6/8 mm thick MS plate. All puddle flanges must be fixed in true alignment and level to ensure further connection in proper order.

Full way gate valves of a approved make shall be provided as near the tank as practicable on every outlet pipe from the storage tank except the overflow pipe. Overflow and vent pipes shall terminate with mosquito proof grating.

The overflow pipe shall be so placed to allow the discharge of water being readily seen. The overflow pipe shall be of size as indicated. A stop valve shall also be provided in the inlet water connection to the tank. The outlet pipes shall be fixed approximately 75mm above the bottom of the tank towards which the floor of the tank is sloping to enable the tank to be emptied for cleaning.

The floor and the walls of the tank shall be tiled with glazed tiles upto the overflow level. Alternatively food grade epoxy to be applied.

#### **Tiling of Walls**

The floor and the walls of the tanks shall be tiled with glazed tiles up to the overflow level. Alternatively food grade epoxy to be applied to the floor and the walls of the tanks.

### **14. MEASUREMENTS**

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include pipe and fittings such as coupling , bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions. Deductions for length of valves shall be made. Rate quoted shall be inclusive of all fittings, clamps, cutting holes chased and making good the same and all items mentioned in the specifications and Bill of Quantities.

All pipes below ground shall be measured per linear meters (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, deduction for valves shall be made rate quoted shall be inclusive of all fittings, excavation, back filling and disposal of surplus earth, cutting holes and chase and making good all item mentioned in Bill of Quantities.

### **15. LAWN HYDRANTS**

Lawn hydrants shall be of 25mm size unless otherwise indicated. All hydrants shall be provided with gate valves and threaded nipple to receive hose pipes. Lawn hydrant valves shall be of approved make and design. Where called for lawn hydrants shall be located in masonry chambers of appropriate size.

### **16. PIPE PROTECTION (FOR COLD WATER PIPES BURIED IN TRENCHES / GROUND / EARTH)**

All buried pipes shall be cleaned with zinc chromate primer and bitumen paint, wrapped with three layers of fiber glass tissue, each layer laid in bitumen and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters. The pipes where laid under floor shall be encased with 100 mm thick jamuna sand all around in addition to protective coating as described above. Alternatively pypcoat / coatek insulation for protection of pipe would also be acceptable as per final approval of project engineer / consultant.

### **17. MASONRY CHAMBER**

- i. All masonry chambers for stop cocks, sluice valves and meter etc. shall be built as per supplied drawings.

- ii. The excavation for chambers shall be done true to dimension and level indicated on plans or as directed by the Owner's site representative.
- iii. Concrete shall be of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size).
- iv. Brick shall be of class designation 75 in cement mortar 1:5 (1 cement : 5 fine sand)
- v. Inside Plastering not less than 12 mm thick shall be done in cement mortar 1:3 (1 cement : 3 fine sand) finished with a floating coat of neat cement.

**18. SHIFTING OF EXCAVATED SURPLUS MATERIAL**

Contractor shall make his own arrangement to shift the surplus excavated material within the site limits as directed by Owner's site representative at free of cost within time limit.

**19. HOT WATER PIPING INSULATION**

**MATERIAL**

Insulation material for Pipe insulation shall be Closed Cell Elastomeric Nitrile Rubber or closed cell cross linked polyethylene foam. Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.038 W/moK or 0.0313 Kcal / Mhr oC or 0.212 BTU / (Hr-ft2-oF/inch) at an average temperature of 30oC. The product shall have temperature range of -40 oC to 105oC. Density of material shall not be less than 0.06 gm/cm3. The insulation shall have fire performance such that it passes minimum CLASS 1 as per BS476 part 7 for surface spread of flame. Water vapour permeability shall not exceed 0.024 perm inch (3 x 10-14 Kgs / m.sec.Pa). The material shall have approval from the Chief Fire Officer.

Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer test certificate for thermal conductivity values. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for

Thermal conductivity and density at Contractor's cost all joints shall be sealed properly with adhesive, which shall provide similar vapour barrier as the original insulating material.

All hot water piping shall be insulated in the manner specified herein. Before applying insulation, all pipes shall be brushed and cleaned. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity:

Pipe size (mm)	Thickness of Nitrile Rubber Insulation
15 mm to 25 mm	9 mm
32 mm to 50 mm	13 mm
65 mm and above	19 mm

Insulation for pipes in wall chase and for pipes in shaft /terrace

Insulating material in tube form shall be sleeved on the pipes. On existing piping, slit opened tube from insulating material shall be placed over the pipe and adhesive (as recommended by the manufacturer) shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards centre.

Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The insulation shall be continuous over the entire run of piping, fittings and valves. All valves, fittings, joints, strainers etc. in hot water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labeled (HWS / HWR / HWRR) and provided with 300 mm wide band of paint along circumference at every 1200 mm for colour coding. Direction of fluid shall also be marked. All painting shall be as per relevant BIS codes.

### **Protective Coating Over Insulation**

To provide mechanical strength and protection from damage all exposed pipe insulated with nitrile rubber as indicated in BOQ shall be covered with fibreglass fabric. The fibreglass fabric shall be applied with one coat of fire proof epoxy or acrylic compound (resin & hardner). The coat shall be allowed to cure to non stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface.

### **Measurement of Insulation**

Unless otherwise specified measurement for pipe insulation for the project shall be on the basis of centre line measurements described herewith

Pipe Insulation shall be measured in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers shall not be separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including valves, orifice plates and strainers etc. shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

## **SECTION - 04 :: INTERNAL DRAINAGE (SOIL, WASTE, VENT & RAIN WATER PIPES)**

### **1. SCOPE**

The scope of this section comprises the supply, installation, testing and commissioning of internal drainage services.

Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the schedule of quantities.

### **2. BASIC PIPING SYSTEM**

Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than and upto 50mm dia shall be of heavy class GI.

The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout GI clamps in two sections, bolted together, built into the walls, wedged and neatly jointed as directed and approved by the Owner's site representative / Architect. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the

walls on suitable wooden cradles. Local authority regulations applicable to the installations shall be strictly followed.

Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanised mild steel pipes. Pipes shall be fixed, jointed and painted as described in installation of soil, waste & vent pipes.

Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that atleast one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanised mild steel pipes, conforming to the requirements laid down earlier. Anti-syphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanised mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.

All traps on branch soil and waste pipes shall also be ventilated at a point not less than 75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.

Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawings so that other agencies are instructed to provide the same.

All the fittings used for connections between soil, waste and ventilation pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.

Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.

Head (starting point) of drains and sewage / waste water sumps (as and where applicable) having a length of greater than 4 m upto it connection to the main drain or manhole shall be provided with a 80 / 100 mm vent pipe.

### **3. PIPING MATERIALS**

#### **3.1UPVC Pipes and Fittings**

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, and free from groovings and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS: 13592. The pipes shall be of Class-III.

#### Fittings

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to Indian Standard.

#### Laying and Jointing

The pipes shall be laid and clamped to wooden plugs fixed above the surface of the wall. Alternatively plastic clamps of suitable designs shall be preferred. Provision shall be made for the effect of thermal

movement by not gripping or disturbing the pipe at supports between the anchors for suspended pipes. The supports shall allow the repeated movements to take place without abrasion.

#### Supports

UPVC pipes require supports at close intervals. Recommended support spacing for unplasticised PVC pipes is 1400 mm for pipes 50 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

#### Repairs

While temporary or emergency repairs may be made to the damaged pipes, permanent repairs shall be made by replacement of the damaged section. If any split or chip out occur in the wall of the pipe, a short piece of pipe of sufficient length to cover the damaged portion of the pipe is cut. The sleeve is cut longitudinally and heated sufficiently to soften it so that it may be slipped over the damaged hard pipe.

### **4. PIPES HANGERS, SUPPORTS, CLAMPS ETC.**

All vertical pipes shall be fixed by galvanized clamps and galvanized angle brackets truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

Horizontal pipes running along ceiling shall be fixed on galvanized structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.

Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surfaces.

All pipes clamps, supports and hangers shall be galvanized. Factory made prefabricated clamps shall be preferred. Contractor may fabricate the clamps of special nature and galvanize them after fabrication but before installation. All nuts, bolts, washers and other fasteners shall be factory galvanized.

Clamps shall be of approved design and fabricated from MS flats (which shall be galvanized after fabrication) of thickness and sizes as per drawings or contractor's shop drawings. Clamps shall be fixed in accordance to manufacturer's details/shop drawings to be submitted by the contractors.

When required to be fixed on RCC columns, walls or beam they shall be fixed with approved type of galvanized expansion anchor fasteners (Dash fasteners) of approved design and size according to load.

Structural clamps e.g.. trapeze or cluster hangers shall be fabricated by electro-welding from MS structural members e.g. rods, angles, channels flats as per contractors shop drawings shall be galvanized after fabrication. All nuts, bolts and washers shall be galvanized.

Galvanized slotted angle/channel of approved sizes supports on walls shall be provided wherever shown on shop drawings. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with anchor fasteners mentioned above. The spacing of support bolts on support members fixed horizontally shall not exceed 1 m.

## 5. INSTALLATION OF SOIL, WASTE & VENT PIPES

Soil, waste & vent pipes in shafts under the floors / suspended below slab shall consist of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be GI pipes and fittings.

All Horizontal pipes running below the slab and along the ceiling, shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

All cast iron pipes and fittings shall be jointed with drip seal / Best Quality pig lead free from impurities confirming to IS 27.

Before jointing, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten Lead shall be poured to the remainder of the socket.

The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes upto 100mm dia and 50mm for the pipes beyond 100mm dia respectively.

The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

### Rainwater Pipes

All open terraces shall be drained by rain water down takes.

Rainwater down takes are separate and independent of the soil and waste system and will discharge into the underground storm water drainage system of the complex.

Rainwater in open courtyards shall be collected in catch basins and connected to the Storm Water Drains.

Any dry weather flow from waste appliances, e.g. AHU's pump rooms, waste water sumps shall connected to sewers after traps and not in the storm water drainage systems.

### Balcony / Planter drainage

Wherever required, all balconies, terraces, planters and other frontal landscape areas will be drained by vertical down takes or other type of drainage system shown on the drawings and directed by the Project Manager.

## **6. TRAPS**

### **6.1 Floor Traps**

Floor traps where specified shall be siphon type full before P or S type iron having a minimum 50 mm deep seal. The trap and waste pipes when buried below ground shall be set and encased in cement concrete blocks firmly supported on firm ground or when installed on a sunken RCC structural slab. The blocks shall be in 1:2:4 mix (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size).

Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30 x 30 cms of the required depth.

### **6.2 Floor Trap Inlet /Hopper**

Bath room traps and connection shall ensure free and silent flow of discharging water. Where Floor trap inlet and the traps shall be set in cement concrete blocks where burried in floors without extra charge.waste connection to each floor trap shall be through multi connector fitting.

### **6.3 Floor Trap Grating**

Floor and urinal traps shall be provided with 100 – 150 mm square or round stainless steel gratings, with frame and rim of approved design and shape or as specified in the schedule of quantities approved by the Owner's site representative.

### **6.4 Cleanout Plugs**

#### **Floor Clean Out Plug**

Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Cleanout plugs shall terminate flush with the floor level.

#### **Cleanout on Drainage Pipes**

Cleanout plugs shall be provided on head of each drain and in between at locations indicated on plans or directed by Owner's site representative. Cleanout plugs shall be of size matching the full bore of the pipe but not exceeding 150 mm dia CO plugs on drains of greater diameters shall be 150 mm dia. Fixed with a suitable reducing adapter.

Floor cleanout plugs shall be cast brass.

Cleanouts provided at ceiling level pipe shall be fixed to a end cap.

## **7. PIPE SLEEVES**

Pipe sleeves, next larger diameter than pipes shall be provided wherever pipes pass through walls & slabs and annular space filled with fiberglass & finished with retainer rings. 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 pipe shall be closed as the pipe is installed to avoid entrance of foreign matter.



## **8. PIPE PROTECTION**

Soil and waste pipes under floor in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 stone aggregate of 12 mm size) 10 cm bed and around. When pipes are running well above the structural slabs, the encased pipes shall be supported with suitable cement concrete pillars of required height and size at intervals directed by the Project Manager.

## **9. CUTTING AND MAKING GOOD**

Pipes shall be fixed and tested as building proceeds. The contractor shall provide all necessary holes, cutouts and chases in structural members as building work proceeds. Wherever holes are cut or left originally they shall be made good with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm nominal size) or cement mortar 1:2 (1 cement : 2 coarse sand). Cured and the surface restored to original condition.

## **11. TESTING**

Testing shall be done in accordance with IS:

Entire drainage system shall be tested for water tightness and smoke tightness during and after completion of the installation. No portion of the system shall remain untested. Contractor must have adequate number of expandable rubber bellow plugs, manometers, smoke testing machines, pipe and fitting work tests,

All materials obtained and used on site must have manufacturer's hydraulic test certificate for each batch of materials used on the site.

Before use at site all pipes shall be tested by filling up with water for at least 15 minutes. After filling, pipes shall be for blow holes and cracks. All defective pipes shall be rejected and removed from the site within 48 hours.

Soil and waste pipes shall be tested in sections after installation, by filling up the stack with water. All openings and connections shall be suitably plugged as approved by the Project Manager. The total head in the stack shall be 4.5 m at the highest point of the section under test. The period of test shall be minimum for 15 minutes or as directed by the Project Manager. If any leakage is visible, the defective part of the work shall be cut out and made good.

After the installation is fully complete, it should be tested by flushing the toilets, running atleast 20% of all taps simultaneously and ensuring that the entire system is self draining, has no leakages, blockages etc. rectify and replace where required.

A test register shall be maintained and all entries shall be signed and dated by the Contractor and the Project Manager or his representative.

All pipes in wall chase or meant to be encased or burried shall be hydro tested before the chase in plastered or the pipe encased or burried.

## **SECTION – 05 :: EXTERNAL DRAINAGE (SEWAGE & STORM WATER DISPOSAL)**

### **1. SCOPE**

The scope of this section comprises the supply, installation, testing and commissioning of external drainage & sewage disposal services.

#### **1.1 General Scheme**

The contractor shall install a drainage system to effectively collect; drain and dispose all soil and waste water from various parts of the buildings, appurtenances and equipment. The piping system shall finally terminate and discharge into the municipal sewer manhole. The piping work mainly consists of laying of pipes. All piping shall be installed at depth greater than 50 cm below finished ground level. The disposal system shall include construction of gully traps, manholes, intercepting chambers as indicated. The piping system shall be vented suitably at the starting point of all branch drains, main drains, the highest/lowest point of drain and at intervals as shown. All ventilating arrangements shall be unobstructive and concealed. The work shall be executed strictly in accordance with IS: 1742. The sewage system shall be subject to smoke test for its soundness as directed by the Project Manager. Wherever the sewerage pipes run above water supply lines, same shall be completely encased in cement concrete 1:4:8 all round with the prior approval of the Project Manager.

Without restricting to the generality of the foregoing, the drainage system shall inter-alia include:

- a. Sewer lines including earth work for excavation, disposal, back filling and compaction, pipe lines, manholes, drop connections and connections to the municipal sewer.
- b. Storm water drainage, earth works for excavation, disposal, backfilling and compaction, pipe lines, manholes, catch basins and connections to the rain water harvesting tank/ existing municipal storm water drain or connected as indicated by the Project Manager.

#### **General Requirements**

All materials shall be new and of quality conforming to specifications and subject to the approval of the Owner's site representative. Wherever particular makes are mentioned, the choice of selection shall remain with the Architect / Consultant / Owner's site representative.

Drainage lines and open drains shall be laid to the required gradients and profiles.

All drainage work shall be done in accordance with the local municipal bye-laws.

Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority.

Location of all manholes, etc shall be got confirmed by the Project Manager before the actual execution of work at site. As far as possible, no drains or sewers shall be laid in the middle of road unless otherwise specifically shown on the drawings or directed by the Project Manager in writing.

All materials shall be rust proofed; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

## **2. TRENCHING FOR PIPES AND DRAINS**

### **2.1 General**

All the material shall be new of best quality conforming to specifications and subject to the approval of the Architects. Drainage lines shall be laid to the required gradients and profiles. All drainage work shall be done in accordance with the local municipal by-laws.

Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority. Location of all manholes, catch basins etc. shall be finalized and shown in approved shop drawings before the actual execution of work at site. All work shall be executed as directed by the Project Manager.

### **2.2 Alignment & Grade**

The sewer and storm water drainage pipes shall be carefully laid to levels and gradients shown in the plans and sections but subject to modifications as shall be ordered by the Architects from time to time to meet the requirements of the works. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in straight lines without vertical or horizontal undulations. The body of the pipes shall rest on an even bed in the trench for its length and places shall be excavated to receive collar for the purpose of jointing. No deviations from the lines, depths of cuttings or gradients as called for on the drawings shall be permitted without the written approval of the Architect. All pipes shall be laid at least 60cms below the finished ground level or as called for on the drawings.

### **2.3 Setting out Trenches**

The contractor shall set out all trenches, manholes, chambers and such other works to true grades and alignments as called for. He shall provide the necessary instruments for setting out and verification for the same. All trenches shall be laid to true grade and in straight lines and as shown on the drawings. The trenches shall be laid to proper levels by the assistance of boning rods and sight rails which shall be fixed at intervals not exceeding 10 meters or as directed by the Project Manager.

### **2.4 Trench Excavation**

The trenches for the pipes shall be excavated with bottoms formed to level and gradients as shown on the drawings or as directed by the Project Manager. In soft and filled in ground, the Project Manager may require the trenches to be excavated to a greater depth than the shown on the drawings and to fill up such additional excavation with concrete (1:4:8) consolidated to bring the excavation to the required levels as shown on the drawings.

All excavations shall be properly protected where necessary by suitable timbering, piling and sheeting as approved by the Project Manager. All timbering and sheeting when withdrawn shall be done gradually to avoid falls. All cavities be adequately filled and consolidated. No blasting shall be allowed without prior approval in writing from the Architect. It shall be carried out under thorough and competent supervision, with the written permission of the appropriate authorities taking full precautions connected with the blasting operations. All excavated earth shall be kept clear of the trenches to a distance equal to 75 cms.

### **2.5 Timbering of Sewer and Trenches**

The Contractor shall at all times support efficiently and effectively the sides of all the trenches and other excavations by suitable timbering, piling and sheeting and they shall be close timbered in loose or sandy starta and below the surface of the sub soil water level.

All timbering, sheeting and piling with their wallings and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.

The Contractor shall be held responsible and shall be accountable for the sufficiency of all timbering, bracings, sheeting and piling used and also for, all damage to persons and property resulting from improper quality strength placing, maintaining or removing of the same.

2.6 **Shoring of Buildings**

The Contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons or property resulting from any accident.

2.7 **Obstruction Road**

The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall then be left for public and private transit. He shall remove the materials excavated and bring them back again when the trench is required to be refilled. The contractor shall obtain the consent of the Project Manager in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

2.8 **Protection of Pipes etc**

All pipes, water mains, cables etc. met in the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the cables, the removal of which shall be arranged by the contractor with the written consent from the Project Manager.

2.9 **Trench Back Filling**

Refilling of the trenches shall not be commenced until the length of pipes therein has been tested and approved. All timbering which may be withdrawn safely shall be removed as filling proceeds. Where the pipes are unprotected by concrete hunching, selected fine material shall be carefully hand-packed around the lower half of the pipes so as to buttress them to the sides of the trench.

The refilling shall then be continued to 150mm over the top of the pipe using selected fine hand packed material, watered and rammed on both sides of the pipes with a wooden hammer. The process of filling and tamping shall proceed evenly in layers not exceeding 150mm thickness, each layer being watered and consolidated so as to maintain an equal pressure on both sides of the pipe line. In gardens and fields the top solid and turf if any, shall be carefully replaced.

2.10 **Contractor to restore settlement and Damages**

The contractor shall at his own costs and expenses, make good promptly during the whole period for the works in hand if any settlement occurs in the surfaces of roads, beams, footpaths, gardens, open spaces etc. in the public or private areas caused by his trenches or by his other excavations and he shall be liable for any accident caused thereby. He shall also, at his own expense and charges, repair (and make good) any damage done to building and other property. If in the opinion of the Project Manager he fails to make good such works with all practicable dispatch, the Project Manager shall be at his liberty to get the work done by other means and the expenses thereof shall be paid by the contractor or deducted from any money that may be or become due to him or recovered from him by any other manner according to the laws of land.

The contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled, surplus soil shall be immediately removed, the surface shall be properly restored and roadways and sides shall be left clear.

#### 2.11 **Removal of Water from Sewer, Trench etc.**

The contractor shall at all times during the progress of work keep the excavations free from water which shall be disposed by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any road or streets, nor cause any interference with the use of the same by the public.

If any excavation is carried out at any point or points to a greater width of the specified cross section of the sewer with its cover, the full width of the trench shall be filled with concrete by the contractor at his own expense and charges to the requirements of the Project Manager.

#### 2.12 **Removal of Filth**

All night soil, filth or any other offensive matter met with during the execution of the works, shall not be deposited on the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be immediately, after it is taken out of any trench, sewer or cess pool, put into the carts and removed to a suitable place to be provided by the Contractor.

#### 2.13 **Width of Trench**

The Project Manager shall have power by giving an order in writing to the Contractor to increase the maximum width/depth for excavation and backfilling in trenches for various classes of sewer, manholes and other works in certain length to be specifically laid down by him, where on account of bad ground or other unusual conditions, he considers that such increased width/depths are necessary in view of the site conditions.

### **3. PIPING MATERIAL**

#### 3.1 **RCC pipes**

All pipes shall be centrifugally spun RCC pipes NP2. Pipes shall be true and straight with uniform bore throughout. Cracked, warped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, prior to use on site, a certificate to that effect from the manufacturer.

The pipes shall be with or without reinforcement as required and of the class as specified. These shall conform to IS:458-1971.

All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.

#### **Laying**

RCC spun pipes shall be laid on cement concrete bed of cradles as specified and shown on the detailed drawings. The cradles may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12 mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Project Manager.

### **Jointing**

Semi flexible type collar joint.

Hemp rope soaked in neat cement wash shall be passed round the joint and inserted in it by means of caulking tool. More skein of yarn shall be added and rammed home. Cement mortar with one part of cement and two part of sand and with minimum water content but on no account soft or sloppy, shall be carefully inserted, punched and caulked into the collar and more cement mortar added until the space of the collar has been filled completely with tightly caulked mortar. Provision of rubber sealing ring in the collar joint shall also be made. The joint shall then be finished off neatly outside the socket at an angle of 45 deg.

### **Curing:**

The joint shall be cured for at least seven days. Refilling at joints will be permitted only on satisfactory completion of curing period.

### **Cement Concrete for Pipe Supports:**

- a. Unless otherwise directed by the Project Manager cement concrete for bed, all round or in haunches shall be as follows:

	<b>upto 1.5 m depth</b>	<b>upto 3 m depth</b>
Stoneware pipes buried in open ground (No sub soil water)	All round (1:3:6)	In Haunches (1:3:6)
RCC or SW in sub soil water	All round (1:3:6)	In Haunches (1:3:6)
PVC / HDPE pipe	All round (1:4:8)	In Haunches (1:3:6)
All pipes under building	All round (1:2:4)	All round (1:2:4)

- b. b. Pipes may be supported on brick masonry or precast RCC or in situ cradles. Cradles shall be as shown on the drawings.
- c. c. Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

### **Measurement:**

- a. Excavation : Measurement for excavation of pipes trenches shall be made per linear meter.
- b. Trenches shall be measurement between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth upto 1.5 metre or as given in the Bill of Quantities.
- c. Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the Bill of Quantities and above the rate for depth upto 1.5 m.

- d. c. RCC pipes shall be measured for length of the pipe line per linear meter.
  - i. Length between manholes shall be recorded from inside of one manhole or inside of other manhole.
  - ii. Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

### 3.2 **UPVC Pipes and Fittings**

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, free from groovings and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter.

#### Fittings

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to Indian Standard.

#### Laying in Trenches

UPVC pipes shall be laid on cement concrete bed of width 300mm over the outside diameter of pipe, and 100 mm thickness. Fine sand shall be carefully filled around the lower half of the pipes so as to buttress them to the sides of the trench.

The filling shall then be continued to 150mm over the top of the pipe using fine sand, watered and rammed on both sides of the pipes. The process of filling and ramming with fine hand picked material shall proceed evenly in layers not exceeding 150mm thickness, each layer being watered and consolidated so as to maintain an equal pressure on both sides of the pipe line.

#### S.W. Gully Trap

Gully trap shall be stoneware conforming to IS:651. These shall be sound and free from visible defects such as fire cracks, or hair cracks. The glaze of the traps shall be free from cracks. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters. Each gully trap shall have one CI grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight CI cover with frame inside dimensions 300 x 300mm the cover weighing not less than 4.5 kg and the frame not less than 2.7kg. The grating cover and frame shall be of good casting and shall have truly square machined seating faces.

#### Fixing of S.W. Gully Trap

The excavation for gully traps shall be done true to dimensions and levels as indicated on plans or as directed by the Project Manager /Consultant / Architect. The gully traps shall be fixed on cement concrete foundation 65cm square and not less than 10cm thick. The mix for the concrete will be 1:4:8. The jointing of gully outlet to the branch drain shall be done similar to the jointing of S.W. Pipes described earlier. After fixing and testing gully and branch drain, a brick work of specified class in cement mortar 1:5 shall be built with a half brick masonry work round the gully trap from the top of the bed concrete upto ground level. The space between the chamber and trap shall be filled in with cement concrete 1:3:6. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside the cement mortar 1:3 finish with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating.

CI cover with frame 300 x 300 mm (minimum inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 and rendered smooth. The finished top cover shall be so as to prevent the surface water from entering the gully trap.

#### Measurements

Gully traps shall be measured by the number and rate which shall include all excavation, foundation, concrete, brick masonry, cement plaster inside and outside, C I grating and sealed cover and frame.

#### **4. CONSTRUCTION OF MANHOLE**

Where manholes are to be constructed, the excavation, filling back and ramming, disposal of surplus earth, preparation of bottom and sides etc. shall be carried out as described earlier under trench excavation. Manhole shall be sized and depths as called for in the drawings and Bill of Quantities.

The manhole shall be built on a base concrete 1:4:8 of 150mm thickness for manholes upto 1500mm depth and 250mm thickness for manholes from 1500 to 2500mm depth and 300mm thickness manholes of depth greater than 2500mm. Reinforcement as shown shall be provided in the base slabs.

The walls shall be of brick work of thickness as shown in drawings built in cement mortar 1:5. The joints of brick work shall be raked and plastered internally in cement mortar 1:3 (at least 12 mm thick) and finish with a coat of neat cement, external plaster shall be rough plaster in 1:3, PCC benching & semi circular channels of the same diameter as the pipes shall be provided and finished with neat cement coating.

Above the horizontal diameter, the sides of channel shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be suitably rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junction with the main channel an appropriate fall suitably rounded off in the direction of flow in the main channel shall be given. All manholes / sumps shall be provided with poly propylene coated steel reinforced foot rest. The polypropylene shall confirm to ASTM D-4101 specification, injection moulded around 12 mm dia IS-1786 grade FE-415 steel reinforcing bar. These rungs shall be set at 30cms interval in two vertical runs at 380mm apart horizontally. The top rung shall be 450mm below the manhole cover. Unless otherwise mentioned, manholes shall be constructed to the requirements of Indian Standard IS:4111 (Part I). All manholes shall be constructed so as to be water tight under test. All angles shall be rounded to a 75mm radius with cement plaster 20mm thick. The benching at the side shall be carried out in such a manner so as to provide no lodgment for any splashing in case of accidental flooding. Manhole cover with frame shall be of cast iron of an approved make. The covers and frame shall generally be double seal as specified in the Bill of Quantities.

#### **4.1 Measurements**

Manhole shall be measured in numbers as indicated in the Bill of Quantity. The depth of manhole shall be measured from invert of channel to the top of manhole cover.

Manhole with depth greater than specified under the main item shall be paid for under 'Extra Depth' and shall include all items as given for manholes depth will be measured



to the nearest cm. Depth of the manholes shall be measured from top of the manhole cover to bottom of channel. The following are inclusive in the cost of manhole viz;

- i. Bed concrete
- ii. Brick work.
- iii. Plastering (inside & outside)
- iv. R C C top slab, benching and channeling including drop connections.
- v. Supply and fix foot rests.
- vi. Keeping holes and embedding pipes for all the connections.
- vii. Excavation, refilling, necessary de-watering and disposing off surplus soil to a places as directed by Project Manager.
- viii. Curing.
- ix. Cost of angle frame and embedding the frame in concrete bed.
- x. Testing.
- xi. De-watering of chambers.

#### 4.2 **Drop Connection**

Drop connection shall be provided between branch sewer and main sewer in the main sewer itself in steep ground when the difference in invert level of two exceeds 60 cms of the required sizes. Drop connections from gully traps to main sewer in rectangular shall be made inside the manholes and shall have CI special types door bend on to top and heel rest bend at bottom connected by a CI pipe. The pipe shall be supported by holder bat clamps at 180 cms intervals with atleast one clamp for each drop connection. All joints shall be lead caulked joints 25mm deep.

Drop connections from branch sewer to main sewer shall be made outside the manhole wall with CI / CI class LA pipe, connection, vertical pipe and bend at the bottoms. The top of the tee shall be finished upto the surface level and provided with a CI hinges type frame and cover 30cms x 30cms. The connection and tee upto the surface chamber of the tee.

Drop connection made from vertical stacks directly into manholes shall not be considered as drop connections.

#### 4.3 **Making Connections**

Contractor shall connect the new sewer line to the existing manhole by cutting the walls benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manhole for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

### 5. GREASE TRAP

#### 5.1 **Size of Grease Trap**

The size given in Bill of Quantities and drawings shall be internal size of chamber. The work shall be done strictly as per standard drawing and following specifications.

#### 5.2 **Bed Concrete**

Shall be in 1:4:8 cement concrete 150 mm thick.

### 5.3 **Brick work**

Brick work shall be with best quality bricks in 1:5 CEMENT MORTAR.

Baffle walls shall be of R.C.C and of size as mentioned in Bill of Quantities. Brick partition constructed of best quality table moulded bricks in cement mortar 1:5 shall be provided for the entire height of chamber.

### 5.4 **Plaster**

The walls of chamber shall be plastered from inside with 12 mm thick cement plaster 1:3 and finished smooth with a floating coat of neat cement & rough plaster on outside in cement mortar 1:3.

### 5.5 **Chamber Covers**

Covers shall be of size and duty as mentioned in Bill of Quantities. Covers shall be of cast iron as per the details given in the drawing and shall be fixed on frame embedded in concrete.

C. Iplastic encapsulated steps shall be provided at inside of the chamber.

### 5.6 **Cast iron Manhole cover and Frame**

The Cast Iron Manhole Cover and Frame shall conform to IS:1726 and the grade and types have been specified in the Bill of Quantities. The cover and frames shall be cleanly cast and they shall be free from air and sand holes and from cold shuts. They shall be neatly dressed and carefully trimmed. All castings shall be free from voids whether due to shrinkage, gas inclusion or other causes. Covers shall have a raised checkered design on the top surface to provide an adequate non-slip grip.

The sizes of covers specified shall be taken as the clear internal dimensions of the frame.

The covers and frames shall be coated with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to a temperature of 63° C and shall not brittle as to chip off at a temperature of 0° C.

## 6. TESTING

All rights of the sewer and drain shall be carefully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subject to a test pressure of 1.5 meter head of water. The test pressure will however, not exceed 6 meters head at any point. The pipes shall be plugged preferably with standard design plugs or with rubber plugs on both sides, the upper end shall, however, be connected to a pipe for filling with water and getting the required head poured at one time.

Sewer lines shall be tested for straightness by:

- i. Inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball shall roll down the invert of the pipe and emerge at the lower end.

- ii. Means of a mirror at one end a lamp at the other end. If the pipe is straight the full circle of light will be seen otherwise obstructions or deviations will be apparent.
- iii. The contractor shall give a smoke test to the drain and sewer at his own expense and charges, if directed by the Owner's site representative.
- iv. A test register shall be maintained which shall be signed and dated by contractor and Owner's site representative.

## **SECTION - 7 :: FIRE PROTECTION SYSTEM**

### **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 for proposed buildings shall be supplied from existing fire fighting system.
- c. Fire Hydrant System (Pressurised) both for the external hydrants, the internal landing valves and the hose reels at landings.
- d. Sprinkler System (Wet Type)
- e. Contractor shall ensure that all false ceiling voids greater than 800 mm are provided with sprinklers.
- f. Contractor shall ensure Hydro Testing for the complete system.
- g. The Contractor shall obtain the necessary approval of the drawings and the schemes from the local authority 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.
- h. 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. PIPE WORK**

### **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 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 2 layers of 400 micron polythene sheet over 2 coats of bitumen.

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, whichever is highest including testing for water hammer effects.

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.

### 2.3 **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:

<b>Pipe Dia (mm)</b>	<b>Hanger Rod Dia (mm)</b>	<b>Spacing between Supports (m)</b>
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.

#### 2.4 **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.

#### 2.5 **Procedure for Pypkote Application**

- a. Surface Preparation - The pipe surface shall be cleaned by a wire brush.
- b. Application of Primer - Pypkote 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 Pypkote 4 mm 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 12.5 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.

## 2.6 **Jointing**

### 2.6.1 Welded Joints

Joints between MS pipes and fittings shall be 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.

All joints in the pipe line with screwed fittings shall be seal welded after testing and the weld plus the adjoining portion shall be given two coats of zinc rich primer.

### 2.6.2 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.

### 2.6.3 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.

## 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.

#### **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, 25 mm dia drain pipe, drain valve and shut off valve.

#### **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 and reflux 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.

#### **6. SYSTEM DRAINAGE**

The system shall be provided with suitable drainage arrangement with drain valves complete with all accessories.

#### **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.

## 8. VALVES

### 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 .

### 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 of high grade elastomer or nitrile rubber. 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.

### 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.

#### 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.

#### 8.5 **Non-Return Valve**

Non-Return valves shall be cast iron double flanged with cast iron body and gunmetal internal parts conforming to IS: 5312.

#### 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.

### 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.

### 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.

### 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.

## **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.

## **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.

## **14. FIRE HYDRANTS**

### **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 single 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 SS male and female instantaneous type couplings machine wound with GI wire (hose to IS:636 type certification) , SS 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".

## 14.2 **Internal Hydrants**

- a. Contractor shall provide on each landing and other locations as shown on the drawings double headed SS landing valve with 80 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 each of 63 mm dia. 15 m long reinforced rubber lined hose pipes with 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, 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 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".

## 14.3 **Hose Reel**

Hosereel 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.

## 14.4 **Fire Hose**

All hose pipes shall be of 63 mm diameter RRL, conforming to IS : 636 . The hose shall be provided with copper alloy delivery coupling. The hose shall be capable of withstanding a bursting pressure of 22 Kg/Sq.cm without undue leakage or sweating. Hose shall be provided with instantaneous spring-lock, type couplings.

#### 14.5 **Branch Pipe, Nozzle**

Branch pipes shall be of with loaded tin bronze ring at the discharge and to receive the nozzle and provided at the other with a leaded 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.

#### 14.6 **Hose Cabinet**

Hose cabinet shall be provided for all internal and external fire hydrants. Hose cabinets shall be fabricated from MS of fully welded construction with hinged double front door partially glazed (4 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.

#### 14.7 **Internal Hose Cabinet**

Hose cabinet shall be of glass fronted with hinged door & lock. The cabinet shall be made of aluminium 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 headed)
- ii. Hose pipe
- iii. Hose reel (36.5 mtr.)
- iv. Branch pipes, nozzles (1 sets)
- v. Fire man's axe and hand appliances

#### 14.8 **External Hose Cabinet**

The hose cabinet shall be of size to accommodate the following:

- i. Single headed yard hydrant valve
- ii. Hose pipe (2 length of 15 m)
- iii. Branch pipes, nozzles (1 set)
- iv. Fire man's axe

### 15. **SPRINKLER SYSTEM**

#### 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.

## 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 HFPA 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.

### 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.

### 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.

### 15.3 **Flow Requirements**

The flow requirement for sprinkler heads shall be specifically approved for the designated area of installation.

### 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.

### 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.

### 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.

### 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.

#### 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 25mm in height. The words shall be painted white on black background.
- 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.

#### 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 upto 50mm dia.
- 25 mm valves for 80mm dia pipe.
- 50 mm valves for pipes larger than 80mm dia.

#### 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.

### **16. HAND HELD FIRE EXTINGUISHERS**

#### 16.1 **Hand Appliances**

##### 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 consist 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.

#### 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.

#### 16.3 **Measurement**

Fire extinguishers shall be counted in numbers and include installation of all necessary items required as given in the specifications.

#### 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/cm<sup>2</sup>

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 upto 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/cm<sup>2</sup> for a minimum period of 2 minutes. The pressure gauge shall be imported and suited for the purpose.

#### 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/cm<sup>2</sup>. 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).

#### 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/cm<sup>2</sup> 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/cm<sup>2</sup>. 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/cm<sup>2</sup>

Control Valve: 125 Kg/cm<sup>2</sup>

Burst Pressure of Hose: 140 Kg/cm<sup>2</sup> 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.

#### **SECTION - 8 :: COMMISSIONING & GUARANTEE**

##### **1. SCOPE OF WORK**

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Architect or his representative or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.

Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rota meters. Contractor shall also supply all required pressure gauge, temperature gauge & rotameter for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Project Manager.

Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

## 2. PRECOMMISSIONING

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

- a. Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fittings and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
- b. All strainers shall be inspected and cleaned out or replaced.
- c. When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
  - Remove oil, grease and foreign residue from the pipe work and fittings;
  - Pre-condition the metal surfaces to resist reaction with water or air.
- d. Establish an initial protective film;
  - After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
  - Details and procedures of the pre-treatment shall be submitted to the Architect for approval.
- e. Check all clamps, supports and hangers provided for the pipes. Check all the equipment, piping and valves coming under hot water system and operate each and every valve on the system to see if the valves are functioning properly. Thereafter conduct & hydro test of the system as for (b) above.
- f. Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

### **Fire Protection System**

- a. Check all hydrant valves by opening and closing : any valve found to be open shall be closed.
- b. Check all the piping under hydro test.
- c. Check that all suction and delivery connections are properly made for all pump sets.
- d. Check rotation of each motor after decoupling and correct the same if required.
- e. Test run each pump set.

- f. All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).

### **Commissioning and Testing**

- a. Pressurise the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump , then
- b. Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.
- c. Open hydrant valve and allow the water to below into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However the jockey pump shall cut-out as soon as the main pump starts,
- d. Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump,
- e. When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage.
- f. Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replace by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.
- g. Check all annunciations by simulating the alarm conditions at site.

### **Sprinkler System**

- a. Start the sprinkler pump and develop the required pressure in the sprinkler pipes.
- b. Open the test valve to test the automatic starting of the pump. If necessary , make necessary adjustments in the setting of pressure switch. The sprinkler water gong alarm shall also operate when the test valve is open. This operation is to be done for each and every section of the sprinkler system and the alarm for each section (via flow switch) shall be checked for operation.
- c. After satisfactory operation of the pump the Contractor shall set up mock fire and test the system.
- d. Check all annunciations by simulating the alarm conditions at site.

### **3. STATUTORY AUTHORITIES' TESTS AND INSPECTIONS**

As and when notified in writing or instructed by the Architect, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect as a result of such tests and inspections where these indicate non-compliance with Statutory

Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.

The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect for checking before submission.

The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Architect without delay.

#### **4. FINAL ACCEPTANCE TESTS**

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

#### **5. REJECTION OF INSTALLATION / PLANT**

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Architect.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

## 6. WARRANTY AND HANDOVER

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

## 7. HANDING OVER OF DOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

## 8. PIPE COLOUR CODE

S.No.	Pipe Lines	Ground / Base Colour	First Colour Band	Second Colour Band
1.	Cooling Water	Sea Green	French Blue	
4.	Drinking Water (All cold water lines after filter)	Sea Green	French Blue	Single Red
5.	Treated Water (Soft Water)	Sea Green	Light Orange	
6.	Domestic Hot Water	Sea Green	Light Grey	
9.	Drainage (Storm Water)	Black		
10.	Drainage (Sewage Water)	Brown		
12.	Fire System	Post Office Red		

## 9. CHECK LIST FOR COMMISSIONING

### Fire Protection System

- a. Check all hydrant & other valves by opening and closing. Any valve found to be open shall be closed.
- b. Check all clamps, supports and hangers provided for the pipes.
- c. All the pump sets shall be run continuously for 30 minutes (with temporary piping back to tank from the nearest hydrant, using canvas hose pipes).
- d. Fire Hydrant System - Pressurise the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump, then

Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.

Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However the jockey pump shall cut-out as soon as the main pump starts.

Operate booster pump continuously for 30 minutes with piping back to underground tanks from the hydrant nearest to plant room.

Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.

Check air cushion tanks on the terrace for proper functioning.

### **Water Supply / Water Treatment Equipment**

#### Common

- a. Operate each and every valve on the system to see if the valves are functioning properly.
- b. Check all clamps, support and hangers provided for the pipes.
- c. Check rotation of each motor and correct the same if required.
- d. All the pumps shall run continuously for one hour. Record the pressure and motor current and voltage readings.
- e. Check all annunciations by simulating the alarm conditions if any at site.

### **Water Supply and Drainage**

- a. Remove grease trap manhole covers. Check for cleanliness, check for partitions, and put back the cover.
- b. Remove manhole covers on sewer lines, inspect for cleanliness. After they are found to be clean, pour water into the first manhole and see that all the lines are clear. Make sure that all the covers are put back after the inspection.
- c. Check gully traps by opening of covers and check that water seal in the traps are maintained. Check for general cleanliness.
- d. Check installation of proper vents and cowls at the roof level for all soil and waste pipes.
- e. Performance test to be carried out and recorded in the following table for the pumps.



### **3. STATUTORY AUTHORITIES' TESTS AND INSPECTIONS**

As and when notified in writing or instructed by the Architect, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.

The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect for checking before submission.

The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Architect without delay.

### **4. FINAL ACCEPTANCE TESTS**

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

### **5. REJECTION OF INSTALLATION / PLANT**

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the

intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Architect.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

**6. WARRANTY AND HANDOVER**

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

**7. HANDING OVER OF DOCUMENTS**

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner’s site representative and all testing and commissioning documents shall be handed over to the Owner’s site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner’s site representative.

**8. PIPE COLOUR CODE**

S.No.	Pipe Lines	Ground / Base Colour	First Colour Band	Second Colour Band
1.	Cooling Water	Sea Green	French Blue	
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6.	Domestic Hot Water	Sea Green	Light Grey	
9.	Drainage (Storm Water)	Black		
10.	Drainage (Sewage Water)	Brown		
12.	Fire System	Post Office Red		

**LIST OF PLUMBING MAKES**

S. No.	Details of Materials / Equipments	Manufacturer's Name
1	Vitreous China Sanitaryware	: Jaquar/Hindware/ as approved
2	C.P. Brass fittings	: Jaquar/Hindware/ as approved
3	Cast iron pipes & fittings, Manhole covers and frames.	: NECO/RIF
4	G.I. pipes.	: Tata/Jindal Hissar/Prakash Surya
5	G.I. pipes fittings.	: K.S. / Unik / `R' Brand
6	R.C.C pipe	: K.K. / App. Equivalent ISI marked
7	Stoneware pipes, Gully traps	: Perfect potteries, Jabalpur / Approved equivalent ISI marked
8	Valves	: Zoloto / Leader/ C & R / Advance
9	Paints	: Asian Paints / Shalimar Paints /Berger
10	Pressure Gauge	: H Guru/Fiebig
11	Level Controller & Indicator (Water)	: Advance Auto/Technika / Minilec
12	PVC Pipes	: Supreme / Prince/Astral
13	Urinal Sensor	: UTEC System/Jaquar/Hindware
14	Geysers	: Venus/Racold/AO Smith
15	Sink	: Neelkanth/Kobra/Hindware
16	Water purifier	: Eureka Forbes/Kent
17	Water tanks	: Sintex/Frontier
18	CPVC Pipes	: Aashirwad/Finolex/Astral
19	Gratings,Cleanouts,Funnels	: GMGR/Neer/Jayna

## LIST OF FIRE FIGHTING MAKES

S. No.	Details of Materials / Equipments	Manufacturer's Name
1	G.I./M.S pipes.	: Jindal Hissar
2	MS forged fittings.	: VS/KS
3	Valves	: AUDCO/C& R/Advance/Zoloto
4	`Y' strainer	: Emerald Enterprises / Zoloto
5	Level Controller & Indicator (Water)	: Advance Auto/Technika / Minilec
6	Paints	: Asian Paints/Berger Paints
7	Pressure Gauge	: H Guru/Fiebig
8	Flexible Rubber Expansion Joint	: Kanwal Easyflex, Resistoflex
9	Pump	: Kirloskar
10	Fire Fighting Equipments	: Minimax/Safeguard
11	Sprinklers	: Tyco/Grinnel/Best/HD
12	Welding Rods	: Advani/Victor
13	GI Hangers	: Chilly/GMGR
14	Underground Pipe Protection	: IWC



**CRITERIA FOR EVALUATION OF THE PERFORMANCE OF CONTRACTORS FOR PRE-ELIGIBILITY**

	<b>Attributes</b>		<b>Evaluation</b>	
<b>(a)</b>	Financial strength (20 marks)		(i) 60% marks for minimum eligibility criteria	
	(i) Average annual Turnover	16 marks	(ii) 100% marks for twice the minimum eligibility criteria or more	
	(ii) Solvency Certificate	4 marks	In between (i) & (ii) – on pro-rata basis	
<b>(b)</b>	Experience in similar (20marks) class of works		(i) 60% marks for minimum eligibility criteria	
			(ii) 100% marks for twice the minimum eligibility criteria or more	
			In between (i) & (ii) – on pro-rata basis	
<b>(c)</b>	Performance on (20 marks) works (time over run)			
	Parameter	Calculation for	Score	Maximum Marks
		If TOR =	1.00 2.00 3.00 >3.50	20
	(i) Without levy of Compensation		20 15 10 10	
	(ii) With levy of compensation		20 5 0 -5	
	(iii) Levy of compensation not decided		20 10 0 0	
TOR = AT/ST, where AT=Actual Time; ST=Stipulated Time.				
<b>Note:</b> Marks for value in between the stages indicated above is to be determined by straight line variation basis.				
<b>(d)</b>	<b>Performance of works (Quality marks)</b>			<b>(40)</b>
	(i) Outstanding			40
	(ii) Very Good			30
	(iii) Good			20



**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**  
**FORM 'A'**

**FINANCIAL INFORMATION**

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

**Years**

<b>2013-14</b>	<b>2014-15</b>	<b>2015-16</b>	<b>2016-17</b>	<b>2017-18</b>

- (i) Gross Annual turnover on construction works.  
(ii) Profit/Loss.  
II. Financial arrangements for carrying out the proposed work.  
III. Solvency Certificate from Bankers of the bidder in the prescribed Form "B".

**Signature of Chartered Accountant with Seal**

**Signature of Bidder(s).**



**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**  
**FORM "B"**

**FORM OF BANKERS' CERTIFICATE FROM A SCHEDULED BANK**

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

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

**(Signature)**  
**For the Bank**

**NOTE: -**

- (1)** Bankers certificates should be on letter head of the Bank, sealed in cover addressed to tendering authority.
- (2)** In case of partnership firm, certificate should include names of all partners as recorded with the Bank.



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## FORM 'C'

### DETAILS OF ALL WORKS OF SIMILAR CLASS COMPLETED DURING THE LAST SEVEN YEARS ENDING LAST DAY OF THE MONTH DECEMBER, 2019

S.No	Name of work /project and location	Owner or sponsoring organization	Cost of work in crores of rupees	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation /arbitration cases pending/in progress with details*	Name and address/telephone No. of officer to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

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

Signature of Bidder(s)





**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**  
**FORM 'D'**

**PERFORMANCE REPORT OF WORKS REFERRED TO IN FORMS "B" & "C"**

1. Name of work/project & location

2. Agreement no.

3. Estimated cost

4. Tendered cost

5. Date of start

6. Date of completion

(i) Stipulated date of completion

(ii) Actual date of completion

**7. (a) Whether case of levy of compensation for delay has been decided or not -yes/no.**

**(b) If decided amount of compensation levied for delayed completion if any.**

8. Amount of reduced rate items, if any

9. Performance Report

(1) Quality of work : Outstanding /Very Good/Good/Fair/Poor

(2) Financial soundness : Outstanding /Very Good/Good/Fair/Poor

(3) Technical Proficiency : Outstanding /Very Good/Good/Fair/Poor

(4) Resourcefulness : Outstanding /Very Good/Good/Fair/Poor

(5) General Behaviour : Outstanding /Very Good/Good/Fair/Poor

**Dated:**

**Executive Engineer or Equivalent**



**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**  
**FORM "E"**

**STRUCTURE & ORGANISATION**

1. Name & address of the bidder
2. Telephone no. /Telex no. /Fax no.
3. Legal status of the bidder (attach copies of original document defining the legal status)
  - (a) An Individual
  - (b) A proprietary firm
  - (c) A firm in partnership
  - (d) A limited company or Corporation
4. Particulars of registration with various Government Bodies (attach attested photocopy)

**Organisation/Place of registration**

**Registration No.**

- 1.
- 2.
- 3.
- 4.

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

6. Designation of individuals authorized to act for the organization

**7. Has the bidder or any constituent partner in case of partnership firm Limited company/Joint Venture / Consortium ever been connected by the court of law of work.**

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

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

**Signature of Bidder(s)**

<b>List of Architectural Drawings</b>		
1	DAFFPL/MCMVPL/2020/ TD-01	Site Plan Layout
2	DAFFPL/MCMVPL/2020/ TD-02	Stilt Plan Layout
3	DAFFPL/MCMVPL/2020/ TD-03	First Floor Layout
4	DAFFPL/MCMVPL/2020/ TD-04	Second Floor Layout
5	DAFFPL/MCMVPL/2020/ TD-05	Third Floor Layout
6	DAFFPL/MCMVPL/2020/ TD-06	Terrace Layout
7	DAFFPL/MCMVPL/2020/ TD-07	Section Details
8	DAFFPL/MCMVPL/2020/ TD-08	Elevation Details
9	DAFFPL/MCMVPL/2020/ TD-09	Elevation Details
<b>List of Structural Drawings</b>		
1	ST-01	Foundation plan
2	ST -02	Foundation details
3	ST -03	Plinth Beam Framing Layout
4	ST -04	Plinth Beams Framing Details
5	ST -05	Staircase detail St-01
6	ST -06	Staircase detail St-02
7	ST -07	First Floor Lvl Framing Layout
8	ST-08	First Floor Lvl Beam Detail
9	ST -09	First Floor Lvl Slab R/F. Plan
10	ST -10	Second Floor Lvl Framing Layout
11	ST -11	Second Floor Lvl Beam Detail
12	ST -12	Second Floor Lvl Slab R/F. Plan
13	ST -13	Third Floor Lvl Framing Layout
14	ST -14	Third Floor Lvl Beam Detail
15	ST -15	Third Floor Lvl Slab R/F. Plan
16	ST -16	Terrace Floor Lvl Framing Layout
17	ST -17	Terrace Floor Lvl Beam Detail
18	ST -18	Terrace Floor Lvl Slab R/F. Plan
19	ST -19	Mumty Framing Plan and Details
20	ST -20	Boundary Wall Plan & Details
21	ST -21	Guard room Structural Details

<b>List of HVAC Drawings</b>		
1	DAFFPL/FDS/12056/HVAC/01	Stilt Floor HVAC Layout
2	DAFFPL/FDS/12056/HVAC/02	First Floor HVAC Layout
3	DAFFPL/FDS/12056/HVAC/03	Second Floor HVAC Layout
4	DAFFPL/FDS/12056/HVAC/04	Third Floor HVAC Layout
5	DAFFPL/FDS/12056/HVAC/05	Terrace HVAC Layout

<b>List of Plumbing and fire fighting Drawings</b>		
1	MCMVPL/DAFFPL/2020/ PL-Site-01	Site Plan Layout
2	MCMVPL/DAFFPL/2020/ PL-01	Stilt Floor Layout
3	MCMVPL/DAFFPL/2020/ PL-02	First Floor Layout
4	MCMVPL/DAFFPL/2020/ PL-03	Second Floor Layout
5	MCMVPL/DAFFPL/2020/ PL-04	Third Floor Layout
6	MCMVPL/DAFFPL/2020/ PL-05	Terrace Layout

<b>List of Electrical Drawings</b>		
1	MCMVPL/DAFFPL/2020/ E-01	Stilt Floor Receptable Layout
2	MCMVPL/DAFFPL/2020/ E-02	First Floor Receptable Layout
3	MCMVPL/DAFFPL/2020/ E-03	Second Floor Receptable Layout
4	MCMVPL/DAFFPL/2020/ E-04	Third Floor Receptable Layout
5	MCMVPL/DAFFPL/2020/ E-05	Terrace Receptable Layout
6	MCMVPL/DAFFPL/2020/ E-06	Site Plan Receptable Layout
7	MCMVPL/DAFFPL/2020/ E-07	Stilt Floor FA & PA Layout
8	MCMVPL/DAFFPL/2020/ E-08	First Floor FA & PA Layout
9	MCMVPL/DAFFPL/2020/ E-09	Second Floor FA & PA Layout
10	MCMVPL/DAFFPL/2020/ E-10	Third Floor FA & PA Layout
11	MCMVPL/DAFFPL/2020/ E-11	Terrace FA & PA Layout
12	MCMVPL/DAFFPL/2020/ E-12	Stilt Floor Lightning Protection Layout
13	MCMVPL/DAFFPL/2020/ E-13	Terrace Lightning Protection Layout
14	MCMVPL/DAFFPL/2020/ SC-01	Stilt, First & Third Floor Schematic Layout
15	MCMVPL/DAFFPL/2020/ SC-02	Second Floor Schematic Layout
16	MCMVPL/DAFFPL/2020/ SC-03	Terrace Schematic Layout




**NOTES:**

1. DO NOT SCALE THE DRAWING.
2. THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
3. ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
4. ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
5. ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
6. DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED



**SITE PLAN**

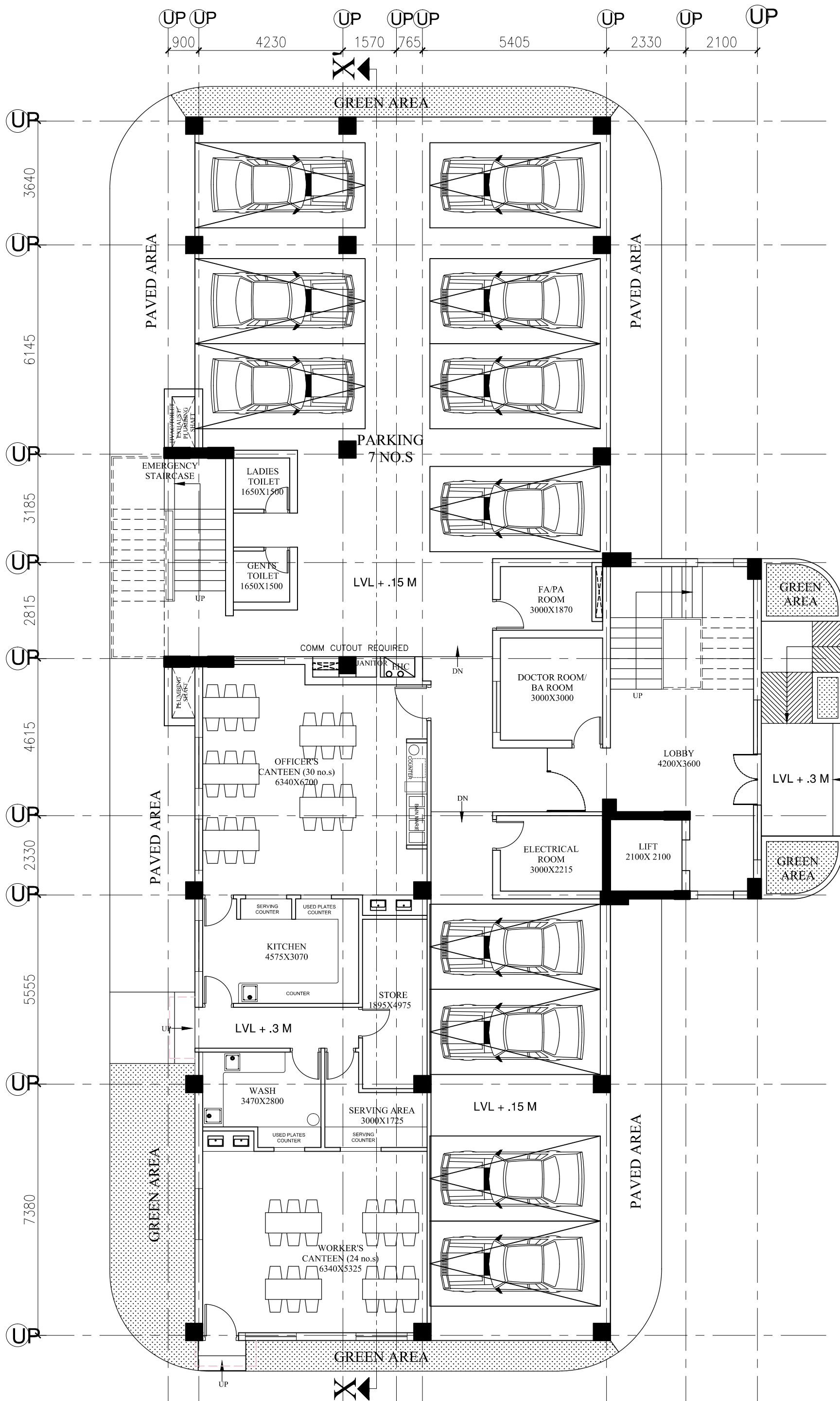
REV. NO.	DATE OF REV.	BY	DESCRIPTION

PROJECT	<b>ADMINISTRATIVE BUILDING</b>
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Vatika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com
STRUCTURE CONSULTANT	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352 . 011- 45650222.
DRAWING TITLE	<b>SITE PLAN</b>

SCALE :	NTS	DRAWN BY :	VAISHALI
DATE :	07-07-2020	CHECKED BY :	AMIT
REVISION NO. :	R0	APPROVED BY :	
DRAWING NO. : <b>DAFFPL/MCMVPL/2020/TD-01</b>			
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<input type="checkbox"/> FOR APPROVAL		<input type="checkbox"/> GOOD FOR CONSTRUCTION	

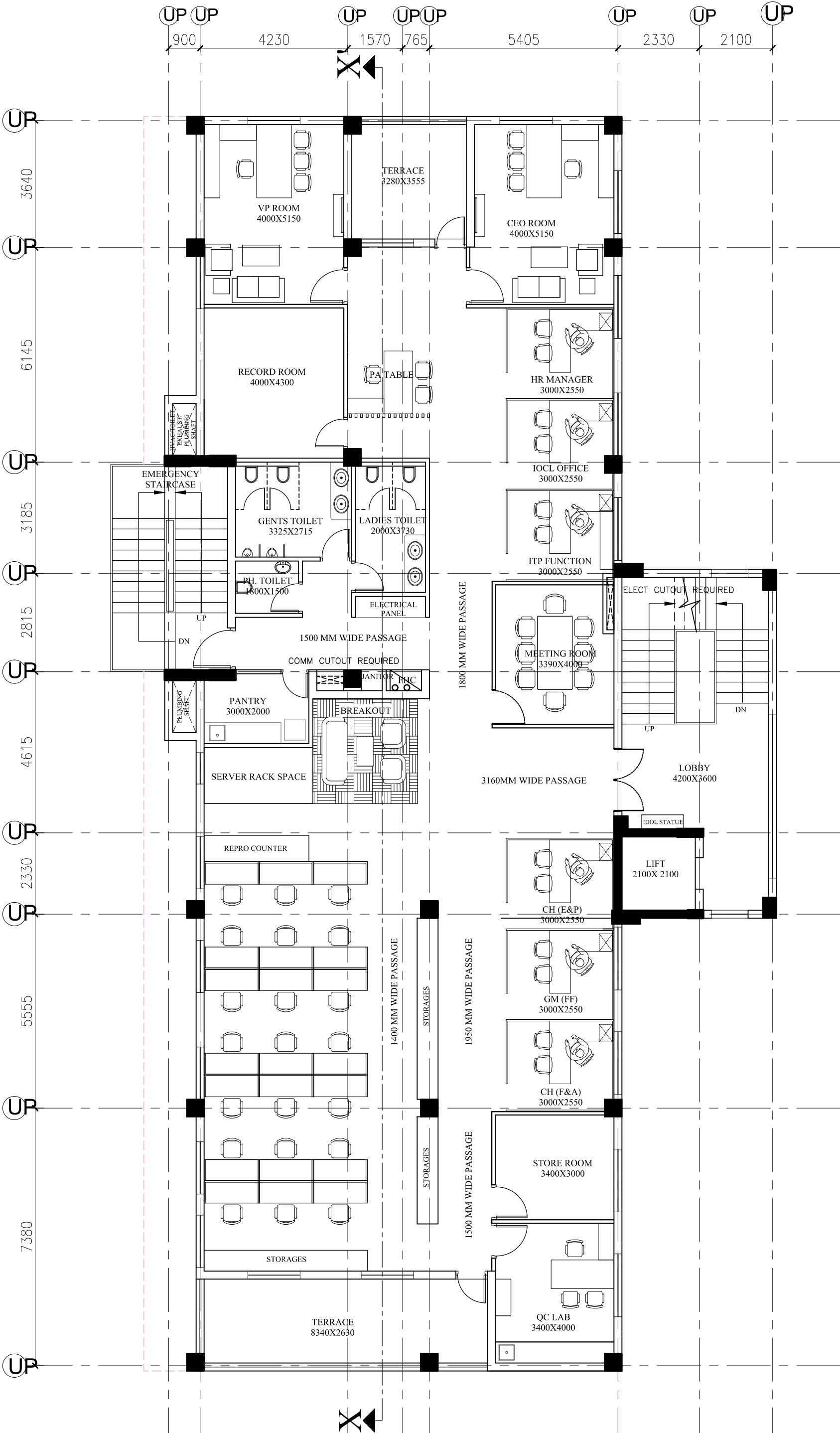
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REV. NO.	DATE OF REV.	BY	DESCRIPTION
PROJECT	ADMINISTRATIVE BUILDING		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Valika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com		
DRAWING STRUCTURE CONSULTANT	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352 . 011- 45650222.		
DRAWING TITLE	STILT FLOOR PLAN		
SCALE :	NTS	DRAWN BY : VAISHALI	
DATE :	07-07-2020	CHECKED BY : AMIT	
REVISION NO. :	RO	APPROVED BY :	
DRAWING NO :			
DAFFPL/MCMVPL/2020/TD-02			
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<input type="checkbox"/>	FDR APPROVAL	<input type="checkbox"/>	GOOD FOR CONSTRUCTION

**STILT FLOOR**



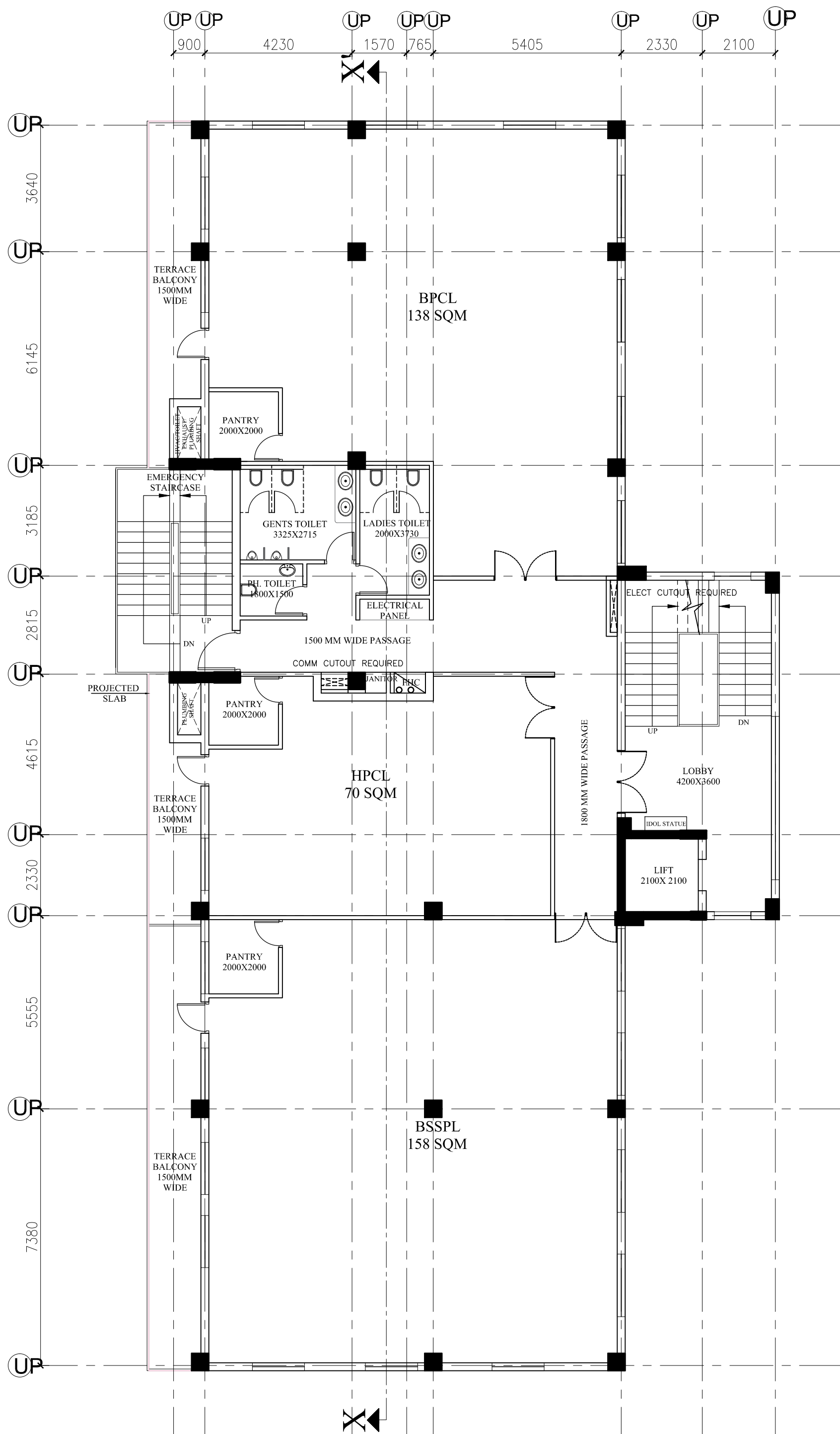
# FIRST FLOOR

- NOTES:**
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  - ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
  - ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
  - ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
  - DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

REV. NO.	DATE OF REV.	BY	DESCRIPTION
PROJECT	ADMINISTRATIVE BUILDING		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Vatika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com		
DRAWING STRUCTURE CONSULTANT	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352 , 011- 45650222.		
<b>DRAWING TITLE</b>			
<b>FIRST FLOOR PLAN</b>			
SCALE :	NTS	DRAWN BY : VAISHALI	
DATE :	07-07-2020	CHECKED BY : AMIT	
REVISION NO. :	RO	APPROVED BY :	
DRAWING NO :			
<b>DAFFPL/MCMVPL/2020/TD-03</b>			
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<input type="checkbox"/> FOR APPROVAL		<input type="checkbox"/> GOOD FOR CONSTRUCTION	

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REV. NO.	DATE OF REV.	BY	DESCRIPTION

**PROJECT**  
ADMINISTRATIVE BUILDING

**CLIENT**  
  
 D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTS**  
  
 MILLENNIUM VENTURES  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

**MEP CONSULTANTS**  
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 Gurgaon (HR)-122004  
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**STRUCTURE CONSULTANT**  
  
 ABL Structural Consultants Pvt. Ltd.  
 H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034,  
 Ph: 9811038352 . 011- 45650222.

**DRAWING TITLE**  
SECOND FLOOR PLAN

SCALE : NTS DRAWN BY : VAISHALI

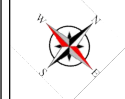
DATE : 07-07-2020 CHECKED BY : AMIT

REVISION NO. : R0 APPROVED BY :

DRAWING NO :

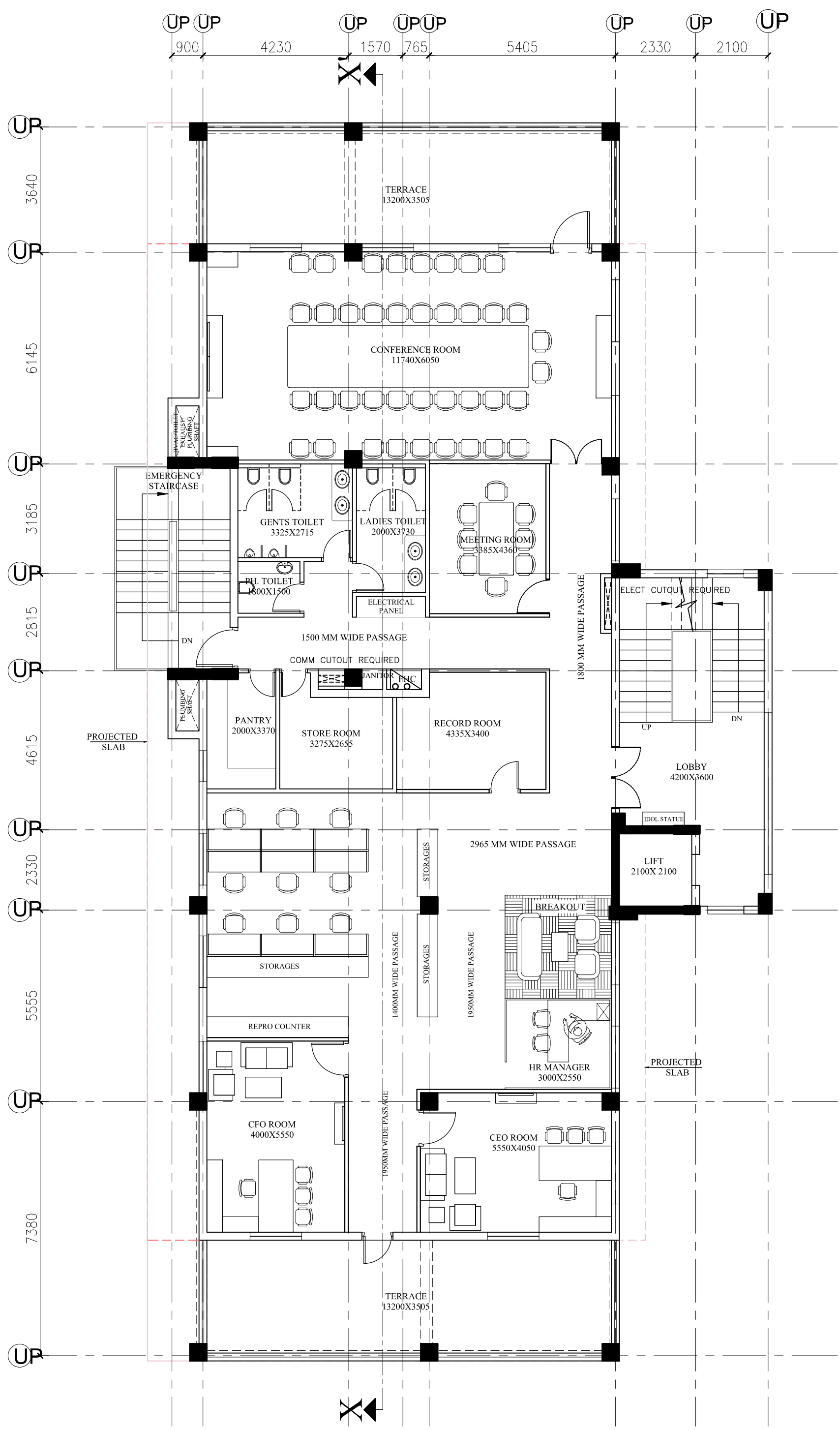
DAFFPL/MCMVPL/2020/TD-04

FOR TENDER  ADVANCE COPY  
 FOR APPROVAL  GOOD FOR CONSTRUCTION



**SECOND FLOOR**








# THIRD FLOOR

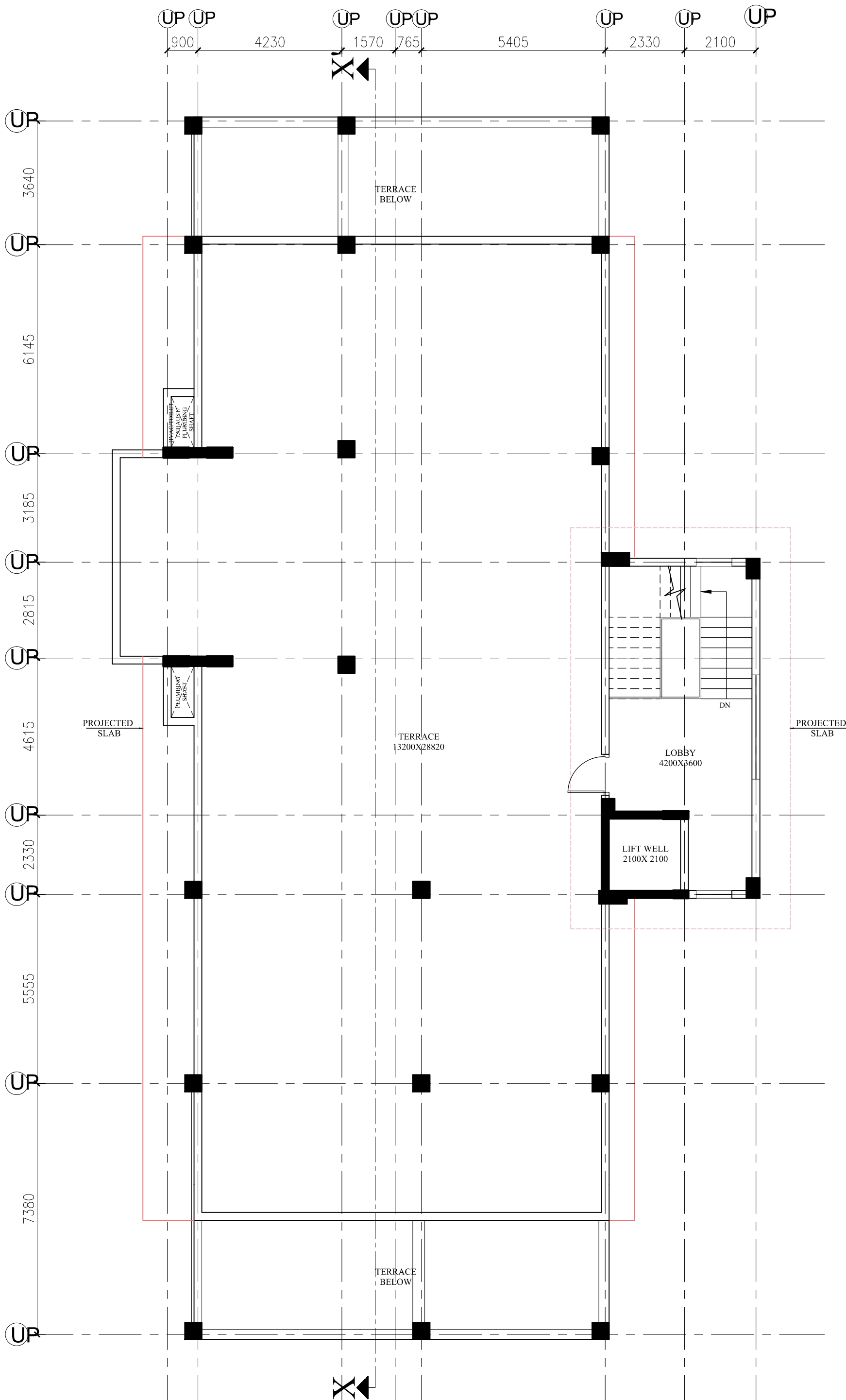
- NOTES:**
1. DO NOT SCALE THE DRAWING.
  2. THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
  3. ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
  4. ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
  5. ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
  6. DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

REV. NO.	DATE OF REV.	BY	DESCRIPTION

<b>PROJECT</b>	<b>ADMINISTRATIVE BUILDING</b>
<b>CLIENT</b>	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
<b>ARCHITECTS</b>	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
<b>MEP CONSULTANTS</b>	Flabellum Design Studio Pvt. Ltd. Valika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com
<b>DRAWING STRUCTURE CONSULTANT</b>	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352 . 011- 45650222.
<b>DRAWING TITLE</b>	<b>THIRD FLOOR PLAN</b>
<b>SCALE :</b>	NTS
<b>DATE :</b>	07-07-2020
<b>REVISION NO. :</b>	R0
<b>DRAWN BY :</b>	VAISHALI
<b>CHECKED BY :</b>	AMIT
<b>APPROVED BY :</b>	
<b>DRAWING NO :</b>	<b>DAFFPL/MCMVPL/2020/TD-05</b>
<input checked="" type="checkbox"/> FOR TENDER	<input type="checkbox"/> ADVANCE COPY
<input type="checkbox"/> FOR APPROVAL	<input type="checkbox"/> GOOD FOR CONSTRUCTION

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
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- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED



REV. NO.	DATE OF REV.	BY	DESCRIPTION

**PROJECT**  
ADMINISTRATIVE BUILDING

**CLIENT**  
  
 D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTS**  
  
 MILLENNIUM VENTURES  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

**MEP CONSULTANTS**  
 Flabellum Design Studio Pvt. Ltd.  
 Vatika India Next  
 E1, 1102, Gurgaon-21  
 Gurgaon (HR)-122004  
 Ph. 0124-4936847  
 flabellumdesign@gmail.com

**DRAWING STRUCTURE CONSULTANT**  
  
 ABL Structural Consultants Pvt. Ltd.  
 H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034,  
 Ph: 9811038352 . 011- 45650222.

**DRAWING TITLE**  
**TERRACE PLAN**

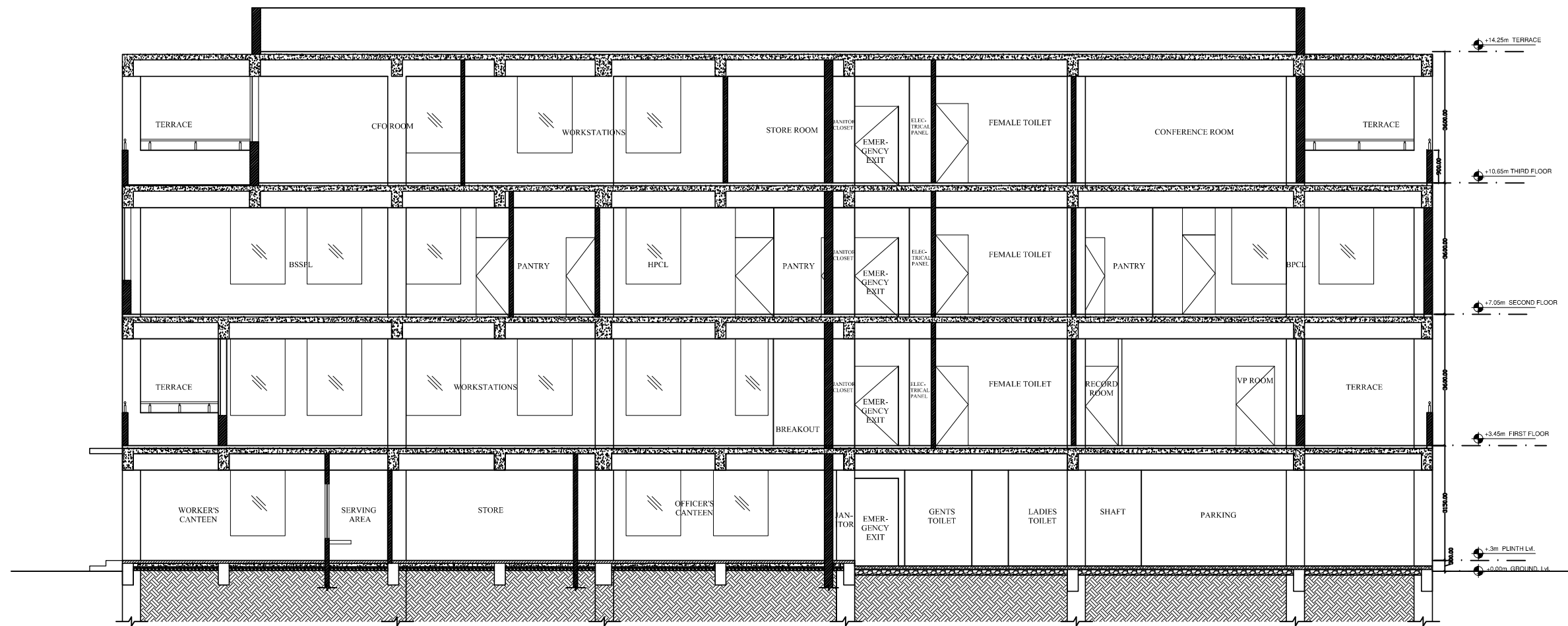
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 DATE : 07-07-2020 CHECKED BY : AMIT  
 REVISION NO. : R0 APPROVED BY :




DRAWING NO :  
**DAFFPL/MCMVPL/2020/TD-06**  
 FOR TENDER  ADVANCE COPY  
 FOR APPROVAL  GOOD FOR CONSTRUCTION

**TERRACE PLAN**

**NOTES:**

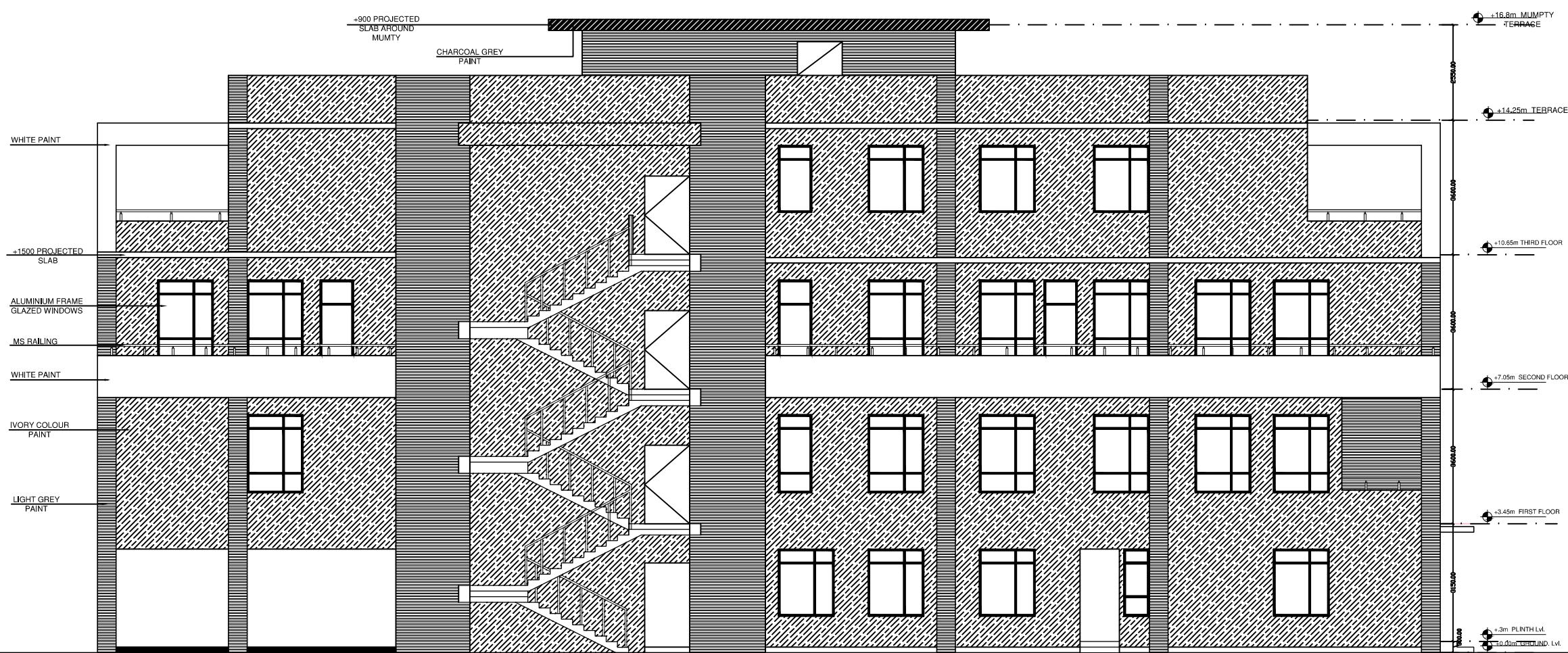
1. DO NOT SCALE THE DRAWING.
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3. ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
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6. DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED



REV. NO.	DATE OF REV.	BY	DESCRIPTION
PROJECT	<b>ADMINISTRATIVE BUILDING</b>		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Vatika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com		
STRUCTURE CONSULTANT	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352, 011-45650222.		
DRAWING TITLE	<b>SECTION</b>		
SCALE :	NTS	DRAWN BY :	VAISHALI
DATE :	07-07-2020	CHECKED BY :	AMIT
REVISION NO. :	RO	APPROVED BY :	
DRAWING NO :		DRAWING NO :	
<b>DAFFPL/MCMVPL/2020/TD-07</b>		<b>DAFFPL/MCMVPL/2020/TD-07</b>	
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**FRONT ELEVATION**

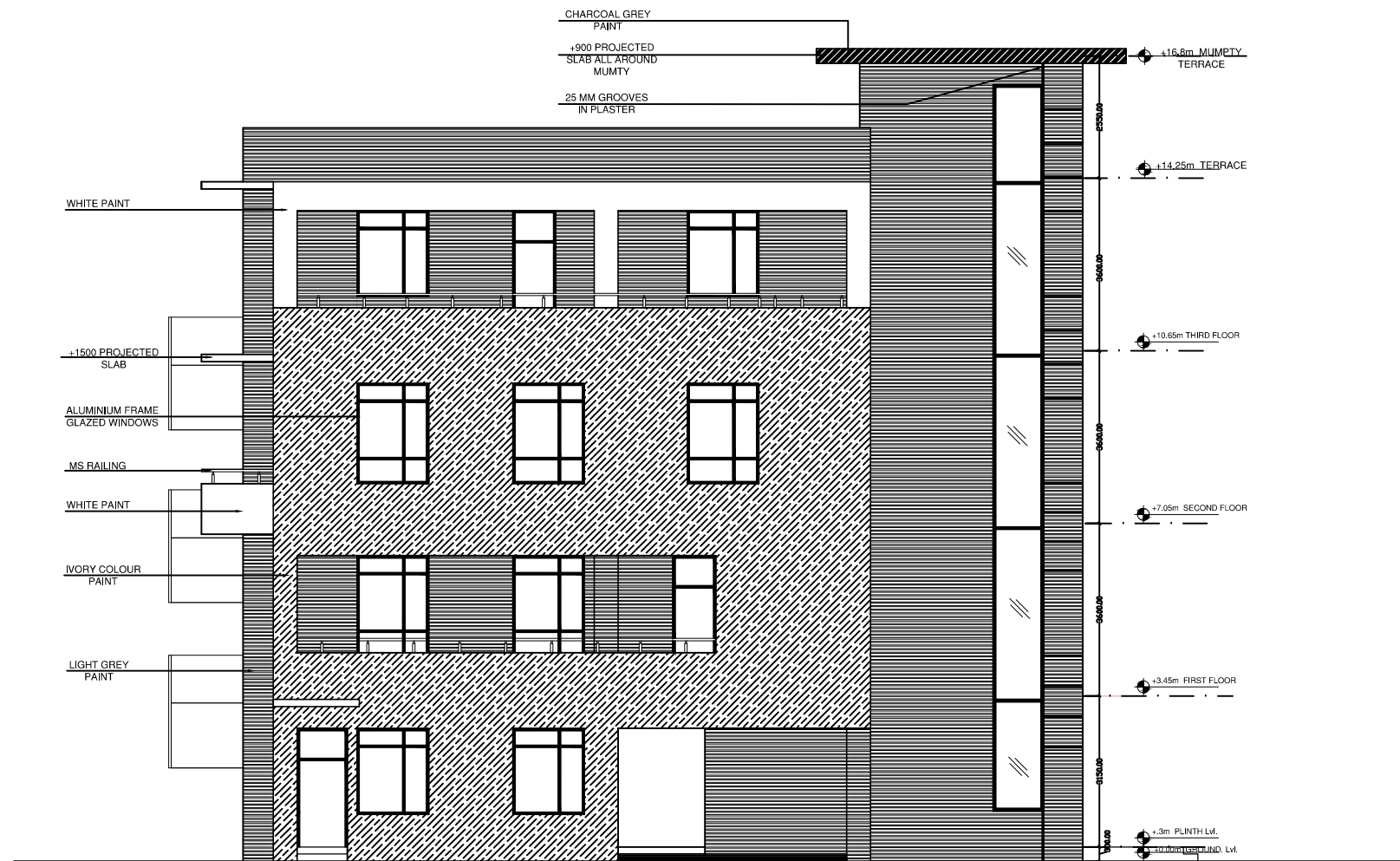


**BACK SIDE ELEVATION**

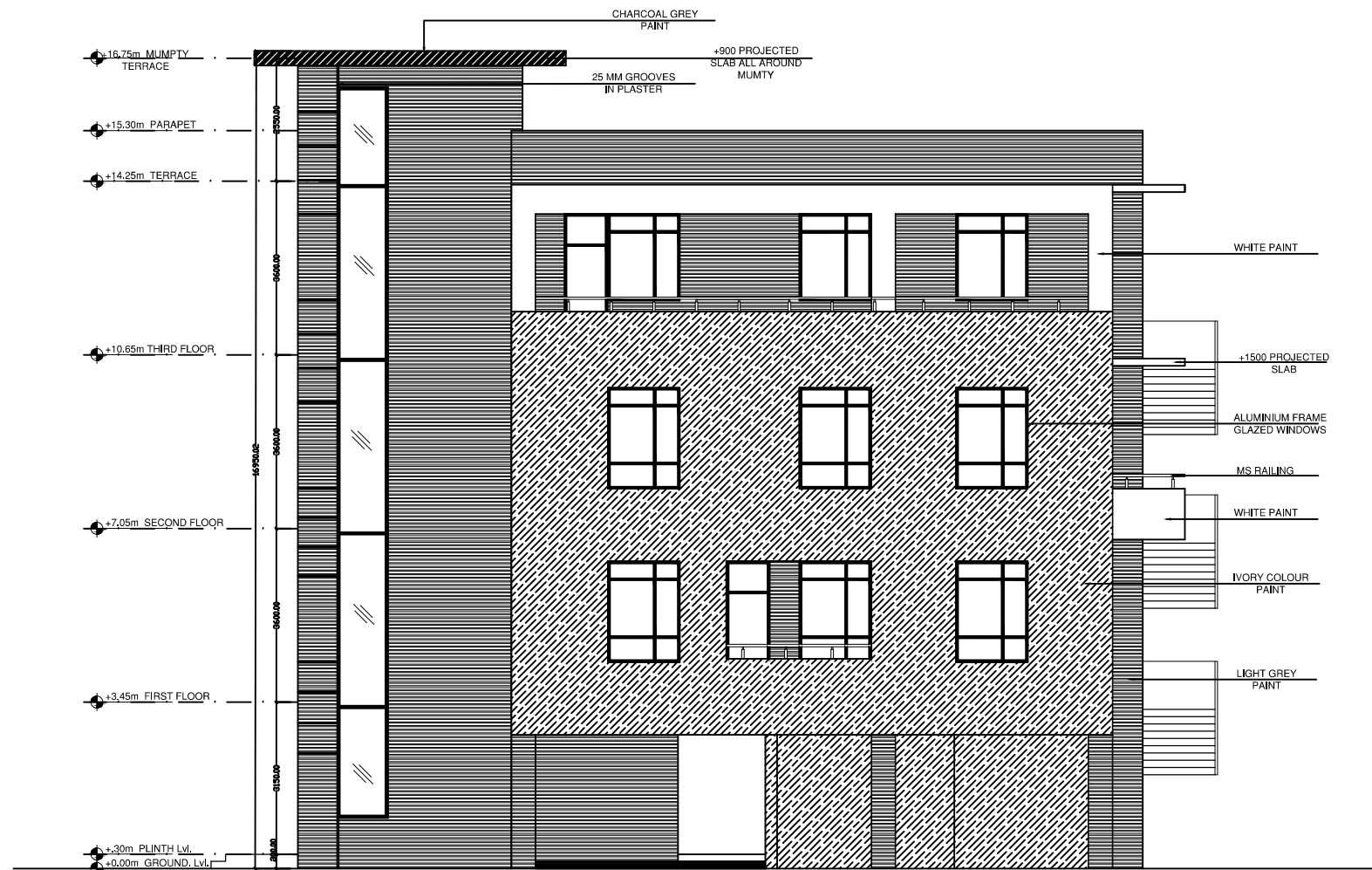
**NOTES:**

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6. DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

REV. NO.	DATE OF REV.	BY	DESCRIPTION
PROJECT	<b>ADMINISTRATIVE BUILDING</b>		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Vatika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com		
STRUCTURE CONSULTANT	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352 , 011- 45650222.		
DRAWING TITLE	<b>ELEVATIONS</b>		
SCALE :	NTS	DRAWN BY :	VAISHALI
DATE :	07-07-2020	CHECKED BY :	AMIT
REVISION NO. :	RO	APPROVED BY :	
DRAWING NO :			
<b>DAFFPL/MCMVPL/2020/TD-08</b>			
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LEFT SIDE ELEVATION



RIGHT SIDE ELEVATION

NOTES:

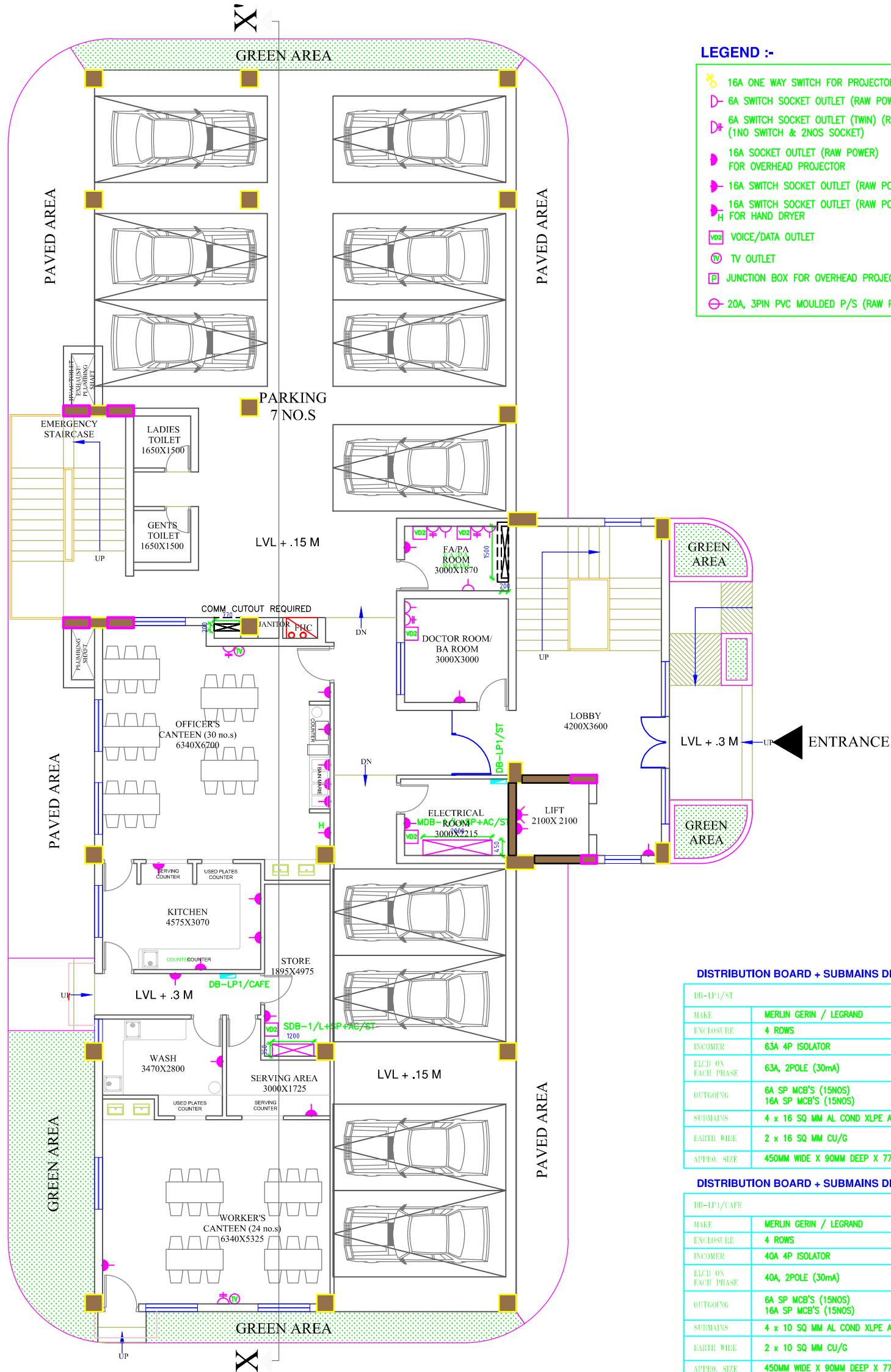
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- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

REV. NO.	DATE OF REV.	BY	DESCRIPTION

PROJECT	<b>ADMINISTRATIVE BUILDING</b>		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Vatika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com		
STRUCTURE CONSULTANT	 ABL Structural Consultants Pvt. Ltd. H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352, 011-45650222.		
DRAWING TITLE	<b>ELEVATIONS</b>		
SCALE :	NTS	DRAWN BY :	VAISHALI
DATE :	07-07-2020	CHECKED BY :	AMIT
REVISION NO. :	RO	APPROVED BY :	

DRAWING NO : **DAFFPL/MCMVPL/2020/TD-09**

<input checked="" type="checkbox"/> FOR TENDER	<input type="checkbox"/> ADVANCE COPY
<input type="checkbox"/> FOR APPROVAL	<input type="checkbox"/> GOOD FOR CONSTRUCTION



- LEGEND :-**
- ⊗ 16A ONE WAY SWITCH FOR PROJECTOR
  - ⊖ 6A SWITCH SOCKET OUTLET (RAW POWER)
  - ⊖ 6A SWITCH SOCKET OUTLET (TWIN) (RAW POWER) (1NO SWITCH & 2NOS SOCKET)
  - ⊖ 16A SOCKET OUTLET (RAW POWER) FOR OVERHEAD PROJECTOR
  - ⊖ 16A SWITCH SOCKET OUTLET (RAW POWER)
  - ⊖ 16A SWITCH SOCKET OUTLET (RAW POWER) FOR HAND DRYER
  - ⊖ VOICE/DATA OUTLET
  - ⊖ TV OUTLET
  - ⊖ JUNCTION BOX FOR OVERHEAD PROJECTOR
  - ⊖ 20A, 3PIN PVC MOULDED P/S (RAW POWER)

**DISTRIBUTION BOARD + SUBMANS DETAILS**

DB-LP1/ST	
MAKE	MERLIN GERIN / LEGRAND
ENCLOSURE	4 ROWS
INCOMER	63A 4P ISOLATOR
ELCB ON EACH PHASE	63A, 2POLE (30mA)
OUTGOING	6A SP MCB'S (15NOS) 16A SP MCB'S (15NOS)
SUBMANS	4 x 16 SQ MM AL COND XLPE ARMD CABLE
EARTH WIRE	2 x 16 SQ MM CU/G
APPRO. SIZE	450MM WIDE X 90MM DEEP X 775MM HEIGHT

**DISTRIBUTION BOARD + SUBMANS DETAILS**

DB-LP1/CAFE	
MAKE	MERLIN GERIN / LEGRAND
ENCLOSURE	4 ROWS
INCOMER	40A 4P ISOLATOR
ELCB ON EACH PHASE	40A, 2POLE (30mA)
OUTGOING	6A SP MCB'S (15NOS) 16A SP MCB'S (15NOS)
SUBMANS	4 x 10 SQ MM AL COND XLPE ARMD CABLE
EARTH WIRE	2 x 10 SQ MM CU/G
APPRO. SIZE	450MM WIDE X 90MM DEEP X 775MM HEIGHT


**PLEASE NOTE MAX. 2NOS SPARE MCB'S TO BE PROVIDED ON EACH PHASE**

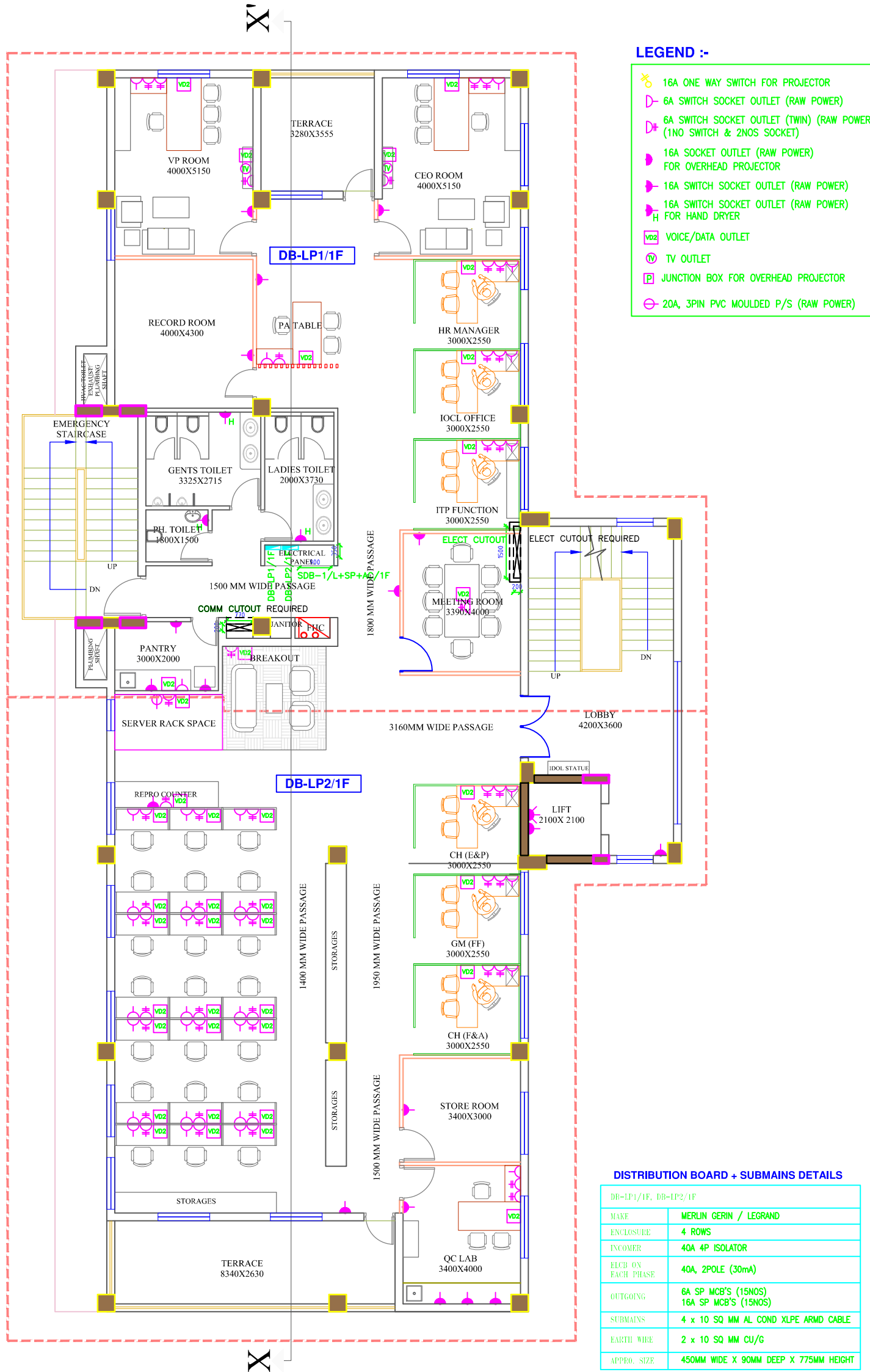
- NOTES :-**
- PLEASE REFER TO ARCHITECT FOR ALL LEVELS/ MOUNTING HEIGHTS.
  - ALL LEVELS/ MOUNTING HEIGHTS ARE TO BE TAKEN TO THE BOTTOM OF OUTLET BOX.
  - ALL CONDUITS FOR RAW / UPS POWER ABOVE FALSE CEILING / DROPS ON COLUMN OR WALL SURFACE SHALL BE 25MM DIA 16 SWG MS.
  - ALL CONDUITS FOR RAW / UPS POWER IN FLOOR SHALL BE 25MM DIA PVC (2MM WALL THICKNESS)

# STILT FLOOR

**GENERAL INFORMATION FOR CIRCUIT DETAILS**

NO	DESCRIPTION	TYPE OF POWER	MAX PTS ON 1 FKT	WIRE SIZE	EARTH WIRE	ISOLATED GROUND
1.	6A SSO - GENERAL	RAW POWER	8 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
2.	16A SSO - GENERAL	RAW POWER	2 NOS	2 X 4.0 SQ MM	1 X 4.0 SQ MM	-
3.	6A SSO - 3NOS	UPS POWER	2 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
4.	6A SSO - TWIN	UPS POWER	4 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
5.	LIGHT POINTS	NORMAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
6.	LIGHT POINTS	CRITICAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, SWITCH ARCADIA SOUTH CITY-41, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	STILT FLOOR PLAN (RECEPTACLE LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RO
DRAWING NO.	MCMVPL/DAFFPL/E-01



- LEGEND :-**
- ⊗ 16A ONE WAY SWITCH FOR PROJECTOR
  - ⊖ 6A SWITCH SOCKET OUTLET (RAW POWER)
  - ⊖ 6A SWITCH SOCKET OUTLET (TWIN) (RAW POWER) (1NO SWITCH & 2NOS SOCKET)
  - ⊖ 16A SOCKET OUTLET (RAW POWER) FOR OVERHEAD PROJECTOR
  - ⊖ 16A SWITCH SOCKET OUTLET (RAW POWER)
  - ⊖ 16A SWITCH SOCKET OUTLET (RAW POWER) FOR HAND DRYER
  - VD2 VOICE/DATA OUTLET
  - TV TV OUTLET
  - ⊖ JUNCTION BOX FOR OVERHEAD PROJECTOR
  - ⊖ 20A, 3PIN PVC MOULDED P/S (RAW POWER)

**DISTRIBUTION BOARD + SUBMAINS DETAILS**

DB-LP1/1F, DB-LP2/1F	
MAKE	MERLIN GERIN / LEGRAND
ENCLOSURE	4 ROWS
INCOMER	40A 4P ISOLATOR
ELCB ON EACH PHASE	40A, 2POLE (30mA)
OUTGOING	6A SP MCB'S (15NOS) 16A SP MCB'S (15NOS)
SUBMAINS	4 x 10 SQ MM AL COND XLPE ARMED CABLE
EARTH WIRE	2 x 10 SQ MM CU/G
APPEO. SIZE	450MM WIDE X 90MM DEEP X 775MM HEIGHT

**PLEASE NOTE MAX. 2NOS SPARE MCB'S TO BE PROVIDED ON EACH PHASE**

**NOTES :-**

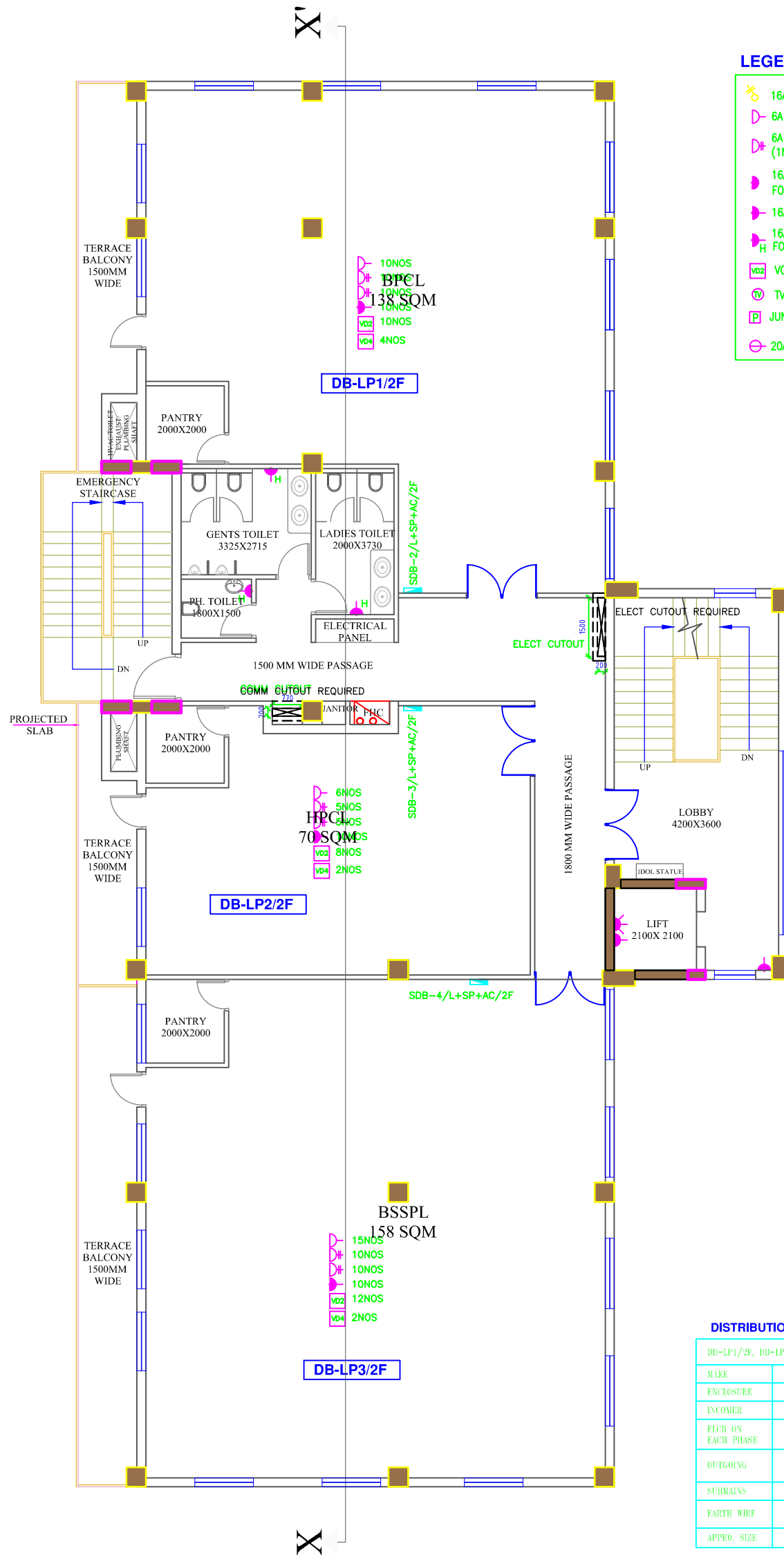
1. PLEASE REFER TO ARCHITECT FOR ALL LEVELS/ MOUNTING HEIGHTS.
2. ALL LEVELS/ MOUNTING HEIGHTS ARE TO BE TAKEN TO THE BOTTOM OF OUTLET BOX.
3. ALL CONDUITS FOR RAW / UPS POWER ABOVE FALSE CEILING / DROPS ON COLUMN OR WALL SURFACE SHALL BE 25MM DIA 16 SWG MS.
4. ALL CONDUITS FOR RAW / UPS POWER IN FLOOR SHALL BE 25MM DIA PVC (2MM WALL THICKNESS)

**FIRST FLOOR**

**GENERAL INFORMATION FOR CIRCUIT DETAILS**

NO	DESCRIPTION	TYPE OF POWER	MAX PIS ON 1 CAT	WIRE SIZE	EARTH WIRE	ISOLATED GROUND
1.	6A SSO - GENERAL	RAW POWER	8 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
2.	16A SSO - GENERAL	RAW POWER	2 NOS	2 X 4.0 SQ MM	1 X 4.0 SQ MM	-
3.	6A SSO - 3NOS	UPS POWER	2 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
4.	6A SSO - TWIN	UPS POWER	4 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
5.	LIGHT POINTS	NORMAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
6.	LIGHT POINTS	CRITICAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNIT-49, KANAKIA SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	FIRST FLOOR PLAN (RECEPTACLE LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	00
DRAWING NO.	MCMVPL/DAFFPL/E-02



**LEGEND :-**

- ⊗ 16A ONE WAY SWITCH FOR PROJECTOR
- ⊖ 6A SWITCH SOCKET OUTLET (RAW POWER)
- ⊖ 6A SWITCH SOCKET OUTLET (TWIN) (RAW POWER) (1NO SWITCH & 2NOS SOCKET)
- ⊖ 16A SOCKET OUTLET (RAW POWER) FOR OVERHEAD PROJECTOR
- ⊖ 16A SWITCH SOCKET OUTLET (RAW POWER)
- ⊖ 16A SWITCH SOCKET OUTLET (RAW POWER) FOR HAND DRYER
- ⊖ VOICE/DATA OUTLET
- ⊖ TV OUTLET
- ⊖ JUNCTION BOX FOR OVERHEAD PROJECTOR
- ⊖ 20A, 3PIN PVC MOULDED P/S (RAW POWER)

**SECOND FLOOR**

**GENERAL INFORMATION FOR CIRCUIT DETAILS**

NO	DESCRIPTION	TYPE OF POWER	MAX PIS ON 1 CAT	WIRE SIZE	EARTH WIRE	ISOLATED GROUND
1.	6A SSO - GENERAL	RAW POWER	8 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
2.	16A SSO - GENERAL	RAW POWER	2 NOS	2 X 4.0 SQ MM	1 X 4.0 SQ MM	-
3.	6A SSO - 3NOS	UPS POWER	2 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
4.	6A SSO - TWIN	UPS POWER	4 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
5.	LIGHT POINTS	NORMAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
6.	LIGHT POINTS	CRITICAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-

**DISTRIBUTION BOARD + SUBMANS DETAILS**

DB-LP1/2F, DB-LP2/2F, DB-LP3/2F	
MAKE	MERLIN GERIN / LEGRAND
ENCLOSURE	4 ROWS
COVER	40A 4P ISOLATOR
FLCB ON EACH PHASE	40A, 2POLE (30mA)
OUTGOING	6A SP MCB'S (15NOS) 16A SP MCB'S (15NOS)
SUBMANS	4 x 10 SQ MM AL COND XLPE ARMED CABLE
EARTH WIRE	2 x 10 SQ MM CU/G
APPRO. SIZE	450MM WIDE X 90MM DEEP X 775MM HEIGHT

**PLEASE NOTE MAX. 2NOS SPARE MCB'S TO BE PROVIDED ON EACH PHASE**

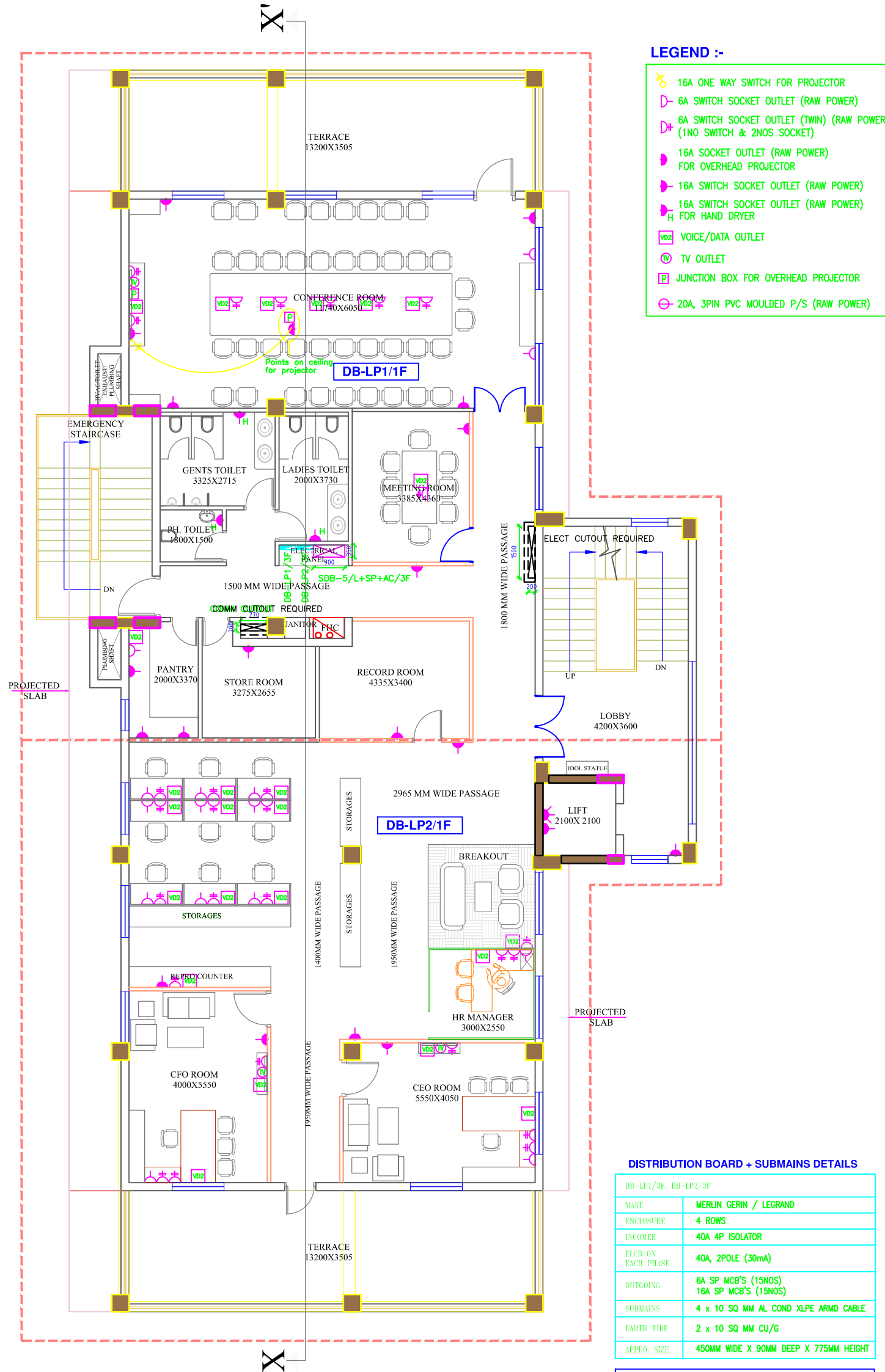
**NOTES :-**

1. PLEASE REFER TO ARCHITECT FOR ALL LEVELS/ MOUNTING HEIGHTS.
2. ALL LEVELS/ MOUNTING HEIGHTS ARE TO BE TAKEN TO THE BOTTOM OF OUTLET BOX.
3. ALL CONDUITS FOR RAW / UPS POWER ABOVE FALSE CEILING / DROPS ON COLUMN OR WALL SURFACE SHALL BE 25MM DIA 16 SWG MS.
4. ALL CONDUITS FOR RAW / UPS POWER IN FLOOR SHALL BE 25MM DIA PVC (2MM WALL THICKNESS)

REV. NO.	DATE OF REV.	DESCRIPTION
R2	02.07.20	ELECT DRG REVISED
R1	29.06.20	ARCH & ELECT DRG REVISED

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNIT-49 KANONIA SOUTH CITY-41, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	SECOND FLOOR PLAN (RECEPTACLE LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RO
DRAWING NO.	MCMVPL/DAFFPL/E-03





- LEGEND :-**
- 16A ONE WAY SWITCH FOR PROJECTOR
  - 6A SWITCH SOCKET OUTLET (RAW POWER)
  - 6A SWITCH SOCKET OUTLET (TWIN) (RAW POWER) (1NO SWITCH & 2NOS SOCKET)
  - 16A SOCKET OUTLET (RAW POWER) FOR OVERHEAD PROJECTOR
  - 16A SWITCH SOCKET OUTLET (RAW POWER)
  - 16A SWITCH SOCKET OUTLET (RAW POWER) FOR HAND DRYER
  - VOICE/DATA OUTLET
  - TV OUTLET
  - JUNCTION BOX FOR OVERHEAD PROJECTOR
  - 20A, 3PIN PVC MOULDED P/S (RAW POWER)

**DISTRIBUTION BOARD + SUBMAINS DETAILS**

DB-LP1/3F, DB-LP2/3F	
MAKE	MERLIN GERIN / LEGRAND
ENCLOSURE	4 ROWS
INCOMER	40A 4P ISOLATOR
FICR ON EACH PHASE	40A, 2POLE (30mA)
OUTGOING	6A SP MCB'S (15NOS) 16A SP MCB'S (15NOS)
SUBMAINS	4 x 10 SQ MM AL COND XLPE ARMED CABLE
EARTH WIRE	2 x 10 SQ MM CU/G
APPROX. SIZE	450MM WIDE X 90MM DEEP X 775MM HEIGHT

**PLEASE NOTE MAX. 2NOS SPARE MCB'S TO BE PROVIDED ON EACH PHASE**

**NOTES :-**

1. PLEASE REFER TO ARCHITECT FOR ALL LEVELS/ MOUNTING HEIGHTS.
2. ALL LEVELS/ MOUNTING HEIGHTS ARE TO BE TAKEN TO THE BOTTOM OF OUTLET BOX.
3. ALL CONDUITS FOR RAW / UPS POWER ABOVE FALSE CEILING / DROPS ON COLUMN OR WALL SURFACE SHALL BE 25MM DIA 16 SWG MS.
4. ALL CONDUITS FOR RAW / UPS POWER IN FLOOR SHALL BE 25MM DIA PVC (2MM WALL THICKNESS)

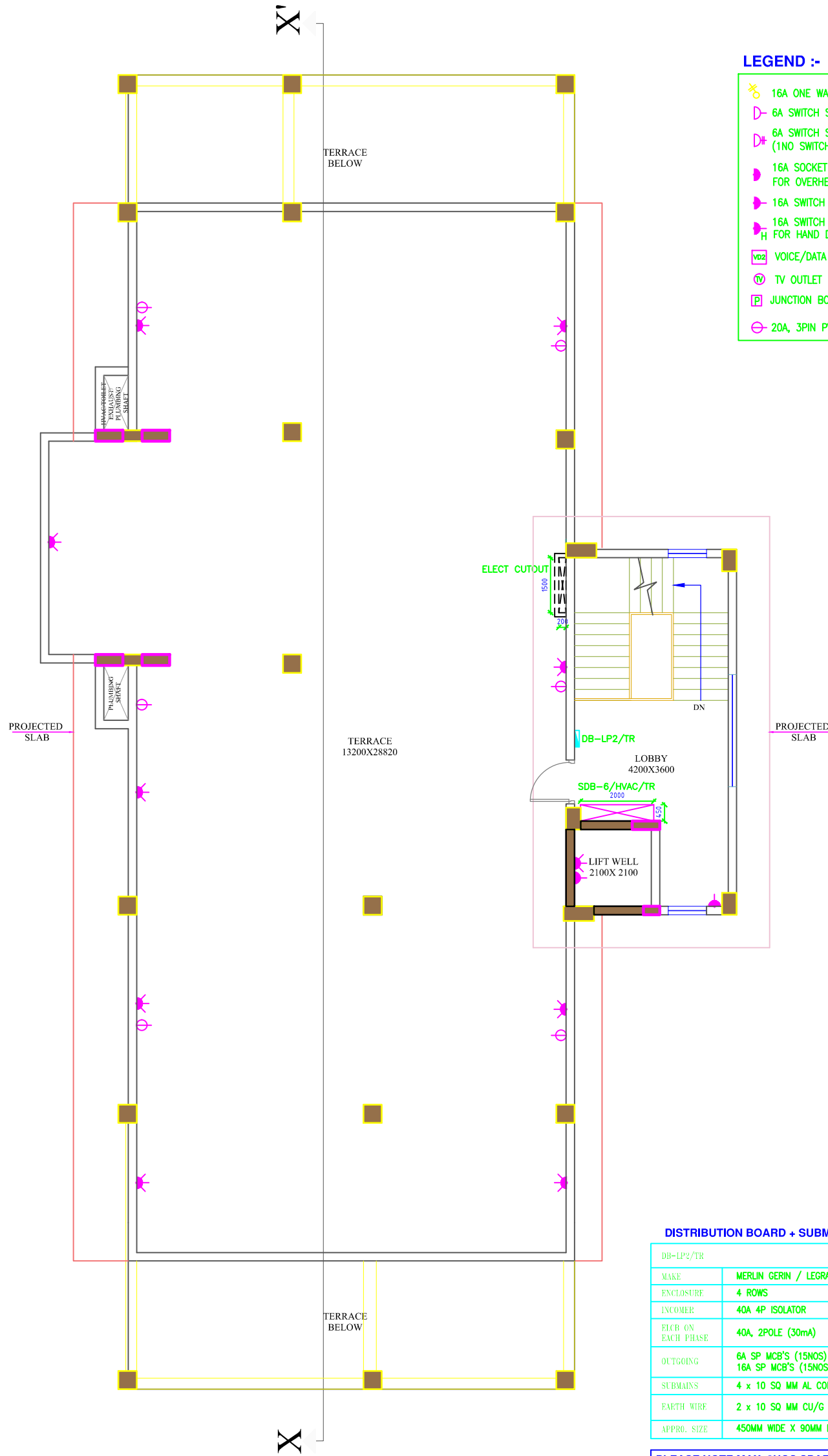
**THIRD FLOOR**

**GENERAL INFORMATION FOR CIRCUIT DETAILS**

NO	DESCRIPTION	TYPE OF POWER	MAX PIS ON 1 CAT	WIRE SIZE	EARTH WIRE	ISOLATED GROUND
1.	6A SSO - GENERAL	RAW POWER	8 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
2.	16A SSO - GENERAL	RAW POWER	2 NOS	2 X 4.0 SQ MM	1 X 4.0 SQ MM	-
3.	6A SSO - 3NOS	UPS POWER	2 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
4.	6A SSO - TWIN	UPS POWER	4 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
5.	LIGHT POINTS	NORMAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
6.	LIGHT POINTS	CRITICAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-

NO.	DATE OF REV.	DESCRIPTION
R2	02.07.20	ELECT DRG REVISED
R1	29.06.20	ARCH & ELECT DRG REVISED

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, SWITCH 4 & C-101A, SOUTH CITY-41, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	THIRD FLOOR PLAN (RECEPTACLE LAYOUT)
SCALE : 1 : 100	DRAWN BY : Kamboj
DATE : 07.07.2020	CHECKED BY : Parveen
REVISION NO. : R0	APPROVED BY : Parveen
DRAWING NO. : MCMVPL/DAFFPL/E-04	



**LEGEND :-**

- 16A ONE WAY SWITCH FOR PROJECTOR
- 6A SWITCH SOCKET OUTLET (RAW POWER)
- 6A SWITCH SOCKET OUTLET (TWIN) (RAW POWER) (1NO SWITCH & 2NOS SOCKET)
- 16A SOCKET OUTLET (RAW POWER) FOR OVERHEAD PROJECTOR
- 16A SWITCH SOCKET OUTLET (RAW POWER) FOR HAND DRYER
- 16A SWITCH SOCKET OUTLET (RAW POWER) FOR HAND DRYER
- VOICE/DATA OUTLET
- TV OUTLET
- JUNCTION BOX FOR OVERHEAD PROJECTOR
- 20A, 3PIN PVC MOULDED P/S (RAW POWER)

**DISTRIBUTION BOARD + SUBMANS DETAILS**

DB-LP2/TR	
MAKE	MERLIN GERIN / LEGRAND
ENCLOSURE	4 ROWS
INCOMER	40A 4P ISOLATOR
EICB ON EACH PHASE	40A, 2POLE (30mA)
OUTGOING	6A SP MCB'S (15NOS) 16A SP MCB'S (15NOS)
SUBMANS	4 x 10 SQ MM AL COND XLPE ARMED CABLE
EARTH WIRE	2 x 10 SQ MM CU/G
APPRO. SIZE	450MM WIDE X 90MM DEEP X 775MM HEIGHT

**PLEASE NOTE MAX. 2NOS SPARE MCB'S TO BE PROVIDED ON EACH PHASE**

**NOTES :-**

1. PLEASE REFER TO ARCHITECT FOR ALL LEVELS/ MOUNTING HEIGHTS.
2. ALL LEVELS/ MOUNTING HEIGHTS ARE TO BE TAKEN TO THE BOTTOM OF OUTLET BOX.
3. ALL CONDUITS FOR RAW / UPS POWER ABOVE FALSE CEILING / DROPS ON COLUMN OR WALL SURFACE SHALL BE 25MM DIA 16 SWG MS.
4. ALL CONDUITS FOR RAW / UPS POWER IN FLOOR SHALL BE 25MM DIA PVC (2MM WALL THICKNESS)

# TERRACE PLAN

**GENERAL INFORMATION FOR CIRCUIT DETAILS**

NO	DESCRIPTION	TYPE OF POWER	MAX PTS ON 1 CKT	WIRE SIZE	EARTH WIRE	ISOLATED GROUND
1.	6A SSO - GENERAL	RAW POWER	8 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
2.	16A SSO - GENERAL	RAW POWER	2 NOS	2 X 4.0 SQ MM	1 X 4.0 SQ MM	-
3.	6A SSO - 3NOS	UPS POWER	2 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
4.	6A SSO - TWIN	UPS POWER	4 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
5.	LIGHT POINTS	NORMAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
6.	LIGHT POINTS	CRITICAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-

REV. NO.	DATE OF REV.	DESCRIPTION
R2	02.07.20	ELECT DRG REVISED
R1	29.06.20	ARCH & ELECT DRG REVISED
<b>PROJECT</b>		
ADMINISTRATIVE BUILDING		
<b>CLIENT</b>		
 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
<b>ARCHITECTS</b>		
 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNIT-49, KANAKIA-SOUTH CITY-41, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
<b>STATUS</b>		
TENDER DRAWING		
<b>DRAWING TITLE</b>		
TERRACE PLAN (RECEPTACLE LAYOUT)		
SCALE :	1 : 100	DRAWN BY : Kamboj
DATE :	07.07.2020	CHECKED BY : Parveen
REVISION NO. :	R0	APPROVED BY : Parveen
DRAWING NO. : MCMVPL/DAFFPL/E-05		

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
- ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
- ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
- ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE.
- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED.



**GENERAL INFORMATION FOR CIRCUIT DETAILS**

NO	DESCRIPTION	TYPE OF WIRING	NO. OF WIRING	WIRE SIZE	DEPTH	THICKNESS
1.	6A SSO - GENERAL	RAW POWER	8 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
2.	10A SSO - GENERAL	RAW POWER	2 NOS	2 X 4.0 SQ MM	1 X 4.0 SQ MM	-
3.	6A SSO - 3NOS	UPS POWER	2 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
4.	6A SSO - TWIN	UPS POWER	4 SETS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	1 X 2.5 SQ MM
5.	LIGHT POINTS	NORMAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-
6.	LIGHT POINTS	CRITICAL	10 NOS	2 X 2.5 SQ MM	1 X 2.5 SQ MM	-

- NOTES :-**
- PLEASE REFER TO ARCHITECT FOR ALL LEVELS/ MOUNTING HEIGHTS.
  - ALL LEVELS/ MOUNTING HEIGHTS ARE TO BE TAKEN TO THE BOTTOM OF OUTLET BOX.
  - ALL CONDUITS FOR RAW / UPS POWER ABOVE FALSE CEILING / DRIPS ON COLUMN OR WALL SURFACE SHALL BE 25MM DIA 16 SWG MS.
  - ALL CONDUITS FOR RAW / UPS POWER IN FLOOR SHALL BE 25MM DIA PVC (2MM WALL THICKNESS)

**LEGEND :-**

	6A ONE WAY SWITCH
	6A SWITCH SOCKET OUTLET (TWIN) (RAW POWER)
	10A SWITCH & 2NOS SOCKET
	10A SWITCH SOCKET OUTLET (RAW POWER)
	VOICE/DATA OUTLET
	TV OUTLET
	FUSE UNIT IN PVC WALLBOX OUTLET BOX AT CEILING LEVEL FOR HAND OPER AS WELL AS INFRARED FLUSH VALVES
	CEILING FAN

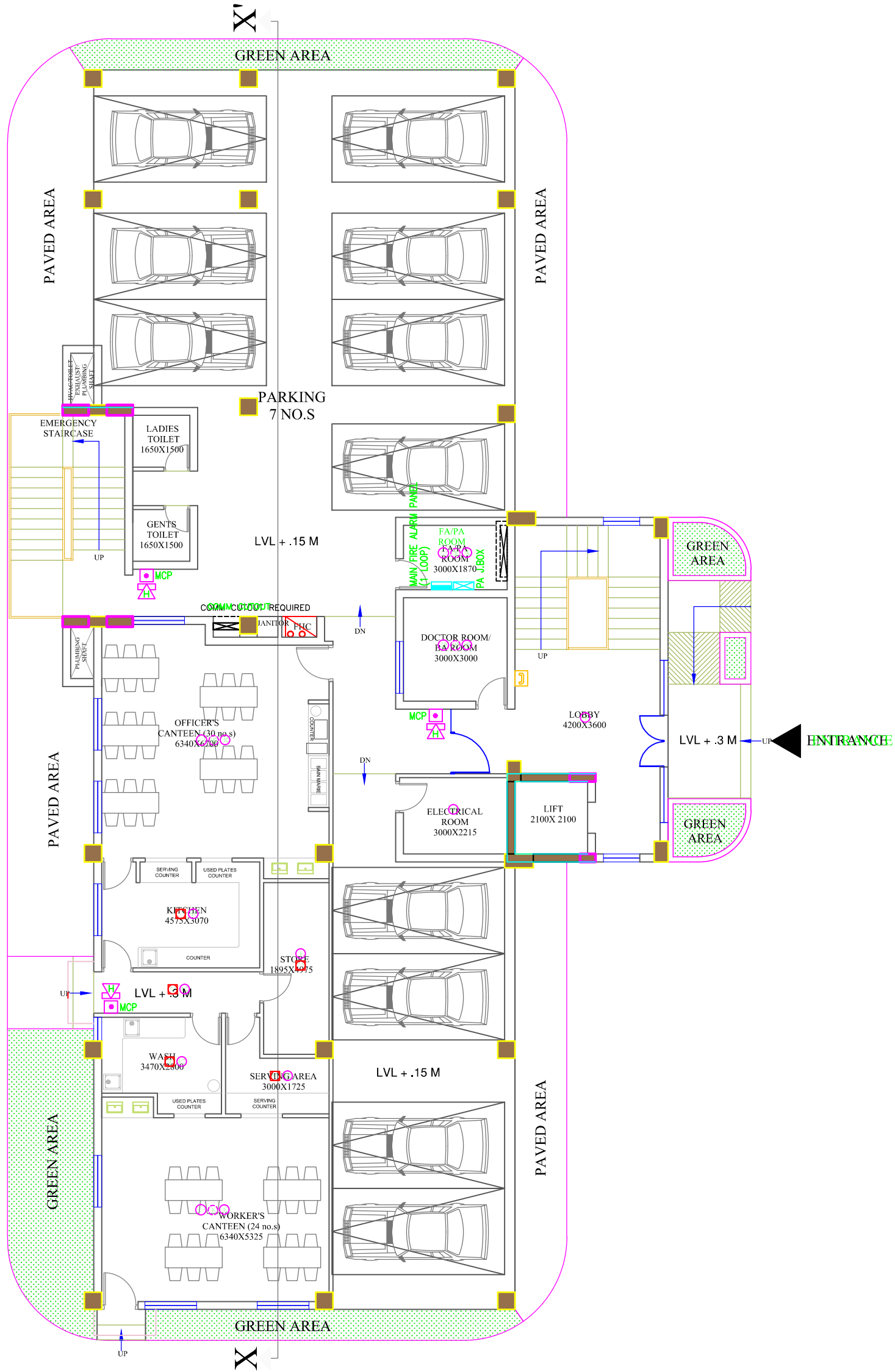
**DETAIL OF LIGHTING FIXTURES**

NO	DESCRIPTION	LEGEND	MAKE	CATALOGUE NO	FIXTURE TYPE
1	1 X 20W LED LIGHT FIXTURE		PHILIPS/EQUAL	BN10BC LED20S-4000 L120 PSU WH	SURFACE MOUNTED
2	1 X 40W LED LIGHT FIXTURE		PHILIPS/EQUAL	BN10BC LED40S-4000 L120 PSU WH	SURFACE MOUNTED

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	MILLENNIUM CITY MULTIVENTURES Pvt.Ltd, 302, UNITECH ARCADIA,SOUTH CITY-II, SECTOR-49,GURUGRAM-122016, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	SITE PLAN (RECEPTACLE LAYOUT)
SCALE :	1 : 100
DATE :	19.03.2020
REVISION NO. :	RD
DRAWING NO. :	MCMVPL/DAFFPL/E-06
DRAWN BY :	Kamboj
CHECKED BY :	Parveen
APPROVED BY :	

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
- ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
- ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND **NOT** MEASURED.
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- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED.



**STILT FLOOR**

**LEGEND :-**

	MULTICRITERION DETECTOR
	MULTICRITERION DETECTOR (ABOVE FALSE CEILING)
	MANUAL CALL POINT
	HOOTER + STROBE
	RECESSED TYPE SPEAKER
	SURFACE MOUNTED SPEAKER
	FAULT ISOLATOR
	TALK BACK UNIT
	CONTROL MODULE FOR HOOTER, PA, TALK BACK & VENT FAN
	MONITOR MODULE FOR FLOW SWITCH

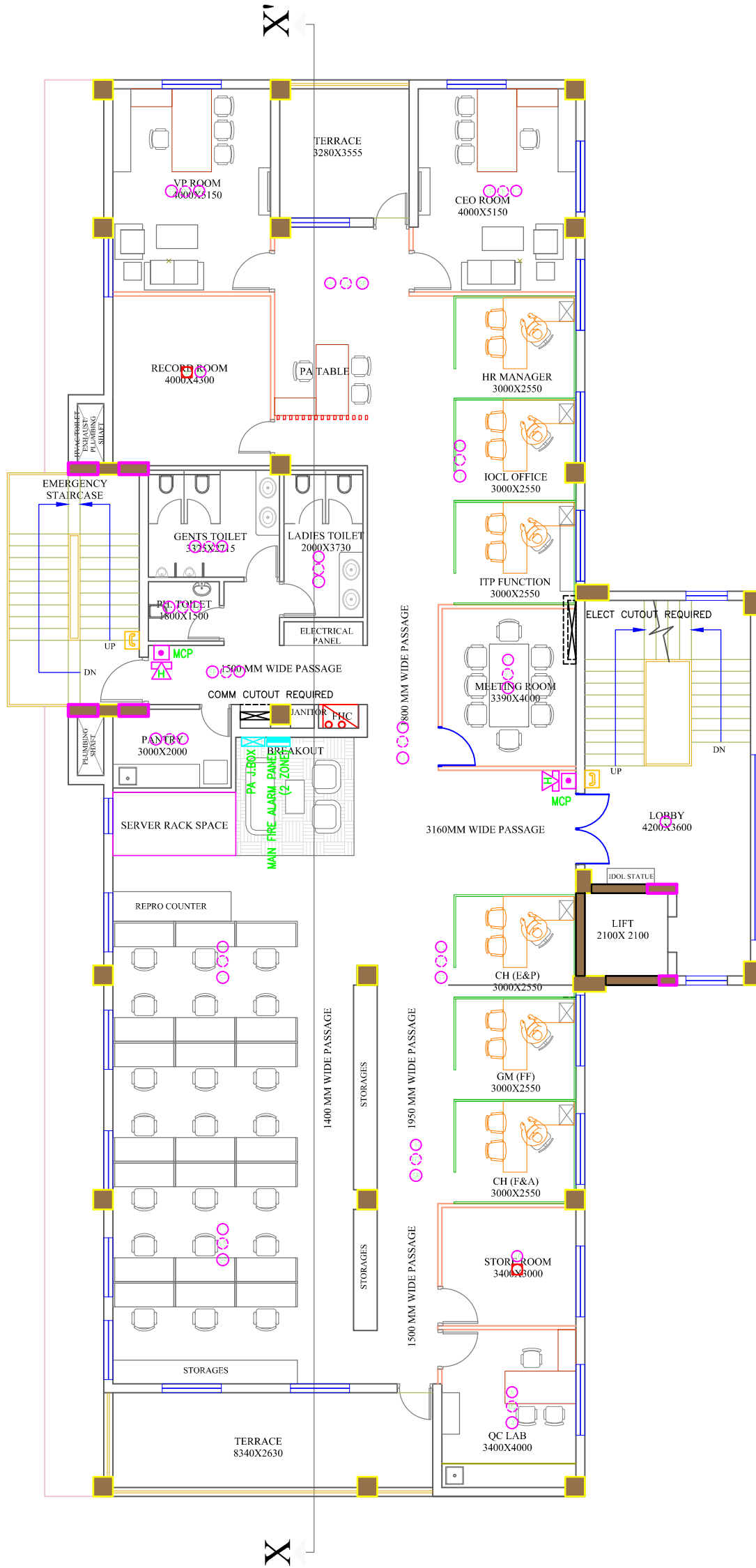
**GENERAL NOTES FOR FIRE ALARM SYSTEM**

- DETECTORS ABOVE FALSE CEILING ARE TO BE LOCATED NEAR LIGHT FIXTURE TO ENABLE EASY ACCESS/MAINTENANCE.
- ELECTRICAL CONTRACTOR IS REQUIRED TO CO-ORDINATE POSITION OF ALL DETECTORS ABOVE/BELOW FALSE CEILING WITH FIXTURE, DUCTS & PIPES ETC. AND ENSURE THAT POSITIONING IS CARRIED OUT CORRECTLY.
- POSITION OF ALL DETECTORS SHOWN ON THE DRAWING IS INDICATIVE AND THESE SHOULD BE LOCATED CAREFULLY AFTER PROPER CO-ORDINATION & NEAR RETURN AIR PATHS WHERE EVER POSSIBLE.
- OPTICAL DETECTORS SHALL BE PROVIDED IN ALL LOFT AREA WHERE AHU'S ARE LOCATED.
- UNLESS OTHERWISE MENTIONED CONDUITS FOR FIRE ALARM SYSTEM SHALL BE MS 20 MM DIA (16 SWG)
- FAULT ISOLATOR TO BE PROVIDED AFTER EVERY 20 ADDRESSABLE DEVICES.

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	STILT FLOOR PLAN (FIRE ALARM, PA & TALK BACK SYSTEM LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RO
DRAWING NO.	MCMVPL/DAFFPL/E-07
DRAWN BY	Kambaj
CHECKED BY	Parveen
APPROVED BY	

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
- ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
- ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND **NOT** MEASURED.
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- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED.



**FIRST FLOOR**

**LEGEND :-**

- MULTICRITERION DETECTOR
- MULTICRITERION DETECTOR (ABOVE FALSE CEILING)
- MANUAL CALL POINT
- ⊞ HOOTER + STROBE
- RECESSED TYPE SPEAKER
- SURFACE MOUNTED SPEAKER
- ⊞ FAULT ISOLATOR
- ⊞ TALK BACK UNIT
- CM CONTROL MODULE FOR HOOTER, PA, TALK BACK & VENT FAN
- MM MONITOR MODULE FOR FLOW SWITCH

**GENERAL NOTES FOR FIRE ALARM SYSTEM**

- DETECTORS ABOVE FALSE CEILING ARE TO BE LOCATED NEAR LIGHT FIXTURE TO ENABLE EASY ACCESS/MAINTENANCE.
- ELECTRICAL CONTRACTOR IS REQUIRED TO CO-ORDINATE POSITION OF ALL DETECTORS ABOVE/BELOW FALSE CEILING WITH FIXTURE, DUCTS & PIPES ETC. AND ENSURE THAT POSITIONING IS CARRIED OUT CORRECTLY.
- POSITION OF ALL DETECTORS SHOWN ON THE DRAWING IS INDICATIVE AND THESE SHOULD BE LOCATED CAREFULLY AFTER PROPER CO-ORDINATION & NEAR RETURN AIR PATHS WHERE EVER POSSIBLE.
- OPTICAL DETECTORS SHALL BE PROVIDED IN ALL LOFT AREA WHERE AHU'S ARE LOCATED.
- UNLESS OTHERWISE MENTIONED CONDUITS FOR FIRE ALARM SYSTEM SHALL BE MS 20 MM DIA (16 SWG)
- FAULT ISOLATOR TO BE PROVIDED AFTER EVERY 20 ADDRESSABLE DEVICES.

PROJECT **ADMINISTRATIVE BUILDING**

CLIENT   
D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

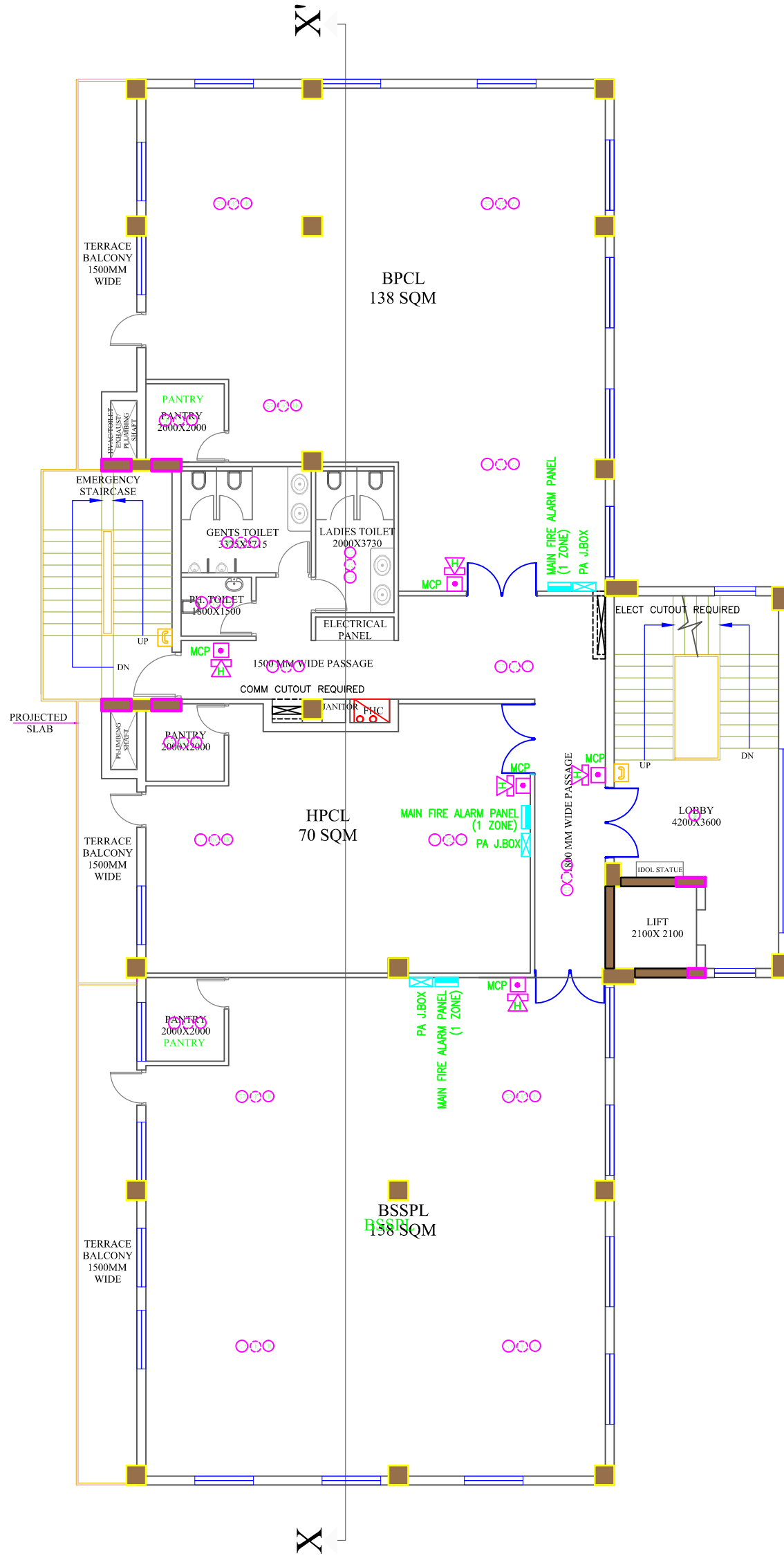
ARCHITECTS   
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

STATUS **TENDER DRAWING**

DRAWING TITLE **FIRST FLOOR PLAN  
(FIRE ALARM, PA &  
TALK BACK SYSTEM LAYOUT)**

SCALE : 1 : 100 DRAWN BY: Kamboj  
DATE : 07.07.2020 CHECKED BY: Parveen  
REVISION NO. : 00 APPROVED BY :

DRAWING NO. **MCMVPL/DAFFPL/E-08**



## SECOND FLOOR

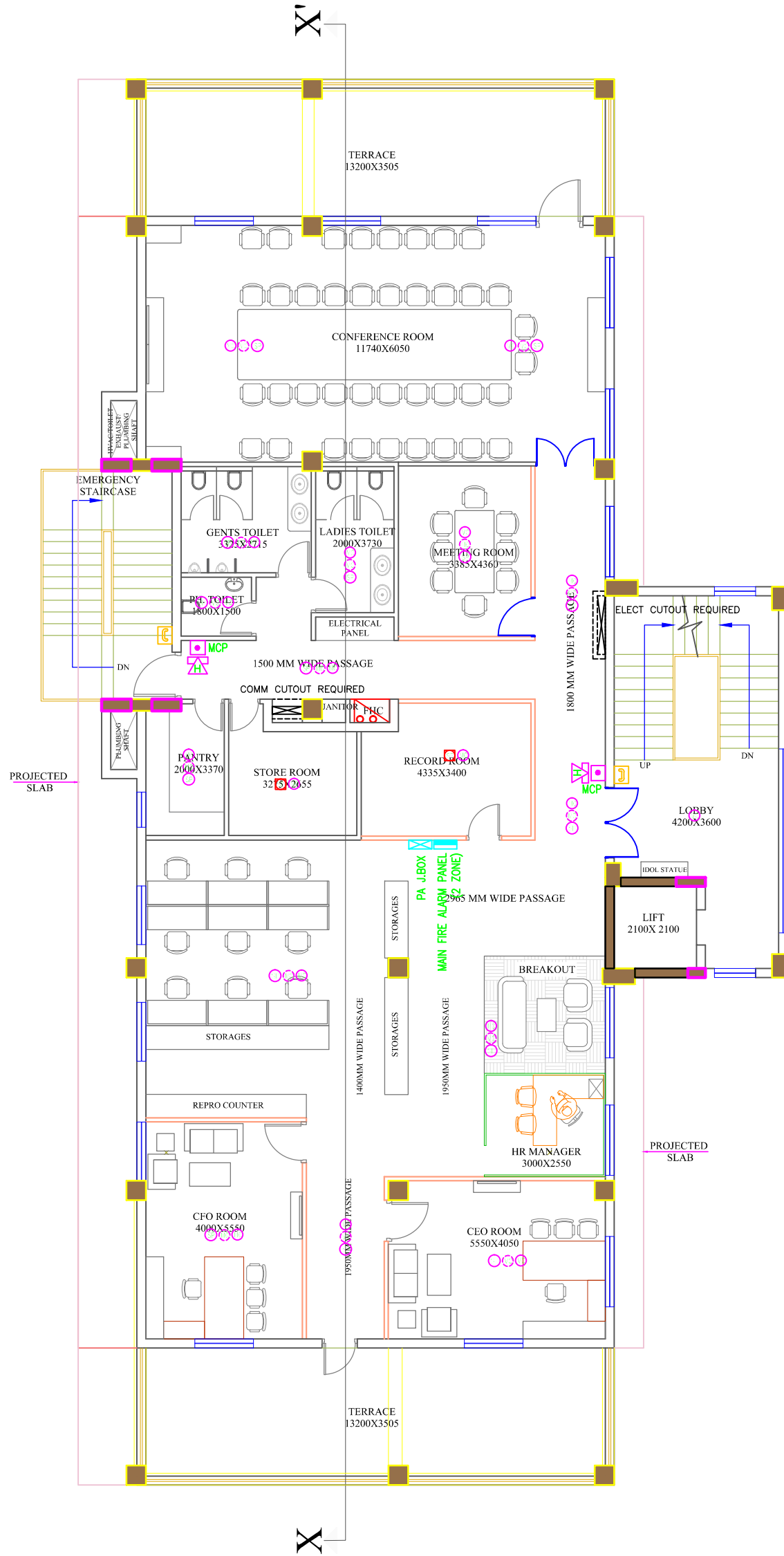
### LEGEND :-

	MULTICRITERION DETECTOR
	MULTICRITERION DETECTOR (ABOVE FALSE CEILING)
	MANUAL CALL POINT
	HOOTER + STROBE
	RECESSED TYPE SPEAKER
	SURFACE MOUNTED SPEAKER
	FAULT ISOLATOR
	TALK BACK UNIT
	CONTROL MODULE FOR HOOTER, PA, TALK BACK & VENT FAN
	MONITOR MODULE FOR FLOW SWITCH

### GENERAL NOTES FOR FIRE ALARM SYSTEM

1. DETECTORS ABOVE FALSE CEILING ARE TO BE LOCATED NEAR LIGHT FIXTURE TO ENABLE EASY ACCESS/MAINTENANCE.
2. ELECTRICAL CONTRACTOR IS REQUIRED TO CO-ORDINATE POSITION OF ALL DETECTORS ABOVE/BELOW FALSE CEILING WITH FIXTURE, DUCTS & PIPES ETC. AND ENSURE THAT POSITIONING IS CARRIED OUT CORRECTLY.
3. POSITION OF ALL DETECTORS SHOWN ON THE DRAWING IS INDICATIVE AND THESE SHOULD BE LOCATED CAREFULLY AFTER PROPER CO-ORDINATION & NEAR RETURN AIR PATHS WHERE EVER POSSIBLE.
4. OPTICAL DETECTORS SHALL BE PROVIDED IN ALL LOFT AREA WHERE AHU'S ARE LOCATED.
5. UNLESS OTHERWISE MENTIONED CONDUITS FOR FIRE ALARM SYSTEM SHALL BE MS 20 MM DIA (16 SWG)
6. FAULT ISOLATOR TO BE PROVIDED AFTER EVERY 20 ADDRESSABLE DEVICES.

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	SECOND FLOOR PLAN (FIRE ALARM, PA & TALK BACK SYSTEM LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RO
DRAWING NO.	MCMVPL/DAFFPL/E-09
DRAWN BY	Kamboj
CHECKED BY	Parveen
APPROVED BY	



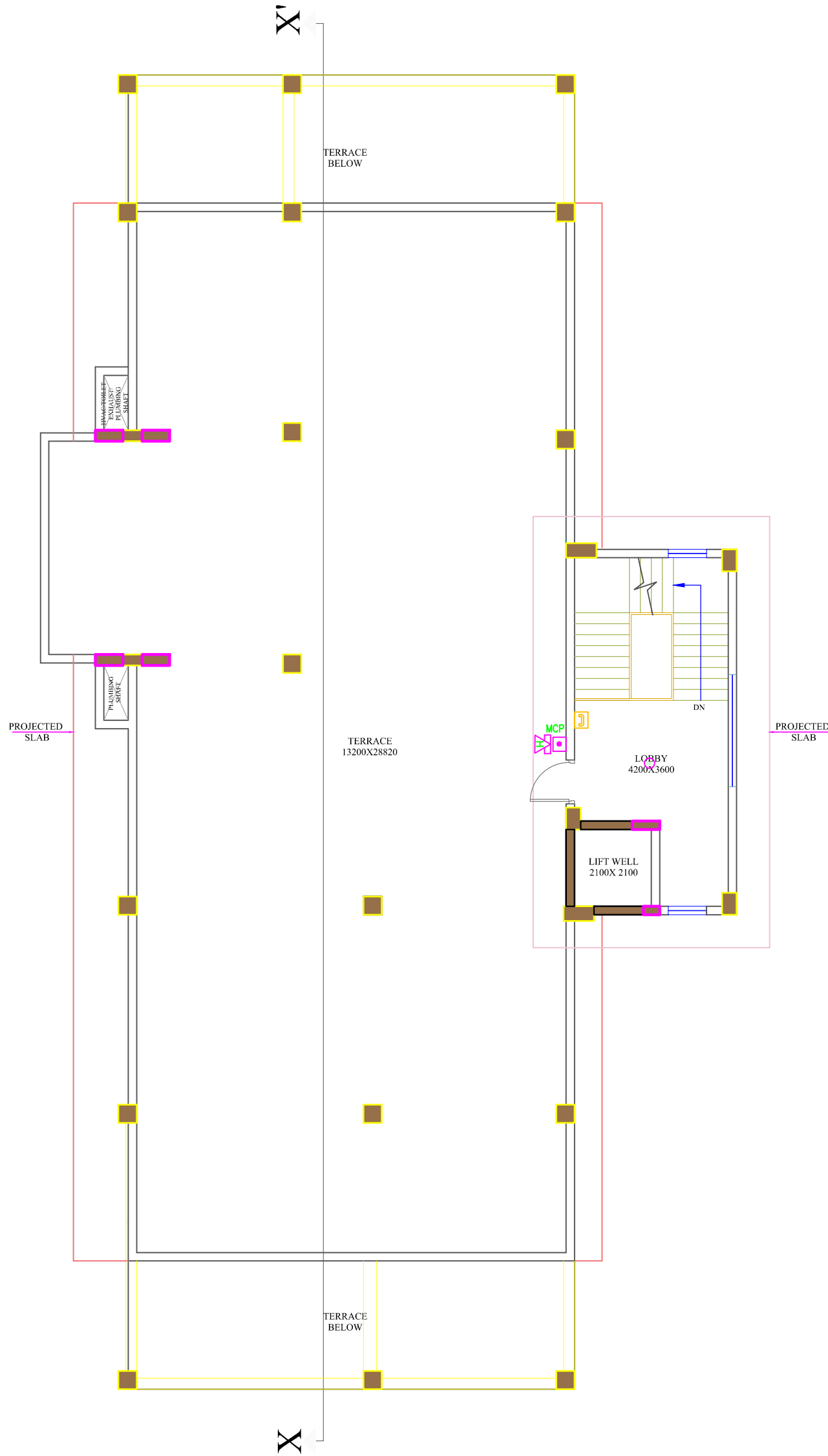
# THIRD FLOOR

**LEGEND :-**

	MULTICRITERION DETECTOR
	MULTICRITERION DETECTOR (ABOVE FALSE CEILING)
	MANUAL CALL POINT
	HOOTER + STROBE
	RECESSED TYPE SPEAKER
	SURFACE MOUNTED SPEAKER
	FAULT ISOLATOR
	TALK BACK UNIT
	CONTROL MODULE FOR HOOTER, PA, TALK BACK & VENT FAN
	MONITOR MODULE FOR FLOW SWITCH

- GENERAL NOTES FOR FIRE ALARM SYSTEM**
1. DETECTORS ABOVE FALSE CEILING ARE TO BE LOCATED NEAR LIGHT FIXTURE TO ENABLE EASY ACCESS/MAINTENANCE.
  2. ELECTRICAL CONTRACTOR IS REQUIRED TO CO-ORDINATE POSITION OF ALL DETECTORS ABOVE/BELOW FALSE CEILING WITH FIXTURE, DUCTS & PIPES ETC. AND ENSURE THAT POSITIONING IS CARRIED OUT CORRECTLY.
  3. POSITION OF ALL DETECTORS SHOWN ON THE DRAWING IS INDICATIVE AND THESE SHOULD BE LOCATED CAREFULLY AFTER PROPER CO-ORDINATION & NEAR RETURN AIR PATHS WHERE EVER POSSIBLE.
  4. OPTICAL DETECTORS SHALL BE PROVIDED IN ALL LOFT AREA WHERE AHU'S ARE LOCATED.
  5. UNLESS OTHERWISE MENTIONED CONDUITS FOR FIRE ALARM SYSTEM SHALL BE MS 20 MM DIA (16 SWG)
  6. FAULT ISOLATOR TO BE PROVIDED AFTER EVERY 20 ADDRESSABLE DEVICES.

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	THIRD FLOOR PLAN (FIRE ALARM, PA & TALK BACK SYSTEM LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RD
DRAWING NO.	MCMVPL/DAFFPL/E-10
DRAWN BY	Kambaj
CHECKED BY	Parveen
APPROVED BY	



# TERRACE PLAN

### LEGEND :-

	MULTICRITERION DETECTOR
	MULTICRITERION DETECTOR (ABOVE FALSE CEILING)
	MANUAL CALL POINT
	HOOTER + STROBE
	RECESSED TYPE SPEAKER
	SURFACE MOUNTED SPEAKER
	FAULT ISOLATOR
	TALK BACK UNIT
	CONTROL MODULE FOR HOOTER, PA, TALK BACK & VENT FAN
	MONITOR MODULE FOR FLOW SWITCH

### GENERAL NOTES FOR FIRE ALARM SYSTEM

1. DETECTORS ABOVE FALSE CEILING ARE TO BE LOCATED NEAR LIGHT FIXTURE TO ENABLE EASY ACCESS/MAINTENANCE.
2. ELECTRICAL CONTRACTOR IS REQUIRED TO CO-ORDINATE POSITION OF ALL DETECTORS ABOVE/BELOW FALSE CEILING WITH FIXTURE, DUCTS & PIPES ETC. AND ENSURE THAT POSITIONING IS CARRIED OUT CORRECTLY.
3. POSITION OF ALL DETECTORS SHOWN ON THE DRAWING IS INDICATIVE AND THESE SHOULD BE LOCATED CAREFULLY AFTER PROPER CO-ORDINATION & NEAR RETURN AIR PATHS WHERE EVER POSSIBLE.
4. OPTICAL DETECTORS SHALL BE PROVIDED IN ALL LOFT AREA WHERE AHU'S ARE LOCATED.
5. UNLESS OTHERWISE MENTIONED CONDUITS FOR FIRE ALARM SYSTEM SHALL BE MS 20 MM DIA (16 SWG)
6. FAULT ISOLATOR TO BE PROVIDED AFTER EVERY 20 ADDRESSABLE DEVICES.

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA,SOUTH CITY-II, SECTOR-49,GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	TERRACE (FIRE ALARM, PA & TALK BACK SYSTEM LAYOUT)
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RO
DRAWING NO.	MCMVPL/DAFFPL/E-11

PROJECT: ADMINISTRATIVE BUILDING

CLIENT: D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

ARCHITECTS: MILLENNIUM VENTURES  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA,SOUTH CITY-II,  
SECTOR-49,GURUGRAM-122018,  
HARYANA, INDIA

STATUS: TENDER DRAWING

DRAWING TITLE: TERRACE  
(FIRE ALARM, PA &  
TALK BACK SYSTEM LAYOUT)

SCALE: 1 : 100

DATE: 07.07.2020

REVISION NO.: RO

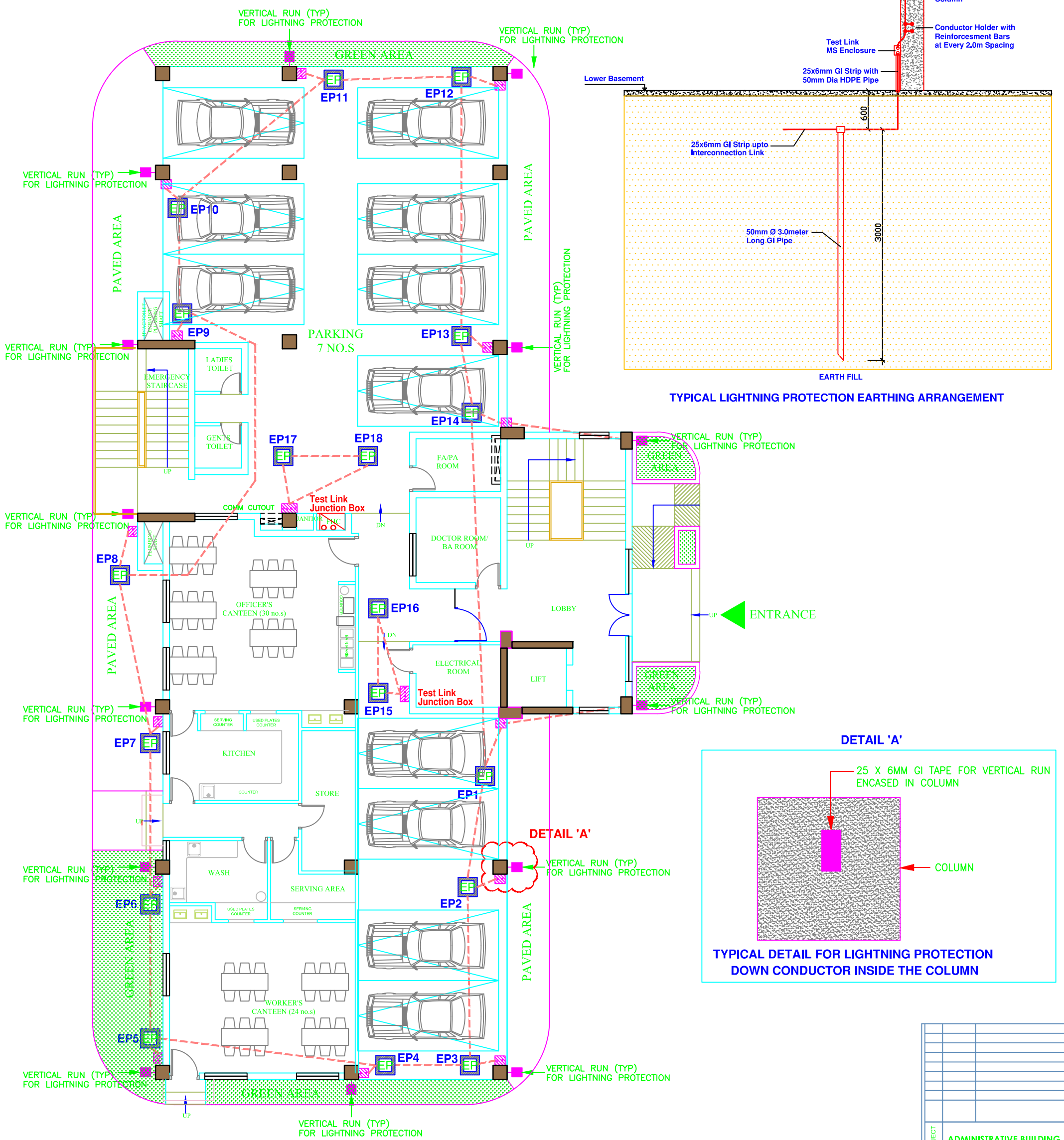
DRAWING NO.: MCMVPL/DAFFPL/E-11

APPROVED BY: Parveen

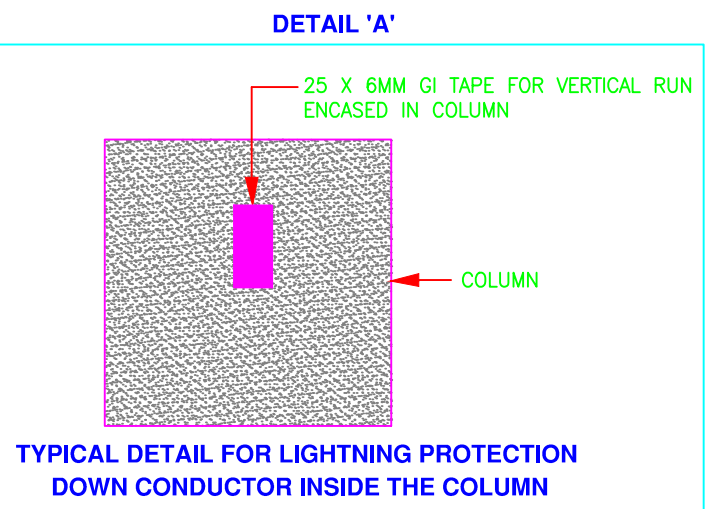
CHECKED BY: Kamboj

DRAWN BY: Kamboj





TYPICAL LIGHTNING PROTECTION EARTHING ARRANGEMENT



TYPICAL DETAIL FOR LIGHTNING PROTECTION DOWN CONDUCTOR INSIDE THE COLUMN

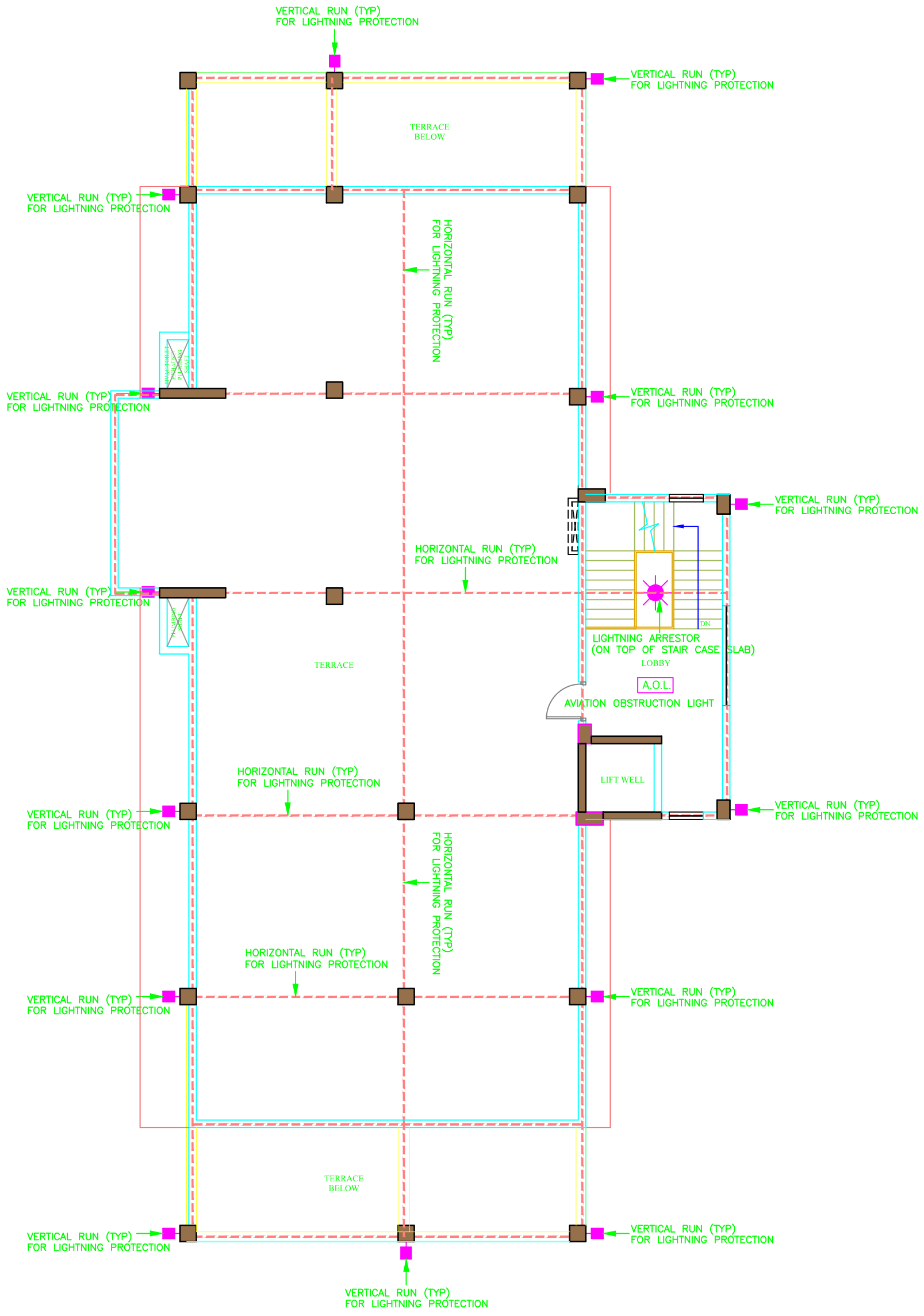
DETAIL OF EARTH PITS/EARTH TAPES

NO.	EARTH PIT NO.	TYPE OF PLATE/PIPE	PLATE/PIPE SIZE	TYPE OF TAPE	TAPE SIZE
1.	LIGHTNING PROTECTION - EP1 TO EP14	GI PIPE	50MM DIA GI PIPE	GI	25 X 6
2.	MDB-1/L+SP+AC/ST-15 - EP15	GI PLATE	900X900X6	GI	50 X 10
3.	MDB-1/L+SP+AC/ST-16 - EP16	GI PLATE	900X900X6	GI	50 X 10
4.	DATA RACK - EP17	CU PIPE	40MM DIA CU PIPE	CU	25 X 6
5.	DATA RACK - EP18	CU PIPE	40MM DIA CU PIPE	CU	25 X 6






LEGEND :-



	EARTH PIT
	TEST LINK JUNCTION BOX
	25x6MM GI TAPE

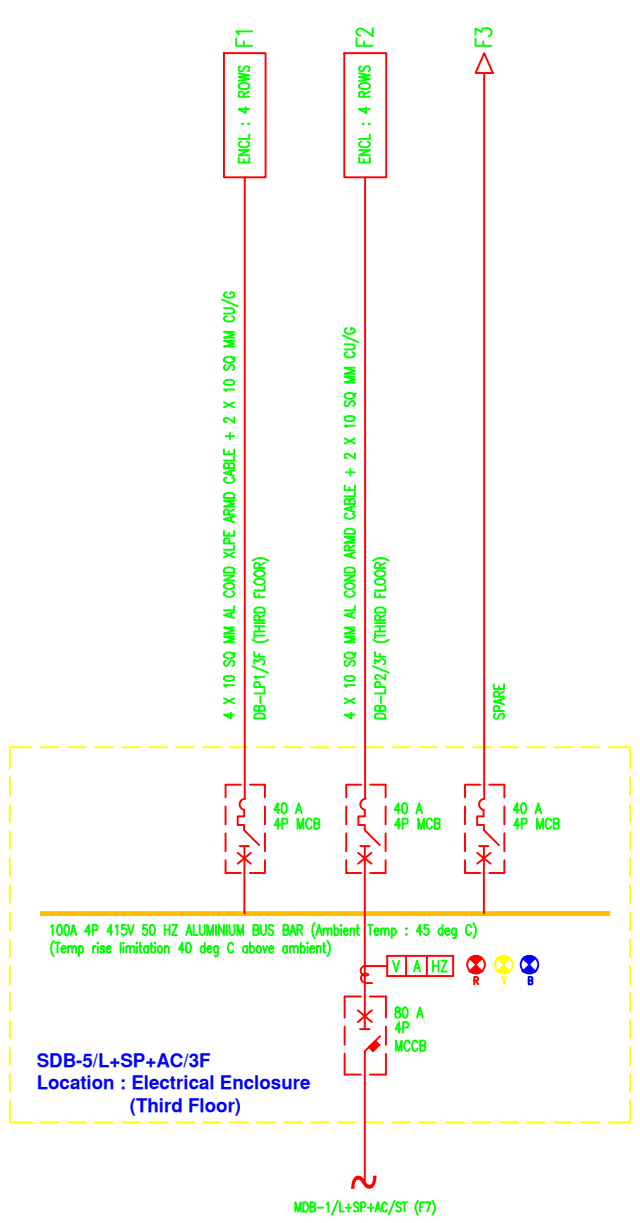
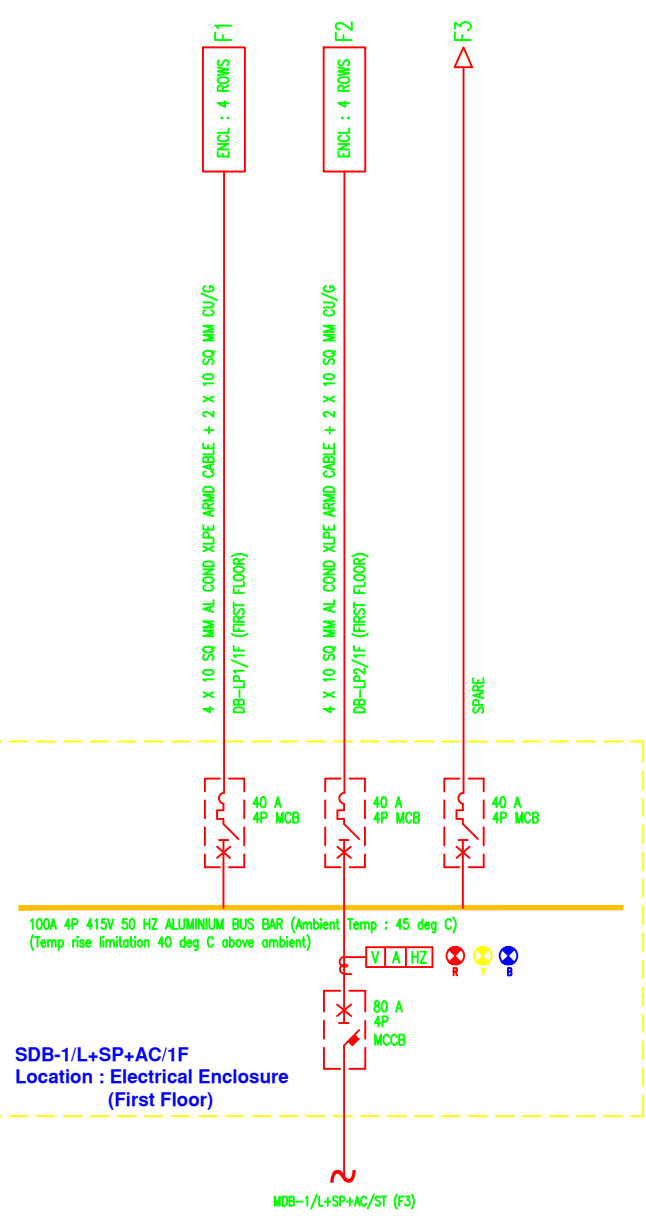
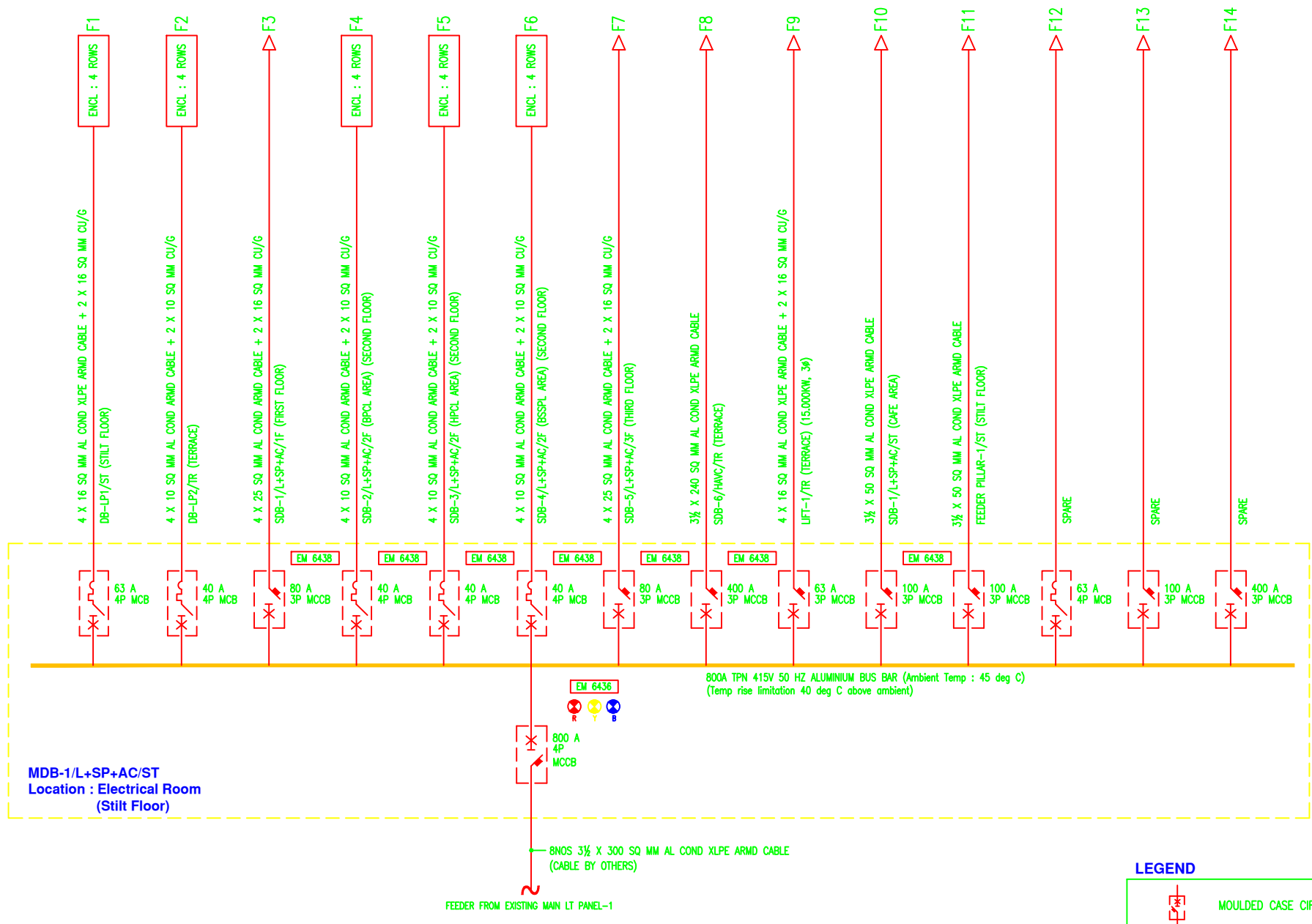
PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	STILT FLOOR PLAN LIGHTNING PROTECTION LAYOUT
SCALE	1 : 100
DATE	07.07.2020
REVISION NO.	RD
DRAWING NO.	MCMVPL/DAFFPL/E-12
DRAWN BY	Kambaj
CHECKED BY	Parveen
APPROVED BY	



**LEGEND :-**

-  LIGHTNING ARRESTOR
-  AVIATION OBSTRUCTION LIGHT
-  25x6MM GI TAPE FOR VERTICAL RUN
-  25x3MM GI TAPE FOR HORIZONTAL RUN AT TERRACE
-  25x6MM GI TAPE FROM TEST JOINT CLAMP UPTO EARTH ELECTRODE

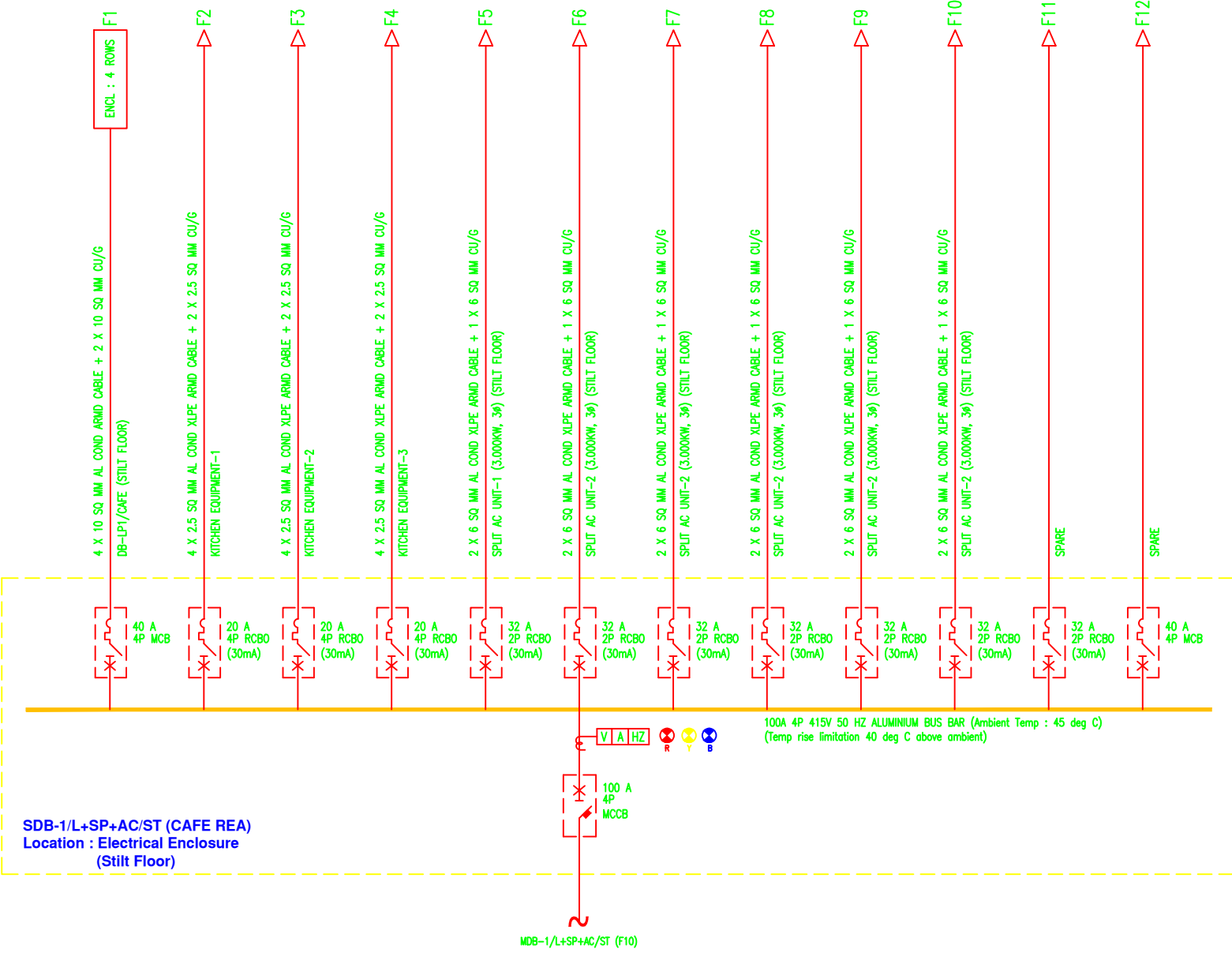
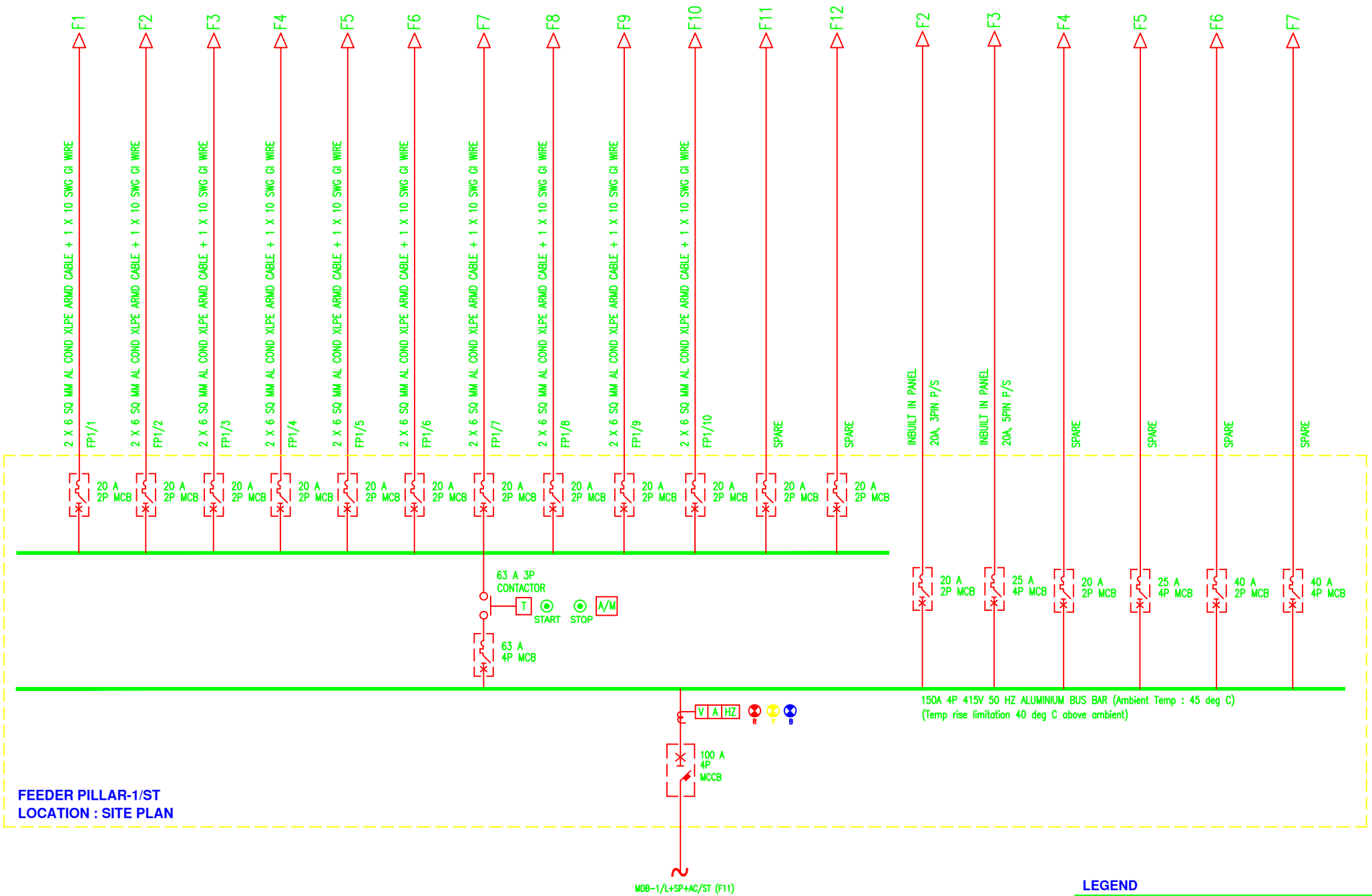
PROJECT	ADMINISTRATIVE BUILDING		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
STATUS	TENDER DRAWING		
DRAWING TITLE	TERRACE LIGHTNING PROTECTION LAYOUT		
SCALE	1 : 100	DRAWN BY	Kamboj
DATE	07.07.2020	CHECKED BY	Parveen
REVISION NO.	RO	APPROVED BY	
	DRAWING NO. MCMVPL/DAFFPL/E-13		



**LEGEND**

	MOULDED CASE CIRCUIT BREAKER
	MINIATURE CIRCUIT BREAKER
	EL+MCB
	DIGITAL AMMETER WITH BUILT-IN SELECTOR SWITCH
	DIGITAL VOLTMETER WITH BUILT-IN SELECTOR SWITCH
	FREQUENCY METER
	INDICATION LAMP (LED TYPE)
	CURRENT TRANSFORMER
	PVC INSULATED COPPER EARTH WIRE
	PVC INSULATED COPPER WIRE FOR DEDICATED EARTH
	IGS
	EM 6436 ENERGY METER
	TCL TOTAL CONNECTED LOAD
	TMDL TOTAL MAXIMUM DEMAND LOAD

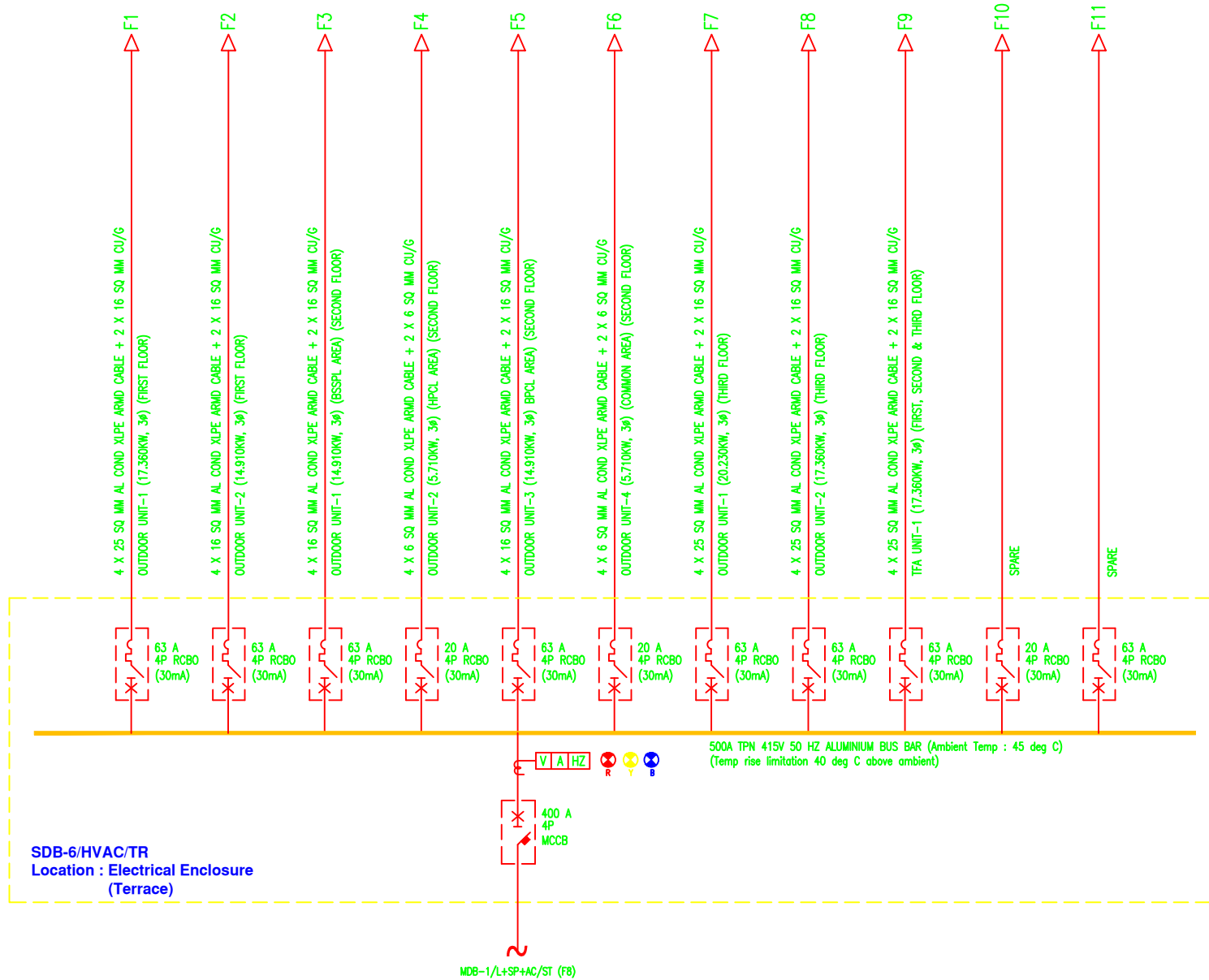
PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECT'S	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNITED-1, KICKA-SOUTH CITY-4, SECTOR-49, GURUGRAM-120116, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	SCHEMATIC DIAGRAM
SCALE	NTS
DATE	07.07.2020
REVISION NO.	R0
DRAWN BY	Kamboj
CHECKED BY	Parveen
APPROVED BY	
DRAWING NO.	MCMVPL/DAFFPL/SC-01



**LEGEND**

	MOULDED CASE CIRCUIT BREAKER
	MINIATURE CIRCUIT BREAKER
	EL+MCB
	DIGITAL AMMETER WITH BUILT-IN SELECTOR SWITCH
	DIGITAL VOLTMETER WITH BUILT-IN SELECTOR SWITCH
	FREQUENCY METER
	INDICATION LAMP (LED TYPE)
	CURRENT TRANSFORMER
	PVC INSULATED COPPER EARTH WIRE
	PVC INSULATED COPPER WIRE FOR DEDICATED EARTH
	ISOLATED GROUND SUPPLY
	ENERGY METER
	TOTAL CONNECTED LOAD
	TOTAL MAXIMUM DEMAND LOAD

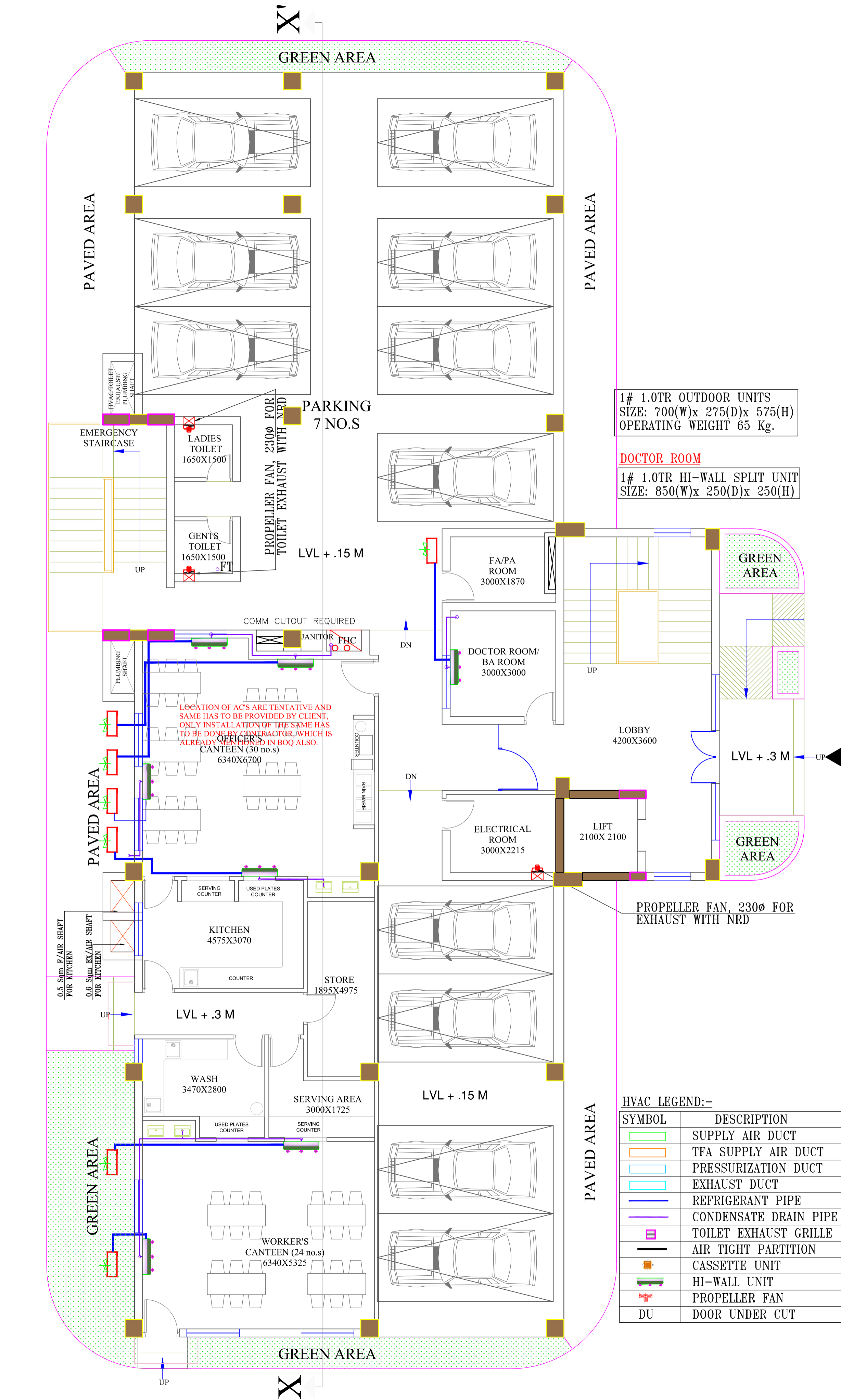
PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECT'S	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNITECH, SIKINDRA SOUTH CITY-4, SECTOR-49, GURUGRAM-120116, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	SCHEMATIC DIAGRAM
SCALE	NTS
DATE	07.07.2020
REVISION NO.	R0
DRAWN BY	Kamboj
CHECKED BY	Parveen
APPROVED BY	
DRAWING NO.	MCMVPL/DAFFPL/SC-02



**LEGEND**

	MOULDED CASE CIRCUIT BREAKER
	MINIATURE CIRCUIT BREAKER
	EL+MCB
	DIGITAL AMMETER WITH BUILT-IN SELECTOR SWITCH
	DIGITAL VOLTMETER WITH BUILT-IN SELECTOR SWITCH
	FREQUENCY METER
	INDICATION LAMP (LED TYPE)
	CURRENT TRANSFORMER
	PVC INSULATED COPPER EARTH WIRE
	PVC INSULATED COPPER WIRE FOR DEDICATED EARTH
	IGS
	EM 6436 ENERGY METER
	TCL TOTAL CONNECTED LOAD
	TMDL TOTAL MAXIMUM DEMAND LOAD

PROJECT	ADMINISTRATIVE BUILDING
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECT'S	 MILLENNIUM CITY MULTIVENTURES PVT.LTD. 302, UNITECH, SIKINDRA SOUTH GATE-4, SECTOR-49, GURUGRAM-122016, HARYANA, INDIA
STATUS	TENDER DRAWING
DRAWING TITLE	SCHEMATIC DIAGRAM
SCALE	NTS
DATE	07.07.2020
REVISION NO.	R0
DRAWN BY	Kamboj
CHECKED BY	Parveen
APPROVED BY	
DRAWING NO.	MCMVPL/DAFFPL/SC-03



- NOTES:**
- DO NOT SCALE THE DRAWING.
  - THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
  - ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
  - ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
  - ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
  - DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

1# 1.0TR OUTDOOR UNITS  
 SIZE: 700(W)x 275(D)x 575(H)  
 OPERATING WEIGHT 65 Kg.

**DOCTOR ROOM**  
 1# 1.0TR HI-WALL SPLIT UNIT  
 SIZE: 850(W)x 250(D)x 250(H)

LOCATION OF AC'S ARE TENTATIVE AND SAME HAS TO BE PROVIDED BY CLIENT. ONLY INSTALLATION OF THE SAME HAS TO BE DONE BY CONTRACTOR, WHICH IS ALREADY MENTIONED IN BOQ ALSO.

PROPELLER FAN, 230Ø FOR EXHAUST WITH NRD

**HVAC LEGEND:-**

SYMBOL	DESCRIPTION
	SUPPLY AIR DUCT
	TFA SUPPLY AIR DUCT
	PRESSURIZATION DUCT
	EXHAUST DUCT
	REFRIGERANT PIPE
	CONDENSATE DRAIN PIPE
	TOILET EXHAUST GRILLE
	AIR TIGHT PARTITION
	CASSETTE UNIT
	HI-WALL UNIT
	PROPELLER FAN
	DOOR UNDER CUT

REV. NO.	DATE OF REV.	BY	DESCRIPTION
R4	05-07-2020	SK	REVISED AS PER ARCHITECT'S COMMENTS
R3	27-06-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R2	18-03-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R1	06.03.2020	SK	CAPACITY OF AC EQUIPMENT REVISED DUE TO REVISION IN GLASS IN ELEVATION

**PROJECT**  
 ADMINISTRATIVE BUILDING

**CLIENT**  
  
 D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTS**  
  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

**MEP CONSULTANTS**  
 Flabellum Design Studio Pvt. Ltd.  
 4th Floor, Plaza Mall, MG Road,  
 Iffco Chowk, Gurgaon (HR) - 122002  
 Ph. No. 9873979157  
 flabellumdesign@gmail.com

**STATUS**  
 TENDER DRAWING

**DRAWING TITLE**  
 HVAC SYSTEM LAYOUT  
 STILT FLOOR PLAN

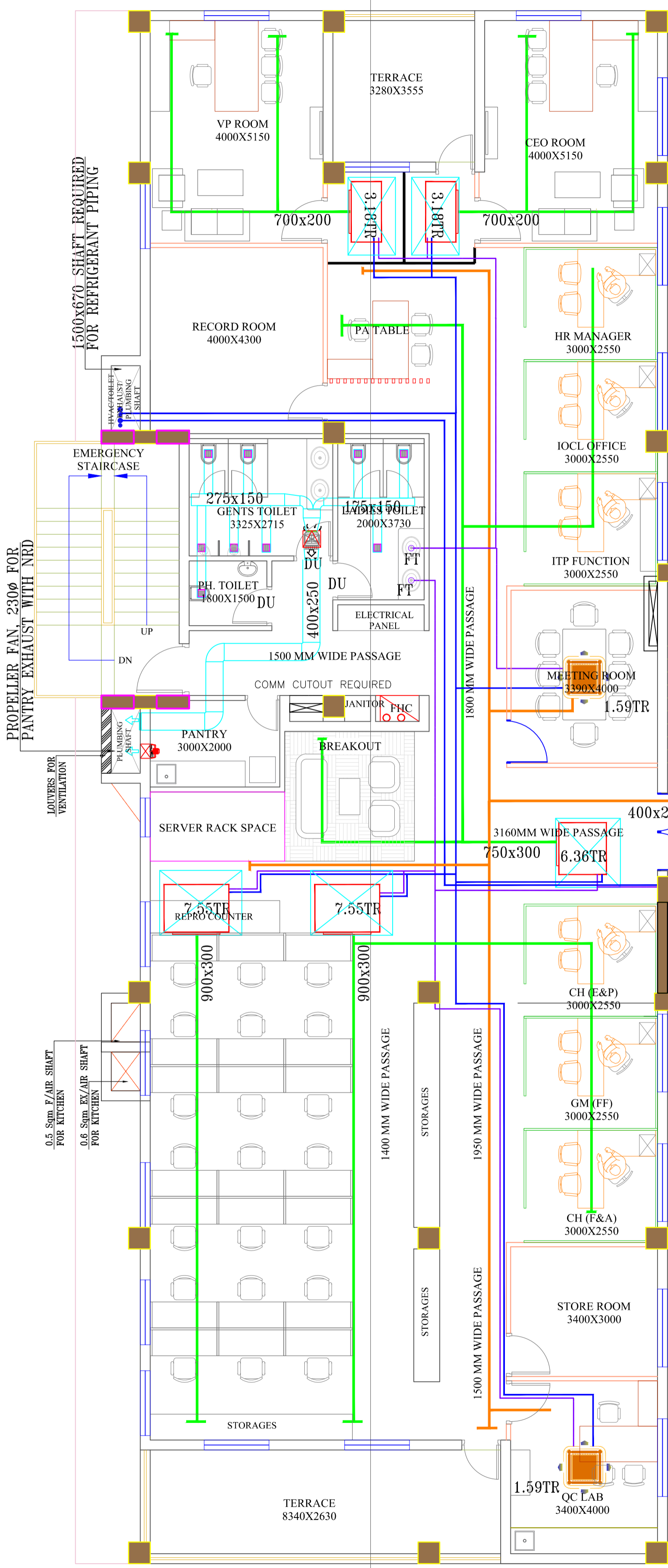
SCALE : 1:75 @ A2  
 DATE : 07-07-2020  
 REVISION NO. : RO

DRAWN BY : SANDEEP  
 CHECKED BY : GAURAV  
 APPROVED BY :

DRAWING NO :  
**DAFFPL/FDS/12056/HVAC/01**

# STILT FLOOR

X



**CEO ROOM**  
 1# 3.18TR DUCTABLE INDOOR UNIT,  
 1130 CFM  
 SIZE: 1400(W)x 700(D)x 300(H)  
 1800x1100 ACCESS PANEL IN F/C

**VP ROOM**  
 1# 3.18TR DUCTABLE INDOOR UNIT,  
 1130 CFM  
 SIZE: 1400(W)x 700(D)x 300(H)  
 1800x1100 ACCESS PANEL IN F/C

**TOILETS**  
 INLINE FAN, 900 CFM WITH NRD  
 FOR TOILETS EXHAUST  
**GENTS TOILET**  
 5# 150x150 EAG, 100 CFM EACH  
 200x100 CONNECTING COLLAR  
**LADIES TOILET**  
 3# 150x150 EAG, 100 CFM EACH  
 200x100 CONNECTING COLLAR  
**PH. TOILET**  
 1# 150x150 EAG, 100 CFM  
 200x100 CONNECTING COLLAR

**OPEN WORKSTATION**  
 1# 6.36TR DUCTABLE INDOOR UNIT,  
 2295 CFM  
 SIZE: 1190(W)x 1090(D)x 440(H)  
 1600x1500 ACCESS PANEL IN F/C  
 2# 7.55TR DUCTABLE INDOOR UNITS,  
 2825 CFM EACH  
 SIZE: 1490(W)x 1090(D)x 440(H)  
 2000x1500 ACCESS PANEL IN F/C

**HVAC LEGEND:-**

SYMBOL	DESCRIPTION
	SUPPLY AIR DUCT
	TFA SUPPLY AIR DUCT
	PRESSURIZATION DUCT
	EXHAUST DUCT
	REFRIGERANT PIPE
	CONDENSATE DRAIN PIPE
	TOILET EXHAUST GRILLE
	AIR TIGHT PARTITION
	CASSETTE UNIT
	HI-WALL UNIT
	PROPELLER FAN
	DOOR UNDER CUT

- NOTES:**
- DO NOT SCALE THE DRAWING.
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  - ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
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  - DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

R4	05-07-2020	SK	REVISED AS PER ARCHITECT'S COMMENTS
R3	27-06-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R2	18-03-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R1	06.03.2020	SK	CAPACITY OF AC EQUIPMENT REVISED DUE TO REVISION IN GLASS IN ELEVATION
REV. NO.	DATE OF REV.	BY	DESCRIPTION

**PROJECT**  
 ADMINISTRATIVE BUILDING

**CLIENT**  
  
 D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTS**  
  
 MILLENNIUM VENTURES  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

**MEP CONSULTANTS**  
 Flabellum Design Studio Pvt. Ltd.  
 4th Floor, Plaza Mall, MG Road,  
 Iffco Chowk, Gurgaon (HR) - 122002  
 Ph. No. 9873979157  
 flabellumdesign@gmail.com

**STATUS**  
 TENDER DRAWING

**DRAWING TITLE**  
 HVAC SYSTEM LAYOUT  
 FIRST FLOOR PLAN

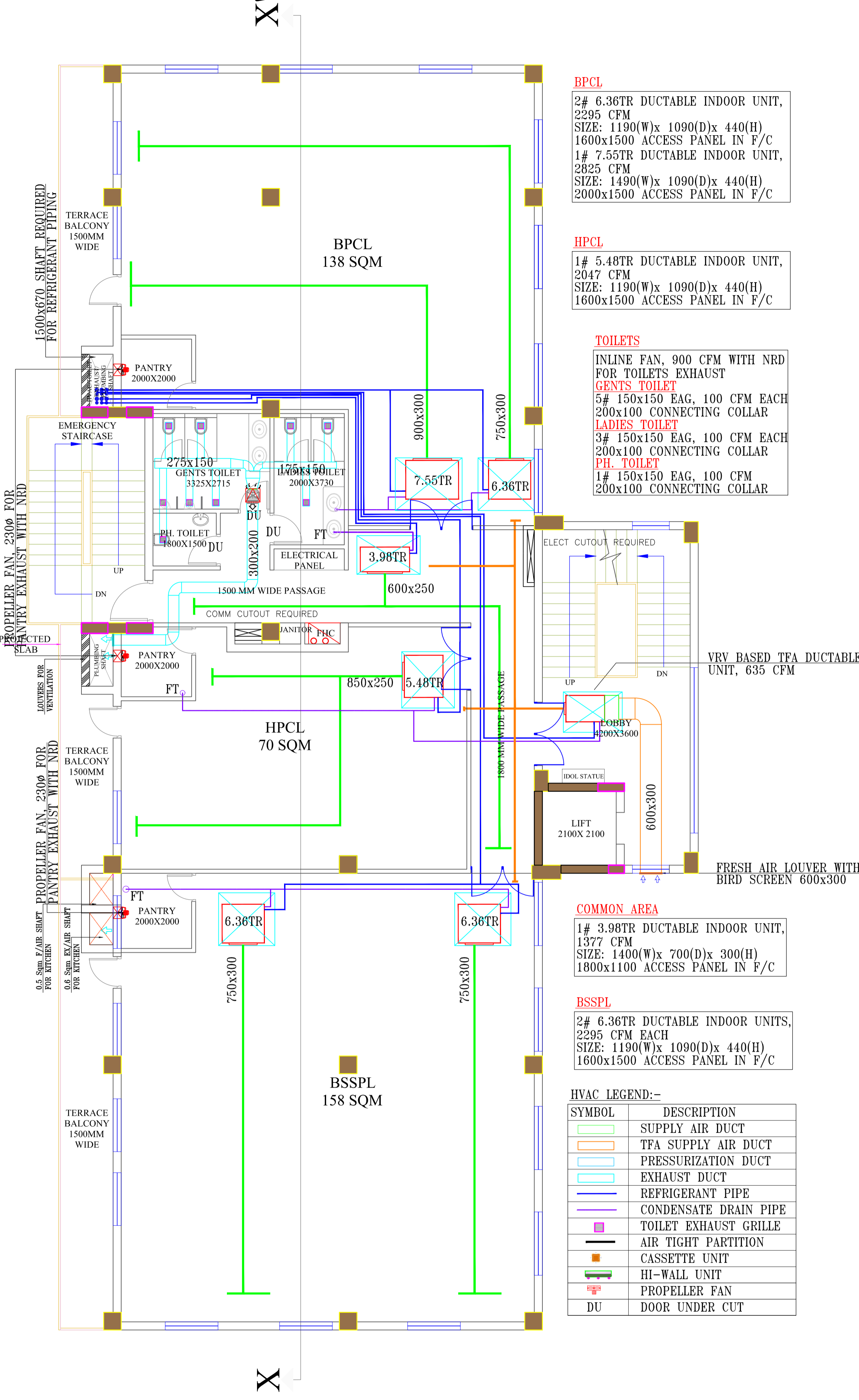
SCALE :	1:75 @ A2	DRAWN BY :	SANDEEP
DATE :	07-07-2020	CHECKED BY :	GAURAV
REVISION NO. :	RO	APPROVED BY :	

DRAWING NO :  
**DAFFPL/FDS/12056/HVAC/02**

**FIRST FLOOR**

X

- NOTES:**
- DO NOT SCALE THE DRAWING.
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**BPCL**  
 2# 6.36TR DUCTABLE INDOOR UNIT,  
 2295 CFM  
 SIZE: 1190(W)x 1090(D)x 440(H)  
 1600x1500 ACCESS PANEL IN F/C  
 1# 7.55TR DUCTABLE INDOOR UNIT,  
 2825 CFM  
 SIZE: 1490(W)x 1090(D)x 440(H)  
 2000x1500 ACCESS PANEL IN F/C

**HPCL**  
 1# 5.48TR DUCTABLE INDOOR UNIT,  
 2047 CFM  
 SIZE: 1190(W)x 1090(D)x 440(H)  
 1600x1500 ACCESS PANEL IN F/C

**TOILETS**  
 INLINE FAN, 900 CFM WITH NRD  
 FOR TOILETS EXHAUST  
**GENTS TOILET**  
 5# 150x150 EAG, 100 CFM EACH  
 200x100 CONNECTING COLLAR  
**LADIES TOILET**  
 3# 150x150 EAG, 100 CFM EACH  
 200x100 CONNECTING COLLAR  
**PH. TOILET**  
 1# 150x150 EAG, 100 CFM  
 200x100 CONNECTING COLLAR

**COMMON AREA**  
 1# 3.98TR DUCTABLE INDOOR UNIT,  
 1377 CFM  
 SIZE: 1400(W)x 700(D)x 300(H)  
 1800x1100 ACCESS PANEL IN F/C

**BSSPL**  
 2# 6.36TR DUCTABLE INDOOR UNITS,  
 2295 CFM EACH  
 SIZE: 1190(W)x 1090(D)x 440(H)  
 1600x1500 ACCESS PANEL IN F/C

**HVAC LEGEND:-**

SYMBOL	DESCRIPTION
	SUPPLY AIR DUCT
	TFA SUPPLY AIR DUCT
	PRESSURIZATION DUCT
	EXHAUST DUCT
	REFRIGERANT PIPE
	CONDENSATE DRAIN PIPE
	TOILET EXHAUST GRILLE
	AIR TIGHT PARTITION
	CASSETTE UNIT
	HI-WALL UNIT
	PROPELLER FAN
	DOOR UNDER CUT

REV. NO.	DATE OF REV.	BY	DESCRIPTION
R4	05-07-2020	SK	REVISED AS PER ARCHITECT'S COMMENTS
R3	27-06-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R2	18-03-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R1	06.03.2020	SK	CAPACITY OF AC EQUIPMENT REVISED DUE TO REVISION IN GLASS IN ELEVATION

PROJECT	<b>ADMINISTRATIVE BUILDING</b>
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. 4th Floor, Plaza Mall, MG Road, Iffco Chowk, Gurgaon (HR) - 122002 Ph. No. 9873979157 flabellumdesign@gmail.com

**STATUS**  
**TENDER DRAWING**

**DRAWING TITLE**  
**HVAC SYSTEM LAYOUT  
 SECOND FLOOR PLAN**

SCALE :	1:75 @ A2	DRAWN BY :	SANDEEP
DATE :	07-07-2020	CHECKED BY :	GAURAV
REVISION NO. :	RO	APPROVED BY :	

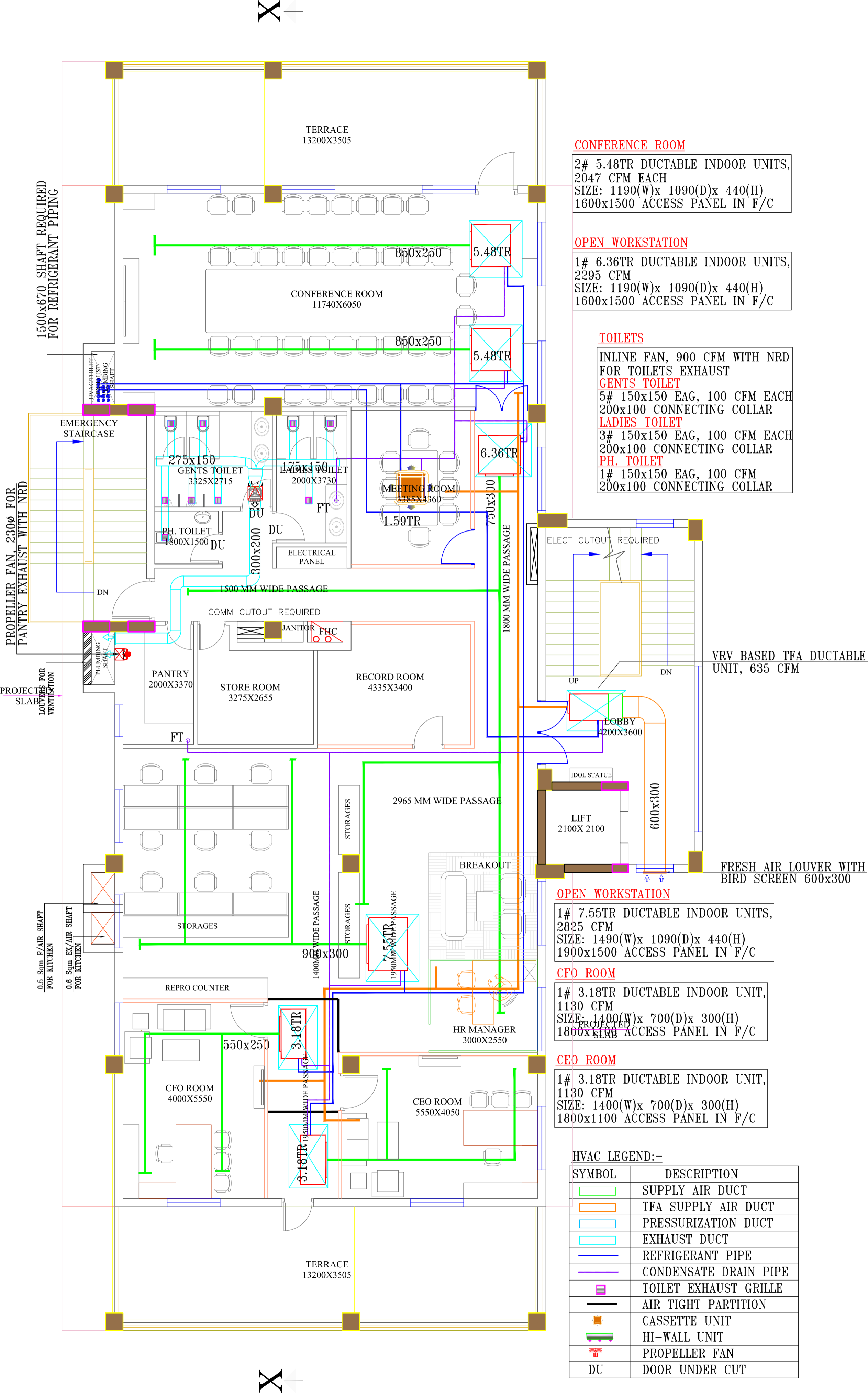
DRAWING NO :  
**DAFFPL/FDS/12056/HVAC/03**

# SECOND FLOOR

TYPE AND CAPACITY OF EQUIPMENT'S ARE FOR REFERENCE ONLY. SAME MIGHT BE CHANGED WITH INTERIOR LAYOUT. APPROVAL OF THE SAME SHOULD BE TAKEN FROM CONSULTANT/ ARCHITECT/CLIENT BEFORE PROCEEDING FURTHER.



- NOTES:**
- DO NOT SCALE THE DRAWING.
  - THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
  - ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
  - ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
  - ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
  - DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED



**CONFERENCE ROOM**  
 2# 5.48TR DUCTABLE INDOOR UNITS,  
 2047 CFM EACH  
 SIZE: 1190(W)x 1090(D)x 440(H)  
 1600x1500 ACCESS PANEL IN F/C

**OPEN WORKSTATION**  
 1# 6.36TR DUCTABLE INDOOR UNITS,  
 2295 CFM  
 SIZE: 1190(W)x 1090(D)x 440(H)  
 1600x1500 ACCESS PANEL IN F/C

**TOILETS**  
 INLINE FAN, 900 CFM WITH NRD  
 FOR TOILETS EXHAUST  
**GENTS TOILET**  
 5# 150x150 EAG, 100 CFM EACH  
 200x100 CONNECTING COLLAR  
**LADIES TOILET**  
 3# 150x150 EAG, 100 CFM EACH  
 200x100 CONNECTING COLLAR  
**PH. TOILET**  
 1# 150x150 EAG, 100 CFM  
 200x100 CONNECTING COLLAR

**OPEN WORKSTATION**  
 1# 7.55TR DUCTABLE INDOOR UNITS,  
 2825 CFM  
 SIZE: 1490(W)x 1090(D)x 440(H)  
 1900x1500 ACCESS PANEL IN F/C

**CFO ROOM**  
 1# 3.18TR DUCTABLE INDOOR UNIT,  
 1130 CFM  
 SIZE: 1400(W)x 700(D)x 300(H)  
 1800x1100 ACCESS PANEL IN F/C

**CEO ROOM**  
 1# 3.18TR DUCTABLE INDOOR UNIT,  
 1130 CFM  
 SIZE: 1400(W)x 700(D)x 300(H)  
 1800x1100 ACCESS PANEL IN F/C

**HVAC LEGEND:-**

SYMBOL	DESCRIPTION
	SUPPLY AIR DUCT
	TFA SUPPLY AIR DUCT
	PRESSURIZATION DUCT
	EXHAUST DUCT
	REFRIGERANT PIPE
	CONDENSATE DRAIN PIPE
	TOILET EXHAUST GRILLE
	AIR TIGHT PARTITION
	CASSETTE UNIT
	HI-WALL UNIT
	PROPELLER FAN
	DOOR UNDER CUT

REV. NO.	DATE OF REV.	BY	DESCRIPTION
R4	05-07-2020	SK	REVISED AS PER ARCHITECT'S COMMENTS
R3	27-06-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R2	18-03-2020	SK	REVISED AS PER LATEST ARCHITECT'S LAYOUT
R1	06.03.2020	SK	CAPACITY OF AC EQUIPMENT REVISED DUE TO REVISION IN GLASS IN ELEVATION

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT**  
  
 D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTS**  
  
 MILLENNIUM VENTURES  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

**MEP CONSULTANTS**  
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 4th Floor, Plaza Mall, MG Road,  
 Iffco Chowk, Gurgaon (HR) - 122002  
 Ph. No. 9873979157  
 flabellumdesign@gmail.com

**STATUS**  
**TENDER DRAWING**

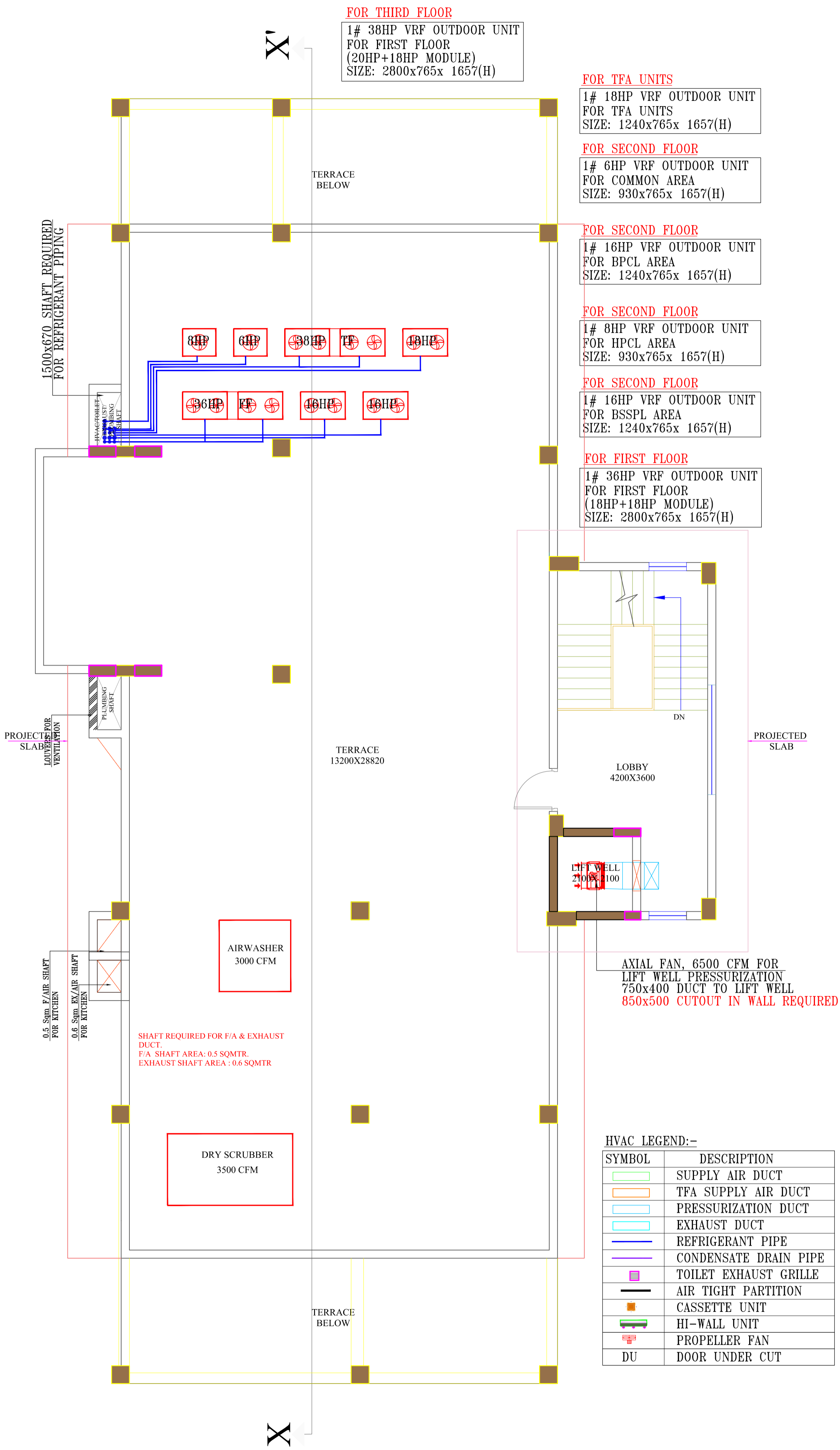
**DRAWING TITLE**  
**HVAC SYSTEM LAYOUT  
 THIRD FLOOR PLAN**

SCALE : 1:75 @ A2  
 DATE : 07-07-2020  
 REVISION NO. : RO

DRAWN BY : SANDEEP  
 CHECKED BY : GAURAV  
 APPROVED BY :

DRAWING NO :  
**DAFFPL/FDS/12056/HVAC/04**

# THIRD FLOOR



**FOR THIRD FLOOR**

1# 38HP VRF OUTDOOR UNIT  
FOR FIRST FLOOR  
(20HP+18HP MODULE)  
SIZE: 2800x765x 1657(H)

**FOR TFA UNITS**

1# 18HP VRF OUTDOOR UNIT  
FOR TFA UNITS  
SIZE: 1240x765x 1657(H)

**FOR SECOND FLOOR**

1# 6HP VRF OUTDOOR UNIT  
FOR COMMON AREA  
SIZE: 930x765x 1657(H)

**FOR SECOND FLOOR**

1# 16HP VRF OUTDOOR UNIT  
FOR BPCL AREA  
SIZE: 1240x765x 1657(H)

**FOR SECOND FLOOR**

1# 8HP VRF OUTDOOR UNIT  
FOR HPCL AREA  
SIZE: 930x765x 1657(H)

**FOR SECOND FLOOR**

1# 16HP VRF OUTDOOR UNIT  
FOR BSSPL AREA  
SIZE: 1240x765x 1657(H)

**FOR FIRST FLOOR**

1# 36HP VRF OUTDOOR UNIT  
FOR FIRST FLOOR  
(18HP+18HP MODULE)  
SIZE: 2800x765x 1657(H)

AXIAL FAN, 6500 CFM FOR  
LIFT WELL PRESSURIZATION  
750x400 DUCT TO LIFT WELL  
850x500 CUTOUT IN WALL REQUIRED

SHAFT REQUIRED FOR F/A & EXHAUST  
DUCT.  
F/A SHAFT AREA: 0.5 SQMTR.  
EXHAUST SHAFT AREA : 0.6 SQMTR

**HVAC LEGEND:-**

SYMBOL	DESCRIPTION
	SUPPLY AIR DUCT
	TFA SUPPLY AIR DUCT
	PRESSURIZATION DUCT
	EXHAUST DUCT
	REFRIGERANT PIPE
	CONDENSATE DRAIN PIPE
	TOILET EXHAUST GRILLE
	AIR TIGHT PARTITION
	CASSETTE UNIT
	HI-WALL UNIT
	PROPELLER FAN
DU	DOOR UNDER CUT

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
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REV. NO.	DATE OF REV.	BY	DESCRIPTION
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R1	06.03.2020	SK	CAPACITY OF AC EQUIPMENT REVISED DUE TO REVISION IN GLASS IN ELEVATION

**PROJECT**  
ADMINISTRATIVE BUILDING

**CLIENT**  
  
D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTS**  
  
MILLENNIUM VENTURES  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

**MEP CONSULTANTS**  
Flabellum Design Studio Pvt. Ltd.  
4th Floor, Plaza Mall, MG Road,  
Iffco Chowk, Gurgaon (HR) - 122002  
Ph. No. 9873979157  
flabellumdesign@gmail.com

**STATUS**  
TENDER DRAWING

**DRAWING TITLE**  
HVAC SYSTEM LAYOUT  
TERRACE FLOOR PLAN

SCALE : 1:75 @ A2  
DATE : 07-07-2020  
REVISION NO. : RO

DRAWN BY : SANDEEP  
CHECKED BY : GAURAV  
APPROVED BY :  
DRAWING NO :  
DAFFPL/FDS/12056/HVAC/05

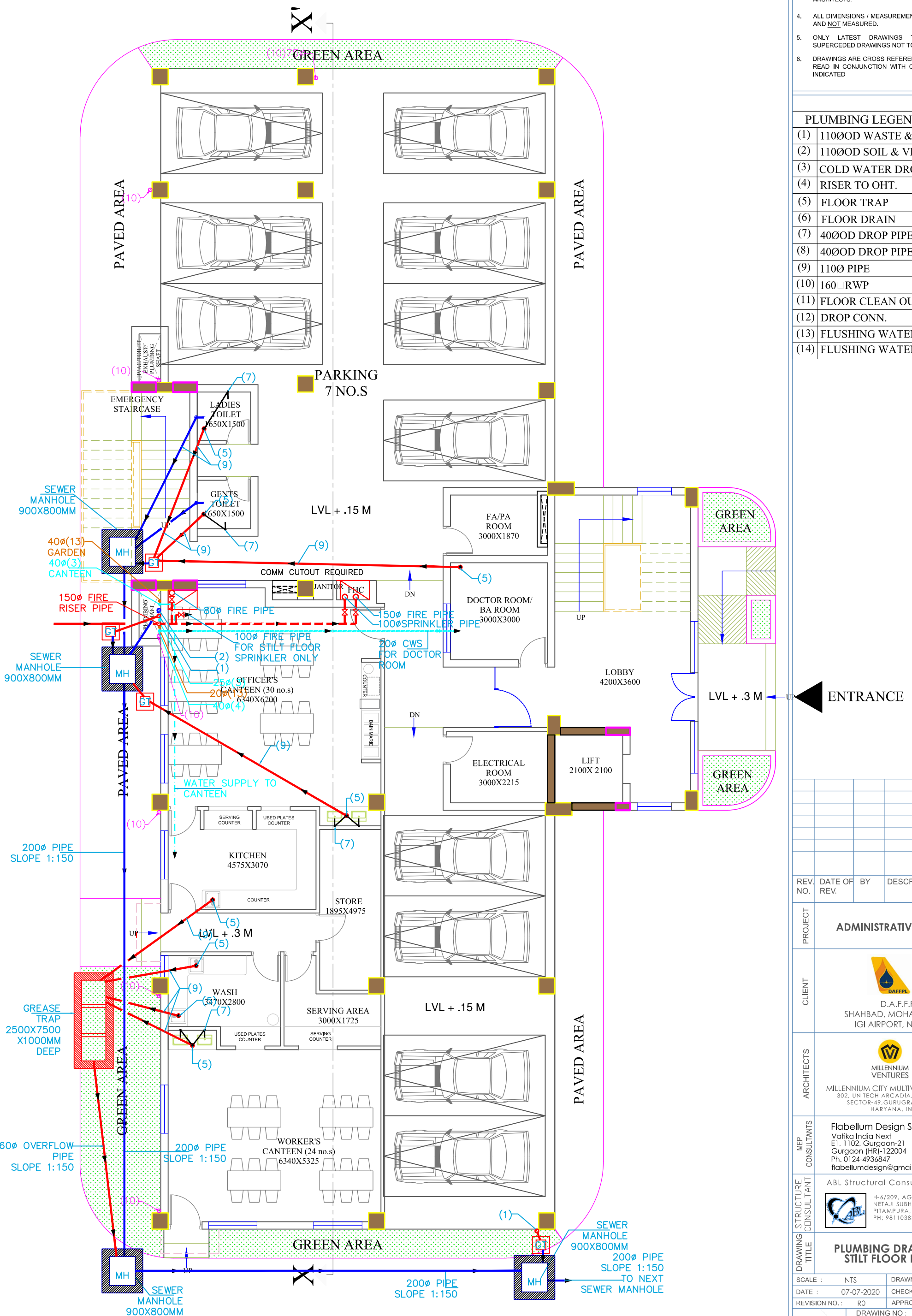
**TERRACE PLAN**

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
- ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
- ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
- ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

**PLUMBING LEGEND:-**

- |      |                          |
|------|--------------------------|
| (1)  | 110ØOD WASTE & VP        |
| (2)  | 110ØOD SOIL & VP         |
| (3)  | COLD WATER DROP PIPE     |
| (4)  | RISER TO OHT.            |
| (5)  | FLOOR TRAP               |
| (6)  | FLOOR DRAIN              |
| (7)  | 40ØOD DROP PIPE          |
| (8)  | 40ØOD DROP PIPE (URINAL) |
| (9)  | 110Ø PIPE                |
| (10) | 160 RWP                  |
| (11) | FLOOR CLEAN OUT          |
| (12) | DROP CONN.               |
| (13) | FLUSHING WATER SUPPLY    |
| (14) | FLUSHING WATER RISER     |



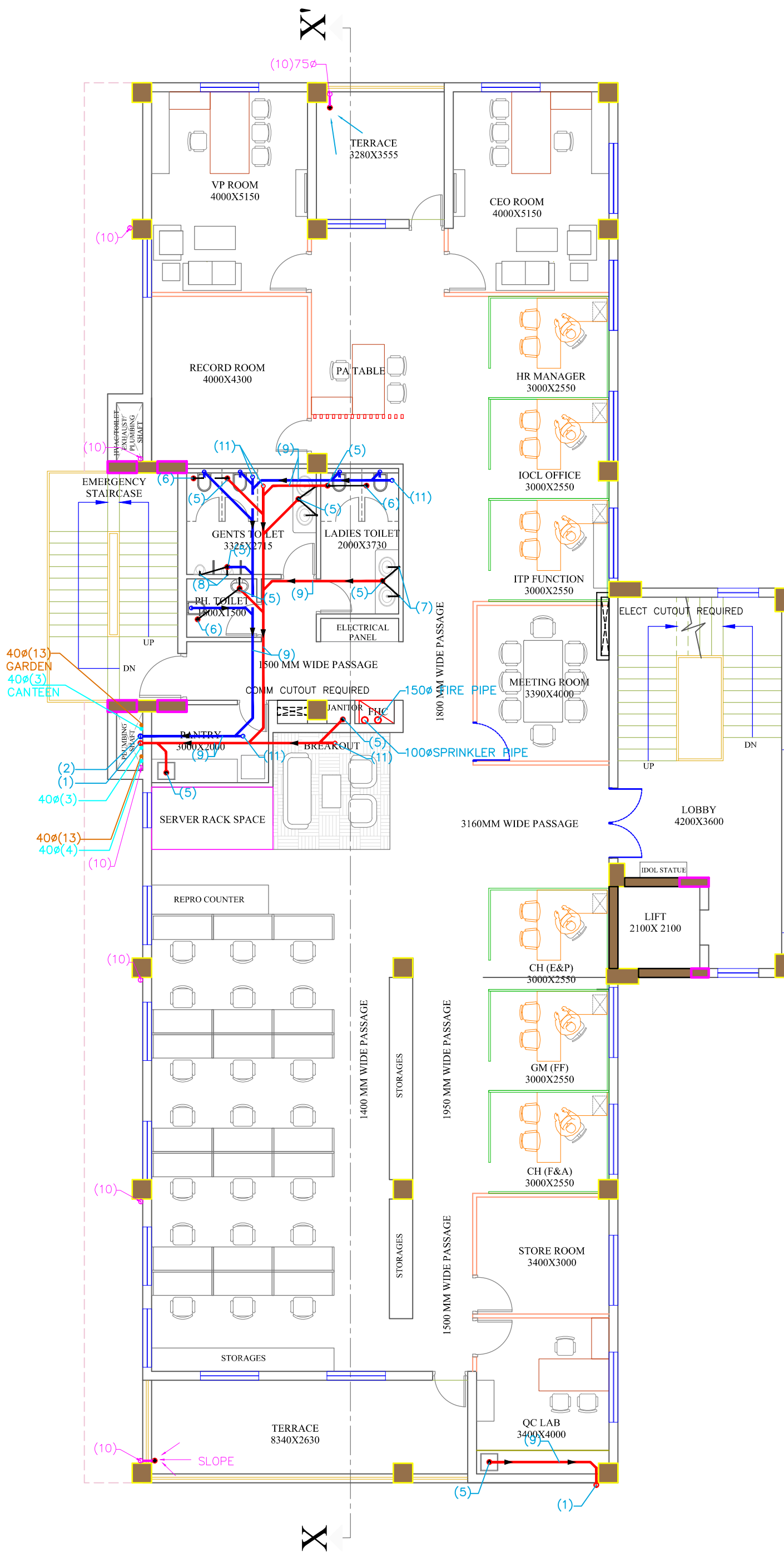
**STILT FLOOR**

**NOTES:**

- DO NOT SCALE THE DRAWING.
- THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
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- DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

**PLUMBING LEGEND:-**

(1)	110Ø OD WASTE & VP
(2)	110Ø OD SOIL & VP
(3)	COLD WATER DROP PIPE
(4)	RISER TO OHT.
(5)	FLOOR TRAP
(6)	FLOOR DRAIN
(7)	40Ø OD DROP PIPE
(8)	40Ø OD DROP PIPE (URINAL)
(9)	110Ø PIPE
(10)	160 RWP
(11)	FLOOR CLEAN OUT
(12)	DROP CONN.
(13)	FLUSHING WATER SUPPLY
(14)	FLUSHING WATER RISER



REV. NO.	DATE OF REV.	BY	DESCRIPTION

PROJECT: **ADMINISTRATIVE BUILDING**

CLIENT: **DAFFPL**  
D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

ARCHITECTS: **MILLENNIUM VENTURES**  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

MEP CONSULTANTS: **Flabellum Design Studio Pvt. Ltd.**  
Valika India Next  
E1, 1102, Gurgaon-21  
Gurgaon (HR)-122004  
Ph. 0124-4936847  
flabellumdesign@gmail.com

STRUCTURE CONSULTANT: **ABL Structural Consultants Pvt. Ltd.**  
H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034,  
PH: 9811038352 . 011- 45650222.

DRAWING TITLE: **PLUMBING DRAWING FIRST FLOOR PLAN**

SCALE: NTS DRAWN BY: GAUTAM  
DATE: 07-07-2020 CHECKED BY: D.K  
REVISION NO.: R0 APPROVED BY:

DRAWING NO.: **DAFFPL/MCMVPL/2020/PL-03**  
FDR TENDER ADVANCE COPY  
FDR APPROVAL GOOD FOR CONSTRUCTION

**FIRST FLOOR**

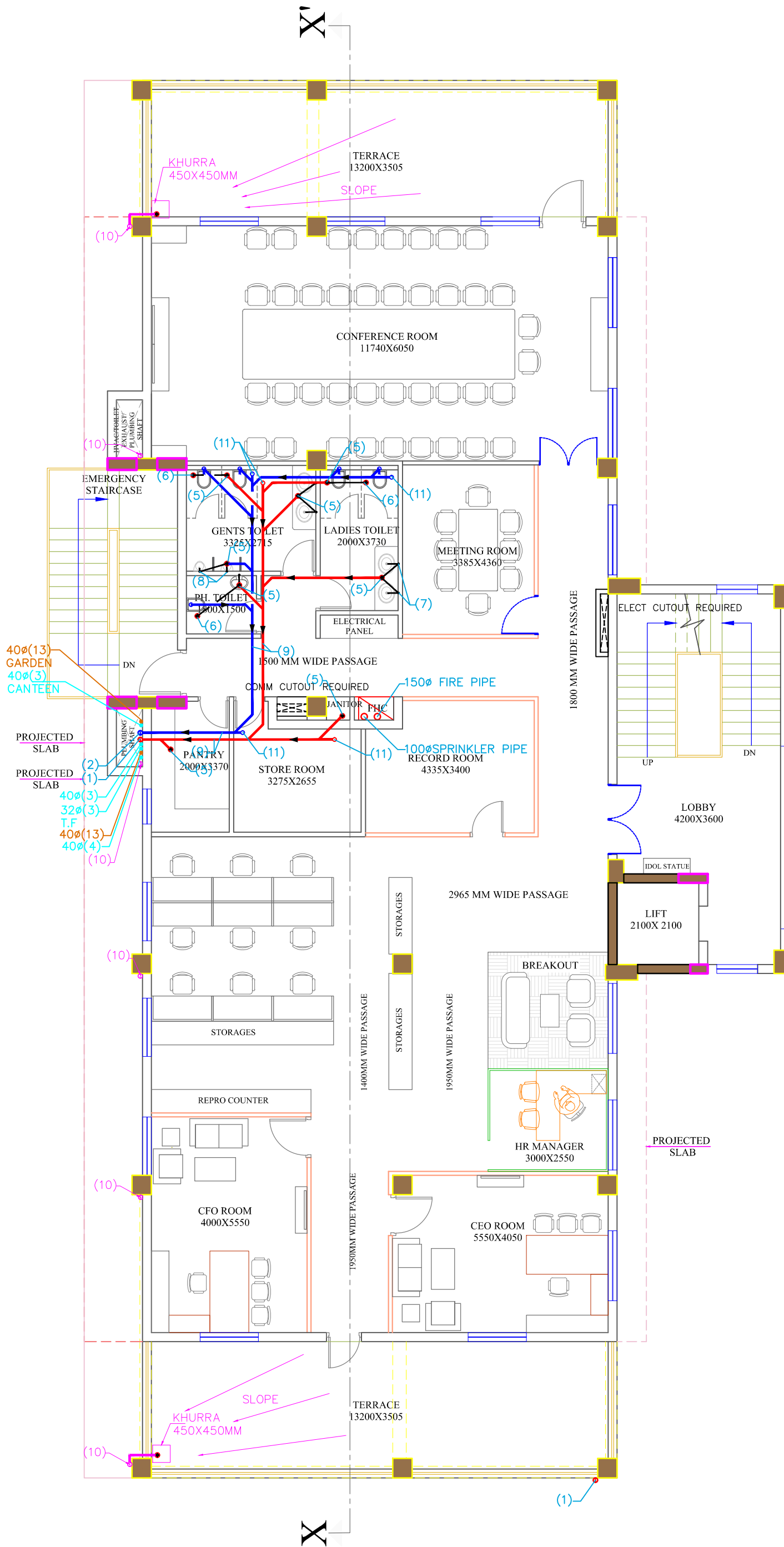


**NOTES:**

1. DO NOT SCALE THE DRAWING.
2. THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
3. ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
4. ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
5. ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
6. DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

**PLUMBING LEGEND:-**

(1)	110Ø OD WASTE & VP
(2)	110Ø OD SOIL & VP
(3)	COLD WATER DROP PIPE
(4)	RISER TO OHT.
(5)	FLOOR TRAP
(6)	FLOOR DRAIN
(7)	40Ø OD DROP PIPE
(8)	40Ø OD DROP PIPE (URINAL)
(9)	110Ø PIPE
(10)	160 RWP
(11)	FLOOR CLEAN OUT
(12)	DROP CONN.
(13)	FLUSHING WATER SUPPLY
(14)	FLUSHING WATER RISER



**THIRD FLOOR**

REV. NO.	DATE OF REV.	BY	DESCRIPTION

PROJECT: **ADMINISTRATIVE BUILDING**

CLIENT:   
D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

ARCHITECTS:   
MILLENNIUM VENTURES  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA





MEP CONSULTANTS: **Flabellum Design Studio Pvt. Ltd.**  
Valika India Next  
E1, 1102, Gurgaon-21  
Gurgaon (HR)-122004  
Ph. 0124-4936847  
flabellumdesign@gmail.com

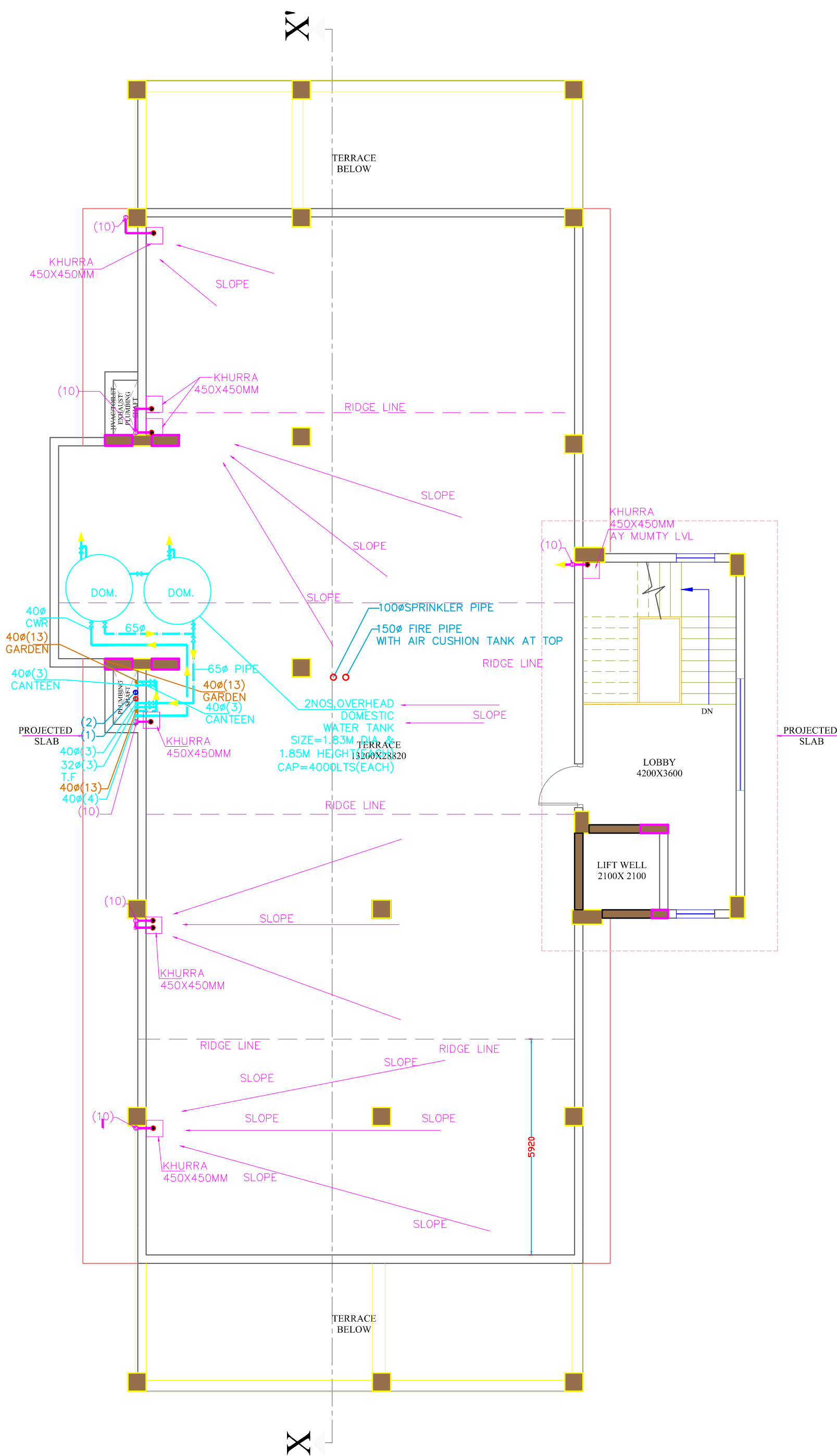
STRUCTURE CONSULTANT: **ABL Structural Consultants Pvt. Ltd.**  
 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034,  
PH: 9811038352 . 011- 45650222.

DRAWING TITLE: **PLUMBING DRAWING  
THIRD FLOOR PLAN**

SCALE :	NTS	DRAWN BY :	GAUTAM
DATE :	07-07-2020	CHECKED BY :	D.K
REVISION NO. :	RO	APPROVED BY :	

DRAWING NO : **DAFFPL/MCMVPL/2020/PL-05**

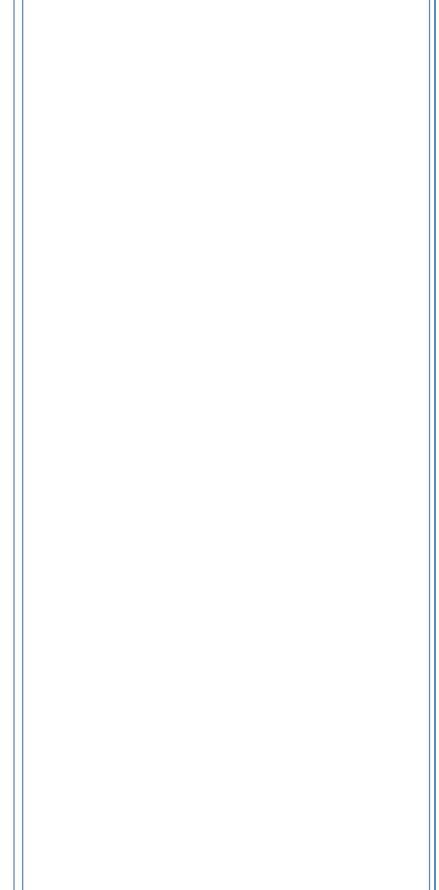
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	FDR APPROVAL		GOOD FOR CONSTRUCTION



- NOTES:**
- DO NOT SCALE THE DRAWING.
  - THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
  - ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
  - ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
  - ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
  - DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

**PLUMBING LEGEND:-**

(1)	110ØOD WASTE & VP
(2)	110ØOD SOIL & VP
(3)	COLD WATER DROP PIPE
(4)	RISER TO OHT.
(5)	FLOOR TRAP
(6)	FLOOR DRAIN
(7)	40ØOD DROP PIPE
(8)	40ØOD DROP PIPE (URINAL)
(9)	110Ø PIPE
(10)	160□RWP
(11)	FLOOR CLEAN OUT
(12)	DROP CONN.
(13)	FLUSHING WATER SUPPLY
(14)	FLUSHING WATER RISER



REV. NO.	DATE OF REV.	BY	DESCRIPTION

PROJECT	<b>ADMINISTRATIVE BUILDING</b>
---------	--------------------------------

CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI
--------	--

ARCHITECTS	 MILLENNIUM VENTURES MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA
------------	---

MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Valika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com
-----------------	--

DRAWING STRUCTURE CONSULTANT	ABL Structural Consultants Pvt. Ltd.  H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352, 011-45650222.
------------------------------	---

DRAWING TITLE	<b>PLUMBING DRAWING TERRACE PLAN</b>
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SCALE :	NTS	DRAWN BY :	GAUTAM
DATE :	07-07-2020	CHECKED BY :	D.K
REVISION NO. :	RO	CHECKED BY :	

DRAWING NO :  
**DAFFPL/MCMVPL/2020/PL-06**

FDR TENDER     ADVANCE COPY  
 FDR APPROVAL     GOOD FOR CONSTRUCTION

# TERRACE PLAN

**NOTES:**

1. DO NOT SCALE THE DRAWING.
2. THE DIMENSIONS SHOULD BE CHECKED AND VERIFIED BEFORE THE EXECUTION OF WORK AT SITE.
3. ANY DISCREPANCY FOUND IN THE DRAWING/AT SITE SHOULD BE BROUGHT TO THE NOTICE OF THE ARCHITECTS.
4. ALL DIMENSIONS / MEASUREMENTS SHOULD BE READ AND NOT MEASURED.
5. ONLY LATEST DRAWINGS TO BE REFERRED, SUPERCEDED DRAWINGS NOT TO BE KEPT ON SITE
6. DRAWINGS ARE CROSS REFERENCED AND ARE TO BE READ IN CONJUNCTION WITH OTHER DRAWINGS AS INDICATED

**PLUMBING LEGEND:-**

	SEWER MANHOLE
	SEWER PIPE
	CATCH BASIN
	STORM WATER PIPE
	GARDEN HYDRANT PIPE
	GARDEN TAP
	EXTERNAL FIRE HYDRANT
	FIRE PIPE

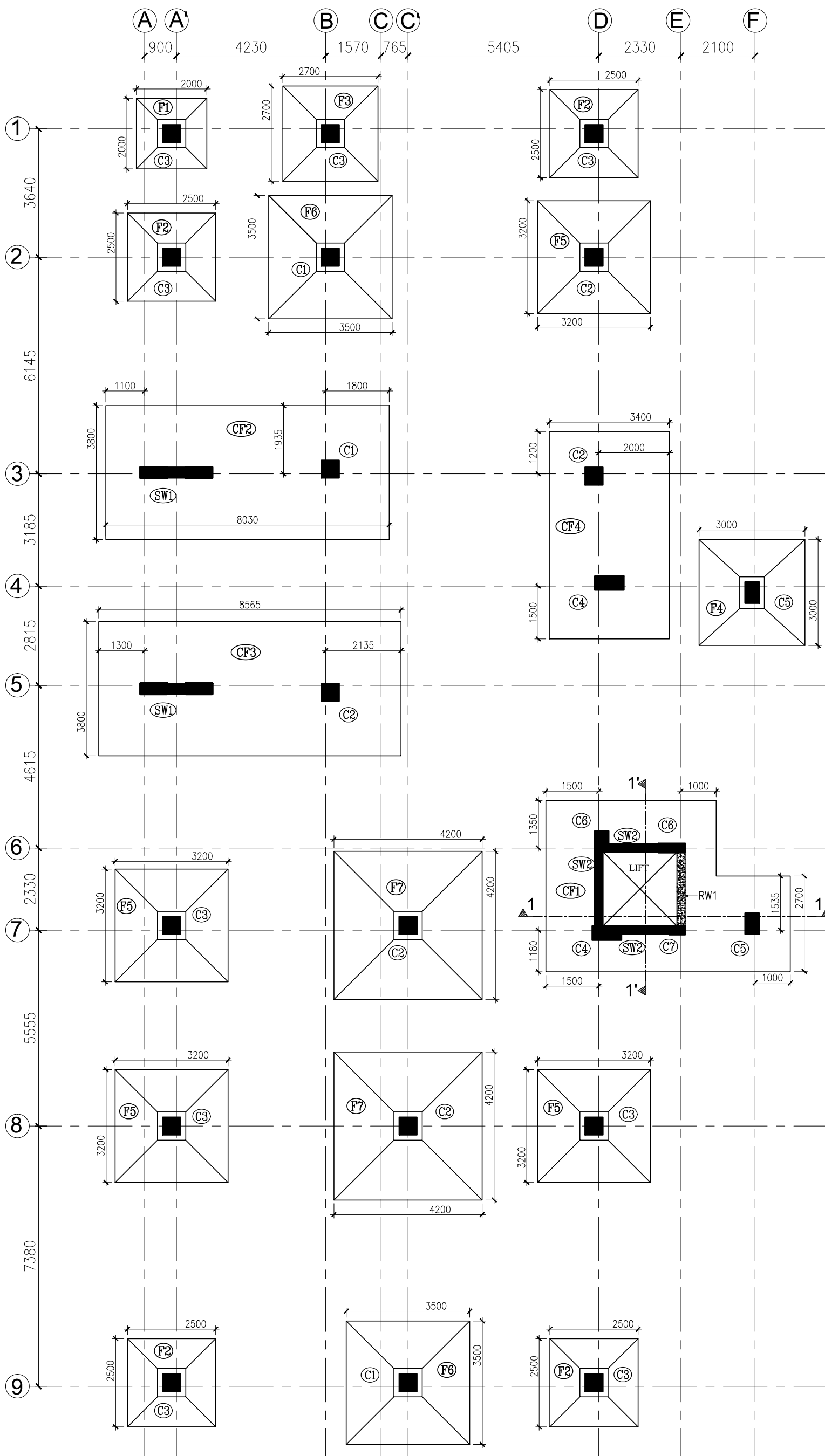


REV. NO.	DATE OF REV.	BY	DESCRIPTION
PROJECT	ADMINISTRATIVE BUILDING		
CLIENT	 D.A.F.F.P.L. SHAHBAD, MOHAMMADPUR, IGI AIRPORT, NEW DELHI		
ARCHITECTS	 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd. 302, UNITECH ARCADIA, SOUTH CITY-II, SECTOR-49, GURUGRAM-122018, HARYANA, INDIA		
MEP CONSULTANTS	Flabellum Design Studio Pvt. Ltd. Vatika India Next E1, 1102, Gurgaon-21 Gurgaon (HR)-122004 Ph. 0124-4936847 flabellumdesign@gmail.com		
DRAWING STRUCTURE CONSULTANT	ABL Structural Consultants Pvt. Ltd.  H-6/209, AGGARWAL TOWER, NETAJI SUBHASH PLACE, PITAMPURA, DELHI-110034, PH: 9811038352   011- 45650222.		

**SITE PLAN**

SCALE :	NTS	DRAWN BY :	GAUTAM
DATE :	07-07-2020	CHECKED BY :	D.K.
REVISION NO. :	R0	APPROVED BY :	
DRAWING NO :	DAFFPL/MCMVPL/2020/PL-01		





FOUNDATION PLAN

**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX, UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786:2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART I) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UP TO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING, THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY
15. BEARING CAPACITY OF SOIL HAS BEEN ASSUMED AS 13.5 T/Sq.m. AT THE DEPTH OF 3500 MM FROM N.G.L.
16. BUILDING HAS BEEN DESIGNED FOR G+3 STOREY ONLY.

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM


rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

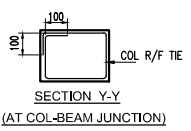
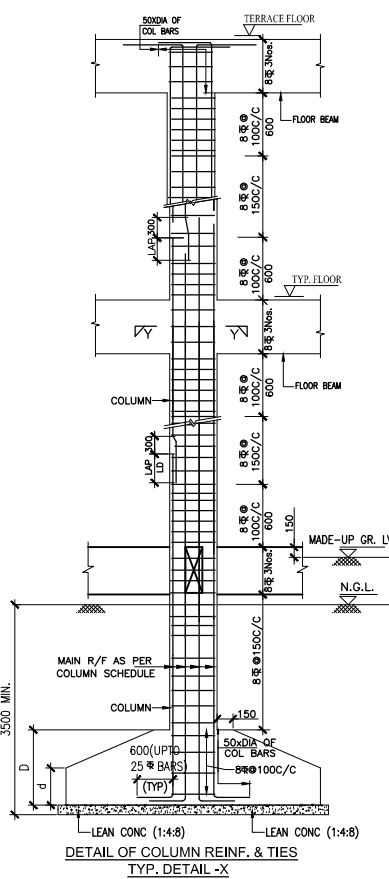
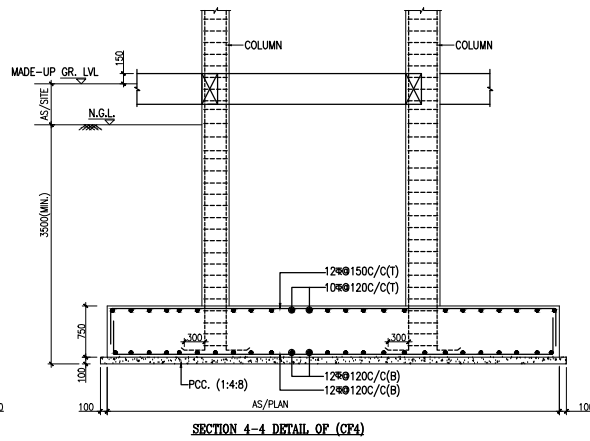
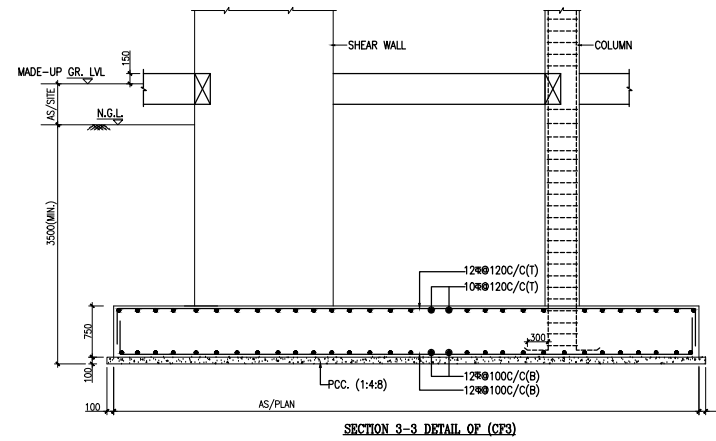
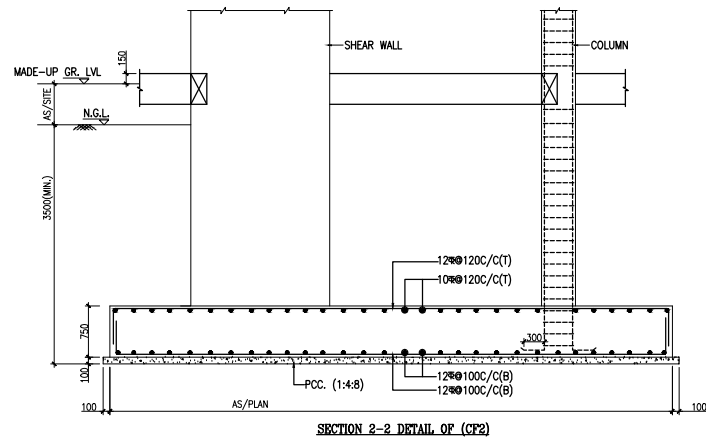
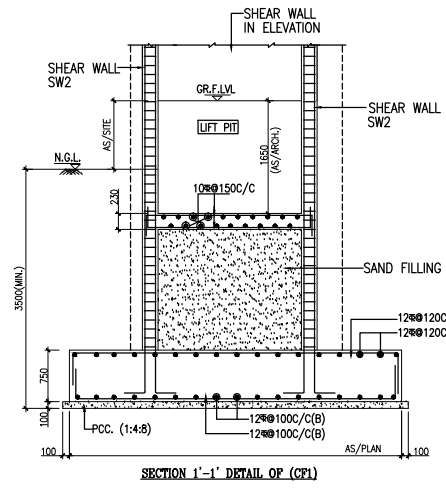
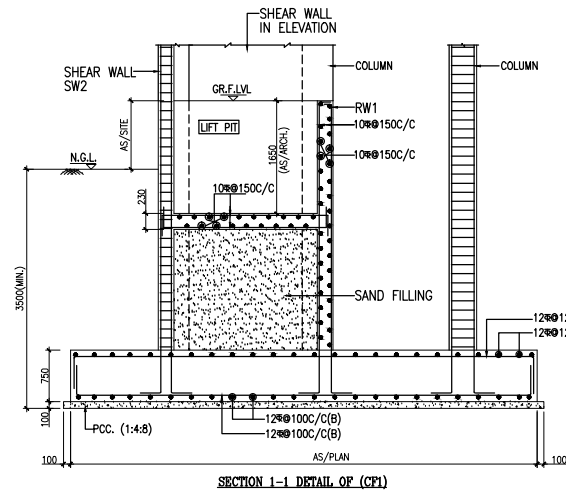
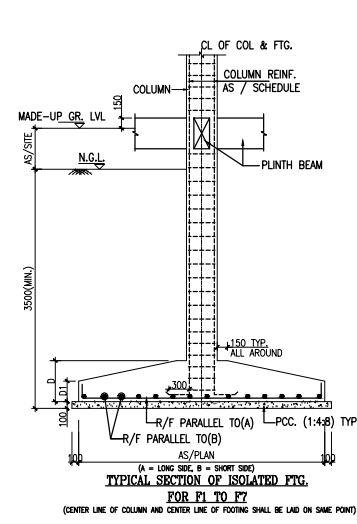
 H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title**  
 FOUNDATION PLAN

Drawn A.Malik	Dealt D.K.	Checked B.K. SINGH	Drg. no. ST-01
Date 07.07.2020	Scale 1:100	REV. R-00	

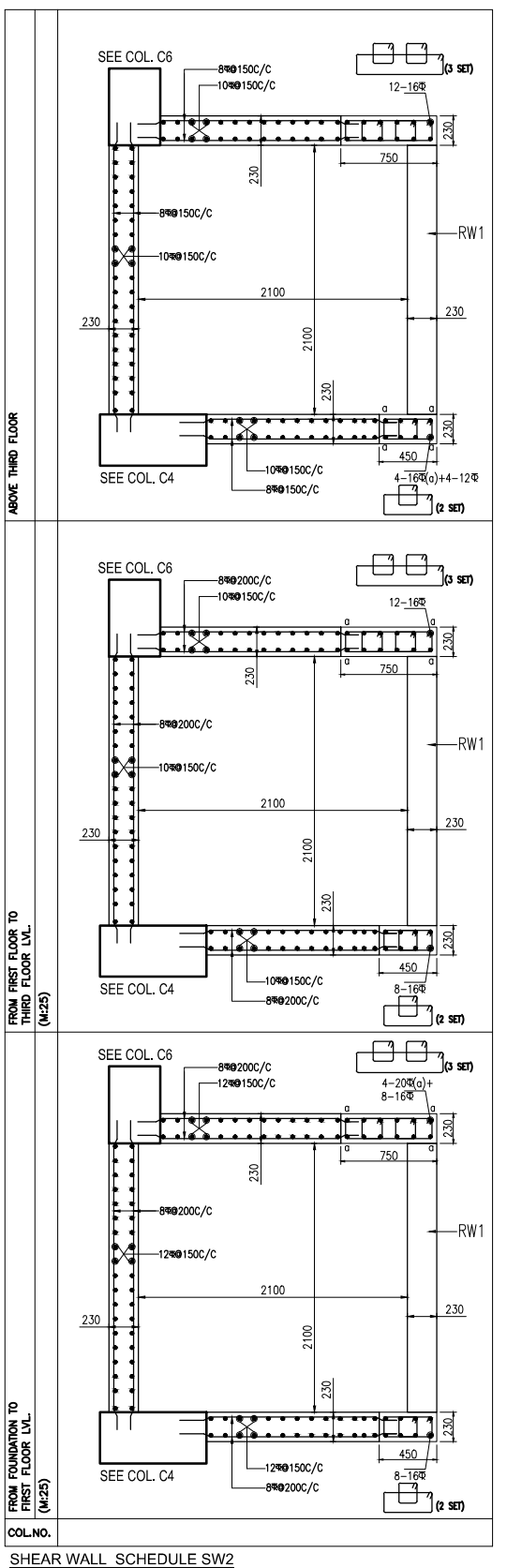
- FOR TENDER
- ADVANCE COPY
- FOR APPROVAL
- GOOD FOR CONSTRUCTION

FTG. MARK	CONC. DIMENSION				REINFORCEMENT (BOTTOM)	
	LONG SIDE (A)	SHORT SIDE (B)	DEPTH (D)	DEPTH (D1)	LONG SIDE (A)	SHORT SIDE (B)
F1	2000	2000	450	250	10 @ 120C/C	10 @ 120C/C
F2	2500	2500	600	300	10 @ 120C/C	10 @ 120C/C
F3	2700	2700	600	300	12 @ 150C/C	12 @ 150C/C
F4	3000	3000	600	300	12 @ 120C/C	12 @ 120C/C
F5	3200	3200	600	300	12 @ 100C/C	12 @ 100C/C
F6	3500	3500	600	300	12 @ 100C/C	12 @ 100C/C
F7	4200	4200	750	300	16 @ 120C/C	16 @ 120C/C



COL. NO.	C1	C2	C3	C4	C5	C6	C7	SHEAR WALL SW1
ABOVE THIRD FLOOR (M-25)	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]
FROM FIRST FLOOR TO THIRD FLOOR LV. (M-25)	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]
FROM FOUNDATION TO FIRST FLOOR LV. (M-25)	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]	[Diagram]

COLUMN SCHEDULE (NOTE:- FOR DIA & SPACING OF TIES REFER TYP. DET.-X)



**General Notes:**

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
- ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
- ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX UNLESS OTHERWISE MENTIONED.
- Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786:2008 SHALL BE USED IN ALL RCC WORK.
- REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS AND AS PER I.S. CODE PROVISION
  - PILE/PILE CAP = 75mm
  - COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - BEAM = 25mm
  - SLAB = 20mm
- LAP/DEVELOPMENT LENGTH FOR ALL REIN. BARS SHALL BE 49x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
- BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART II) : 2016
- NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
- COLUMNS CONCORDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. F.L. LVL.
- THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
- THE SPACING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
- THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
- THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPARATELY
- BEARING CAPACITY OF SOIL HAS BEEN ASSUMED AS 13.5 TISq.m AT THE DEPTH OF 5000 MM FROM N.G.L.
- BUILDING HAS BEEN DESIGNED FOR G-3 STOREY ONLY.

**NOTES FOR CONSTRUCTION JOINTS**

- DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
- CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINFT. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
- CONSTRUCTION JOINT SHALL BE PLANNED AT 3%L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BELM


rev. no.	date	revision

**PROJECT**

**ADMINISTRATIVE BUILDING**

**CLIENT**            D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

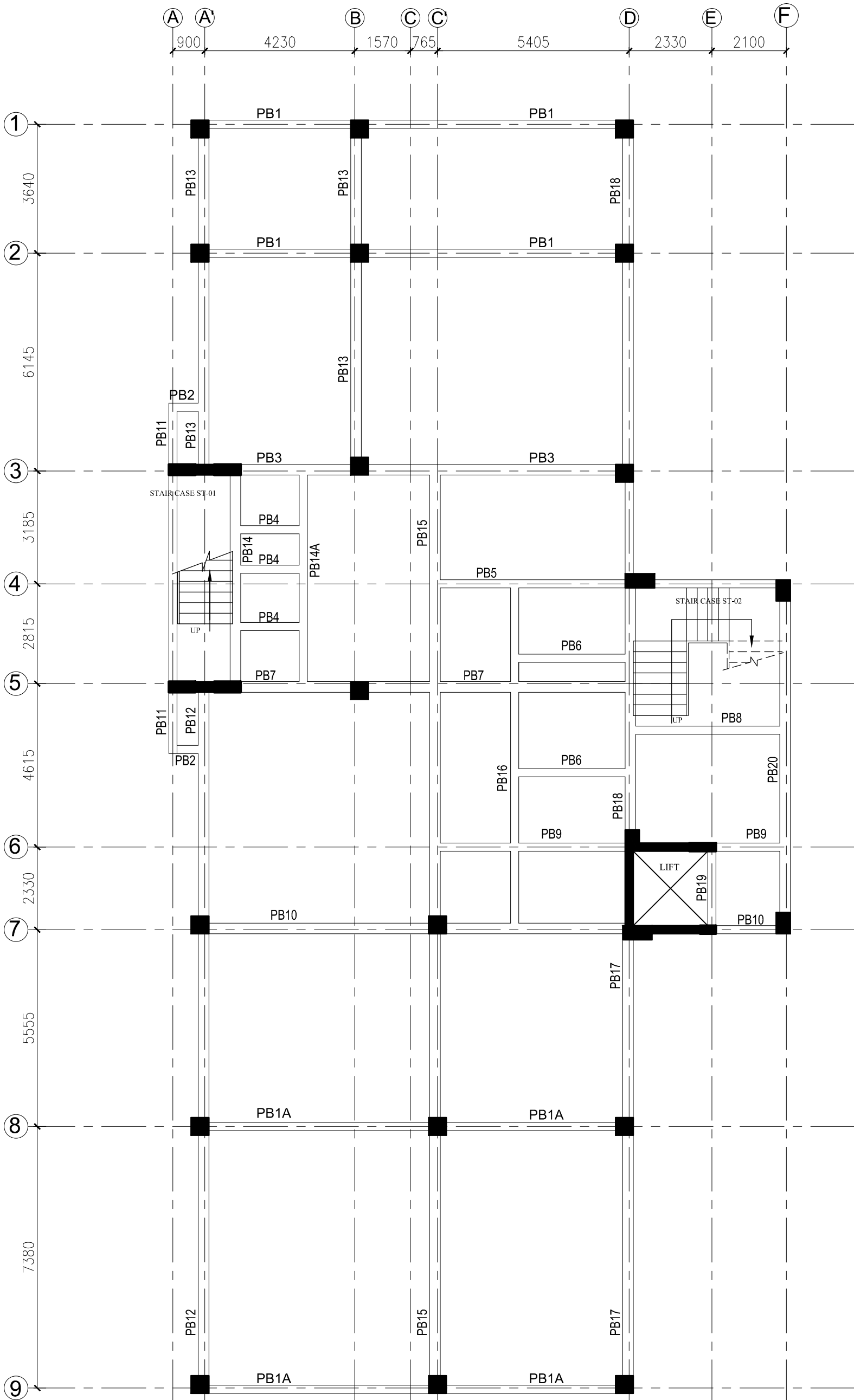
**ARCHITECTURE**  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**  
 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

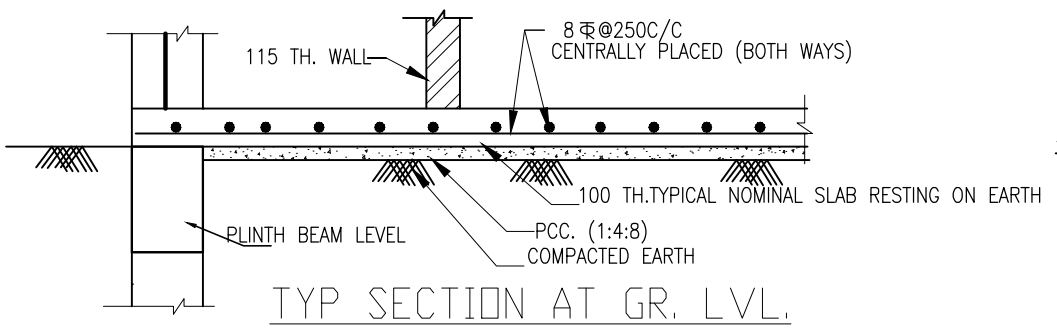
**Title**  
FOUNDATION DETAILS

Drawn	Dealt	Checked	Org. no.
A.Malik	D.K.	B.K. SINGH	ST-02
Date	Scale	REV.	
07.07.2020	1:100	R-00	

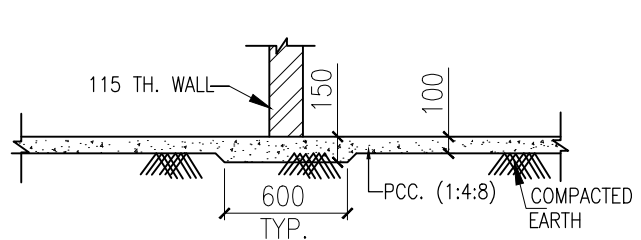
FOR TENDER         ADVANCE COPY  
 FOR APPROVAL       GOOD FOR CONSTRUCTION



PLINTH BEAM FRAMING PLAN



TYP SECTION AT GR. LVL.



TYP SECTION AT GR. LVL.

**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX. UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO I.S.-1786 :2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART I) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING, THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY.

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM


rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTURE**  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

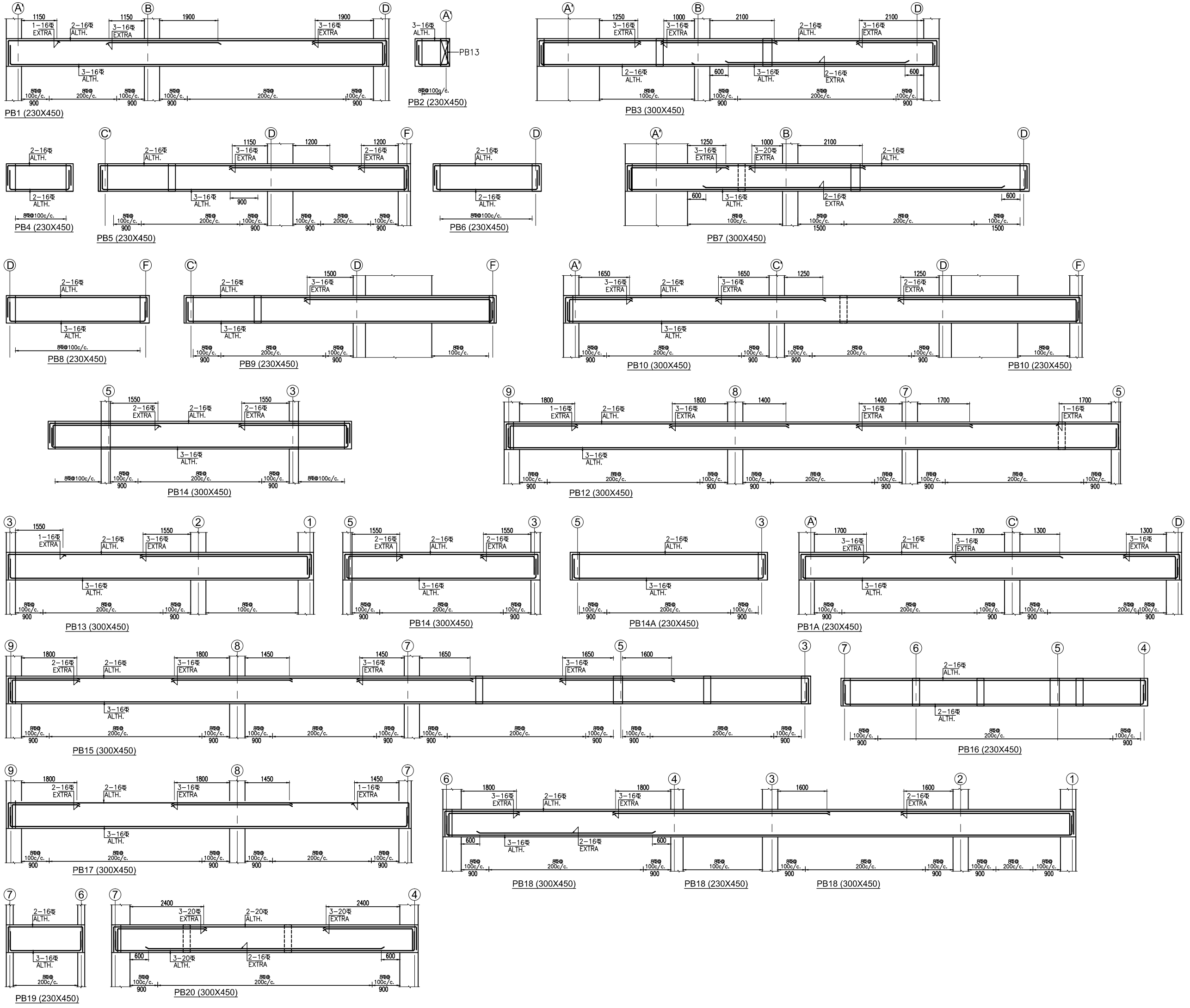
**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**Title**  
PLINTH BEAM FRAMING PLAN

Drawn	Dealt	Checked	Drw. no.
A.Malik	D.K.	B.K. SINGH	ST-03
Date	Scale	REV.	
07.07.2020	1:100	R-00	

- FOR TENDER
- ADVANCE COPY
- FOR APPROVAL
- GOOD FOR CONSTRUCTION



- General Notes:**
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
  - ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
  - ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
  - ALL R.C.C. WORK SHALL BE IN M-45 GRADE MIX. UNLESS OTHERWISE MENTIONED.
  - Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786:2008 SHALL BE USED IN ALL RCC WORK.
  - REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
    - A) PILE/PILE CAP = 75 mm
    - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
    - C) BEAM = 25mm
    - D) SLAB = 20mm
  - LAP/DEVELOPMENT LENGTH FOR ALL REIN. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
  - BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS-1893 (PART II) : 2016
  - NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
  - COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
  - THE SPACING OF TIES WITHIN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
  - THE SPACING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
  - THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
  - THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPARATELY

- NOTES FOR CONSTRUCTION JOINTS**
- DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINT'S SPECIFICATION.
  - CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINFT. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
  - CONSTRUCTION JOINT SHALL BE PLANNED AT .33L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

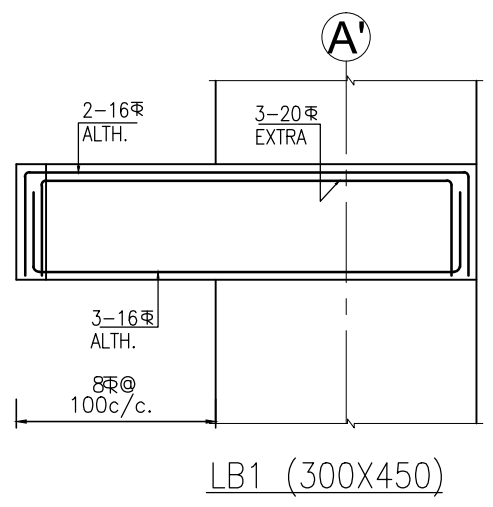
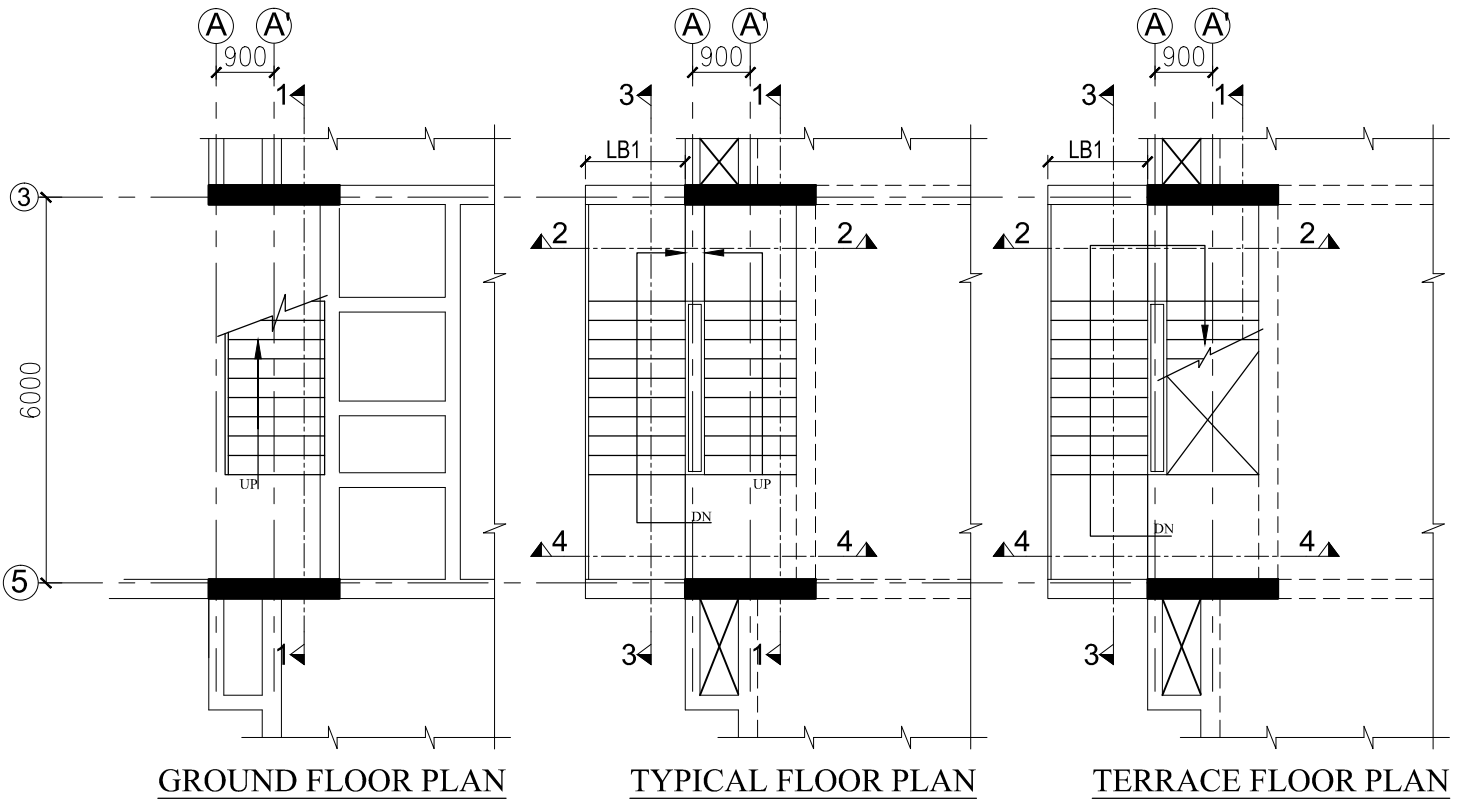
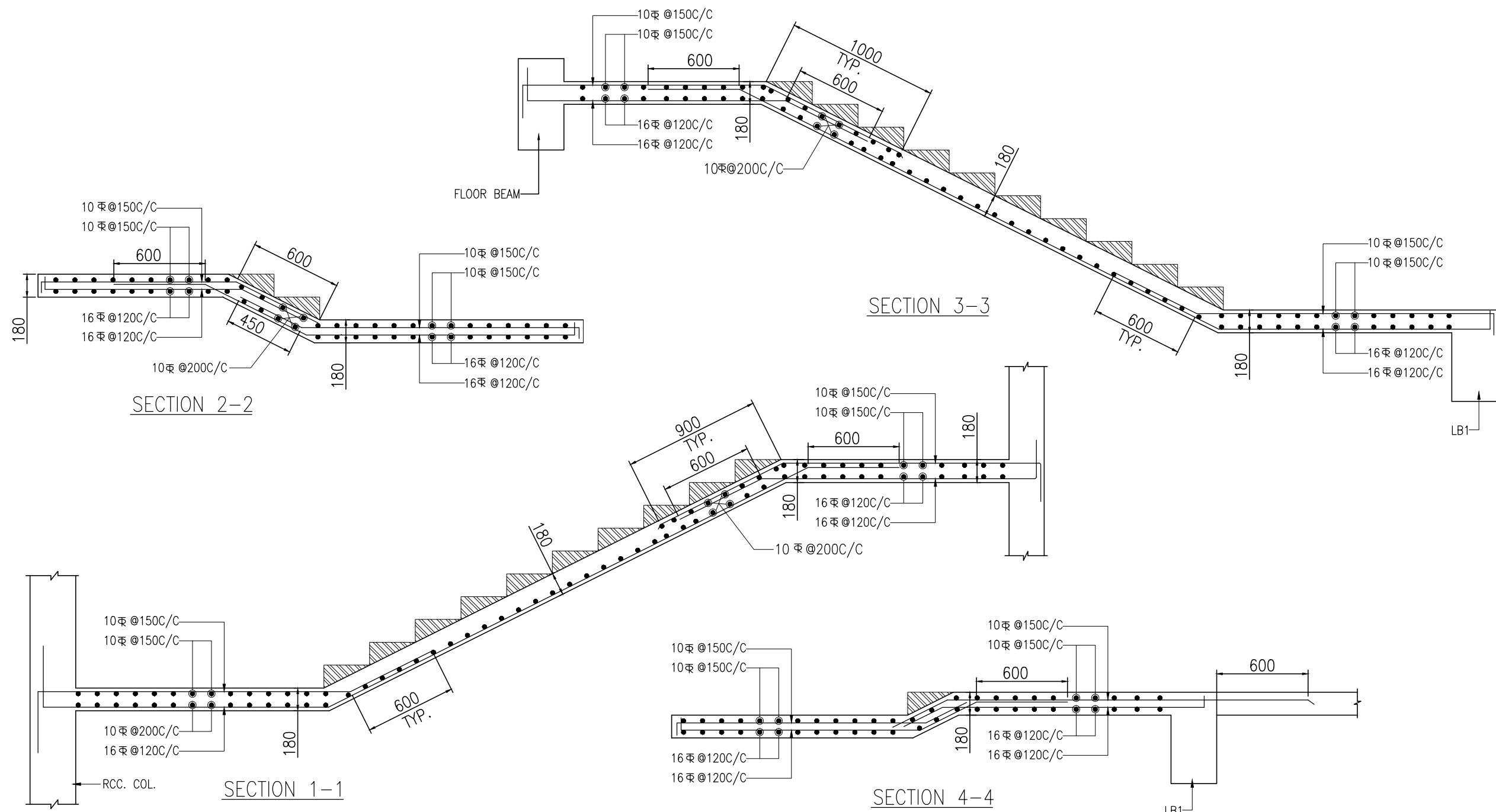
**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

Title  
**PLINTH BEAMS DETAILS**

Drawn A.Malik	Dealt D.K.	Checked B.K. SINGH	Drg. no. ST-04
Date 07.07.2020	Scale 1:100	REV. R-00	

- FOR TENDER     ADVANCE COPY  
 FOR APPROVAL     GOOD FOR CONSTRUCTION



- General Notes:**
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
  2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
  3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
  4. ALL R.C.C. WORK SHALL BE IN M25 GRADE MIX. UNLESS OTHERWISE MENTIONED.
  5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786:2008 SHALL BE USED IN ALL RCC WORK.
  6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS:- AND AS PER I.S. CODE PROVISION
    - A) PILE/PILE CAP = 75 mm
    - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
    - C) BEAM = 25mm
    - D) SLAB = 20mm
  7. LAP / DEVELOPMENT LENGTH FOR ALL REIN. BARS SHALL BE 49 x DIA. OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
  8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS 1893 (PART I) : 2016
  9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
  10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
  11. THE SPACING OF TIES WITHIN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
  12. THE SPACING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
  13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
  14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

- NOTES FOR CONSTRUCTION JOINTS**
1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINT'S SPECIFICATION.
  2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINFT. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
  3. CONSTRUCTION JOINT SHALL BE PLANNED AT .3SL FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

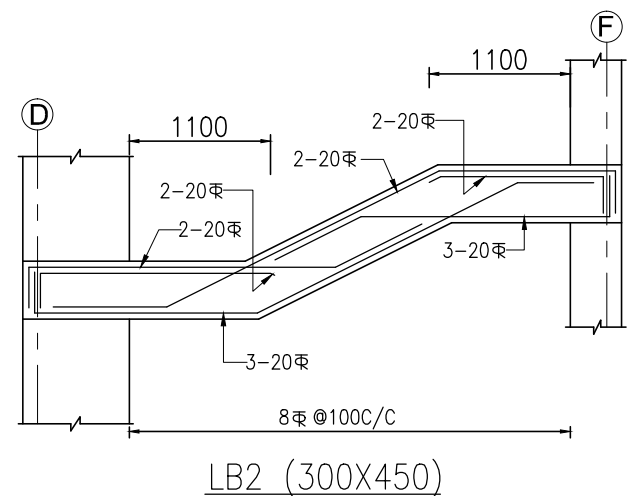
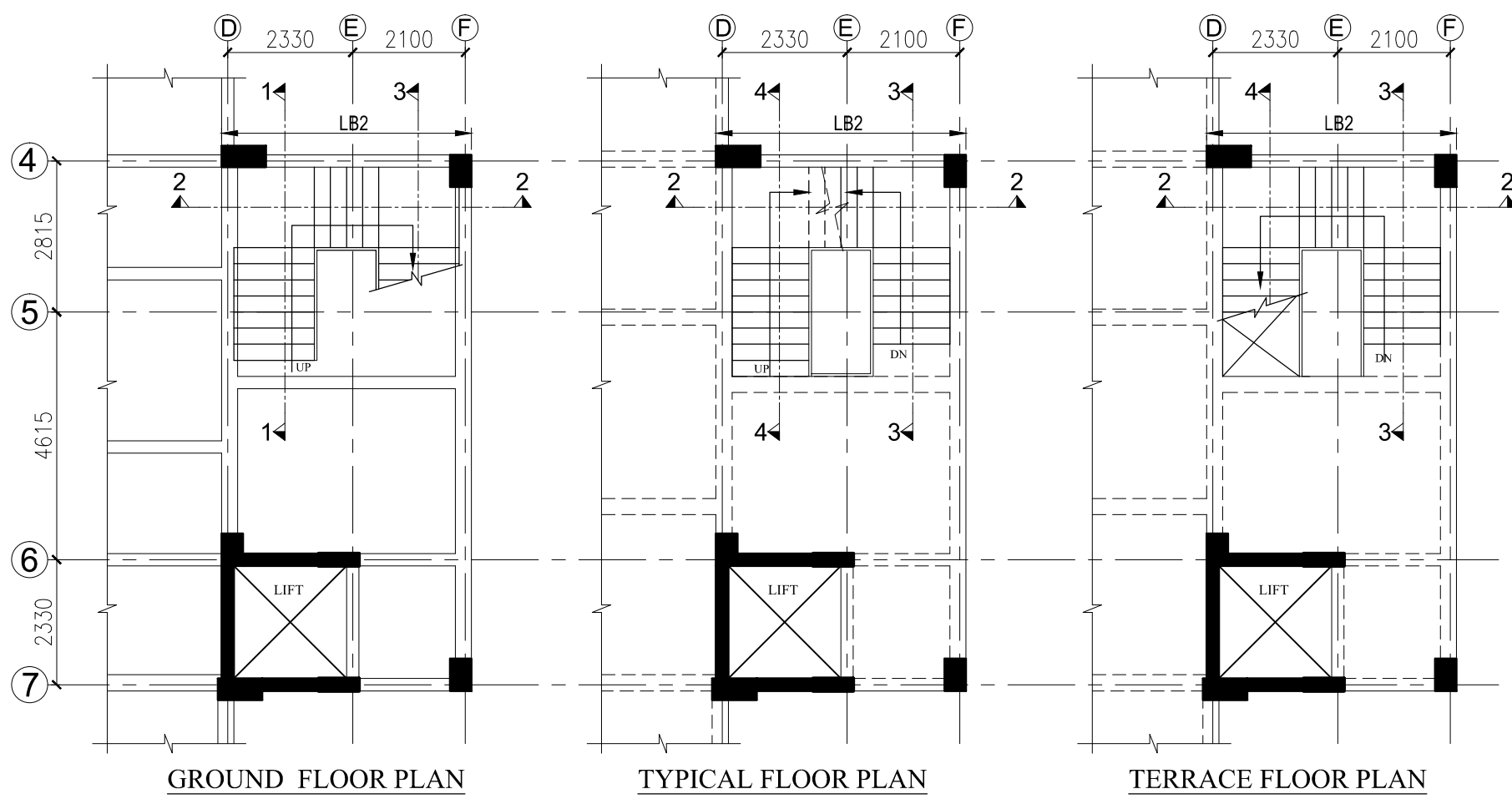
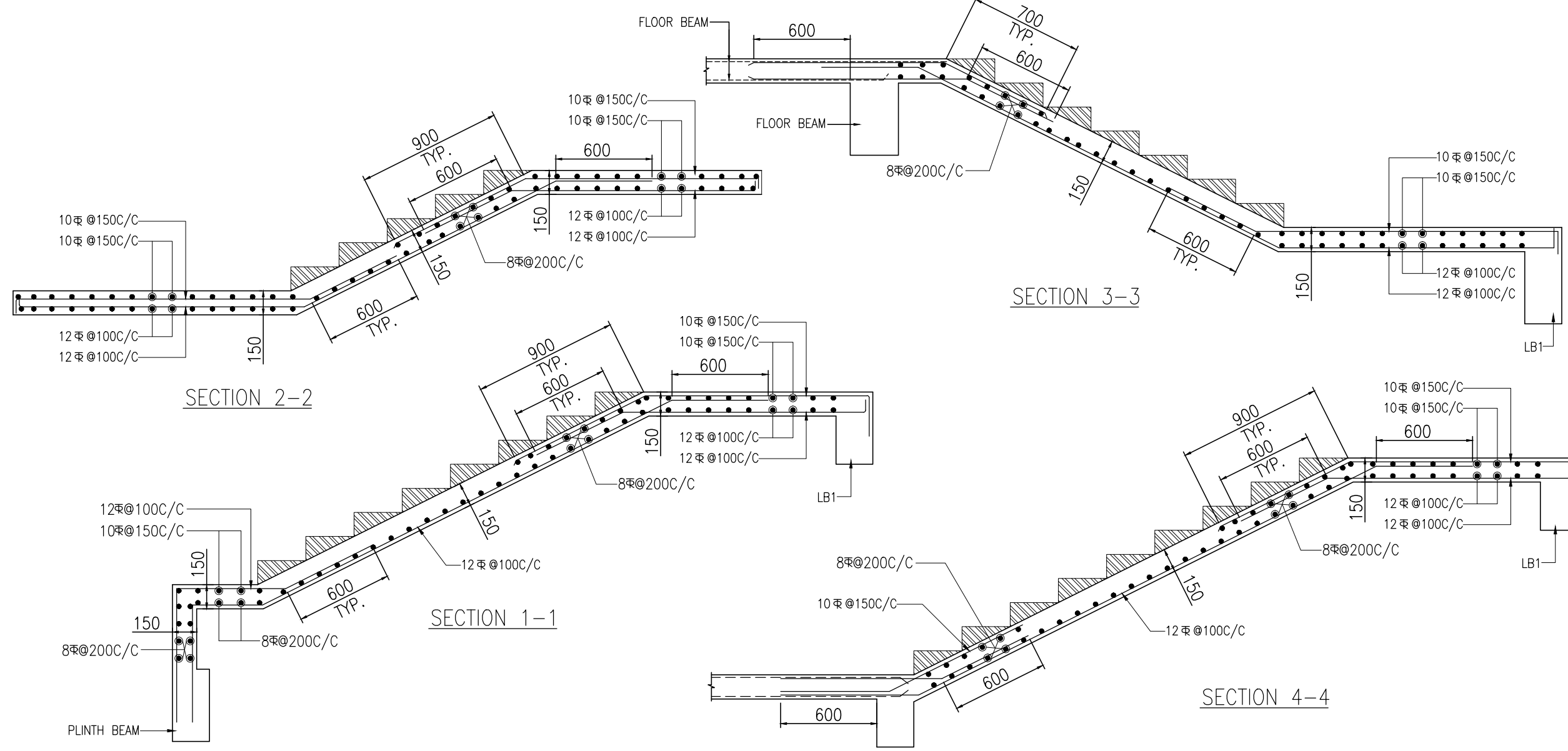
**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title** STAIR CASE DETAIL  
 ST-01

Drawn	Dealt	Checked	Org. no.
A.Malik	D.K.	B.K. SINGH	ST-05
Date	Scale	REV.	
07.07.2020	1:100	R-00	

- FOR TENDER     ADVANCE COPY  
 FOR APPROVAL     GOOD FOR CONSTRUCTION



**General Notes:**

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
- ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
- ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX UNLESS OTHERWISE MENTIONED.
- Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFORMING TO IS-1786:2008 SHALL BE USED IN ALL RCC WORK.
- REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS:- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
- LAP / DEVELOPMENT LENGTH FOR ALL REIN. BARS SHALL BE 48 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
- BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS 1893 (PART I) : 2016
- NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
- COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 CC UPTO GR. FL. LVL.
- THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
- THE SPACING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
- THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
- THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPARATELY.

**NOTES FOR CONSTRUCTION JOINTS**


- DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
- CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINFT. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
- CONSTRUCTION JOINT SHALL BE PLANNED AT .3SL FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

CLIENT: D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

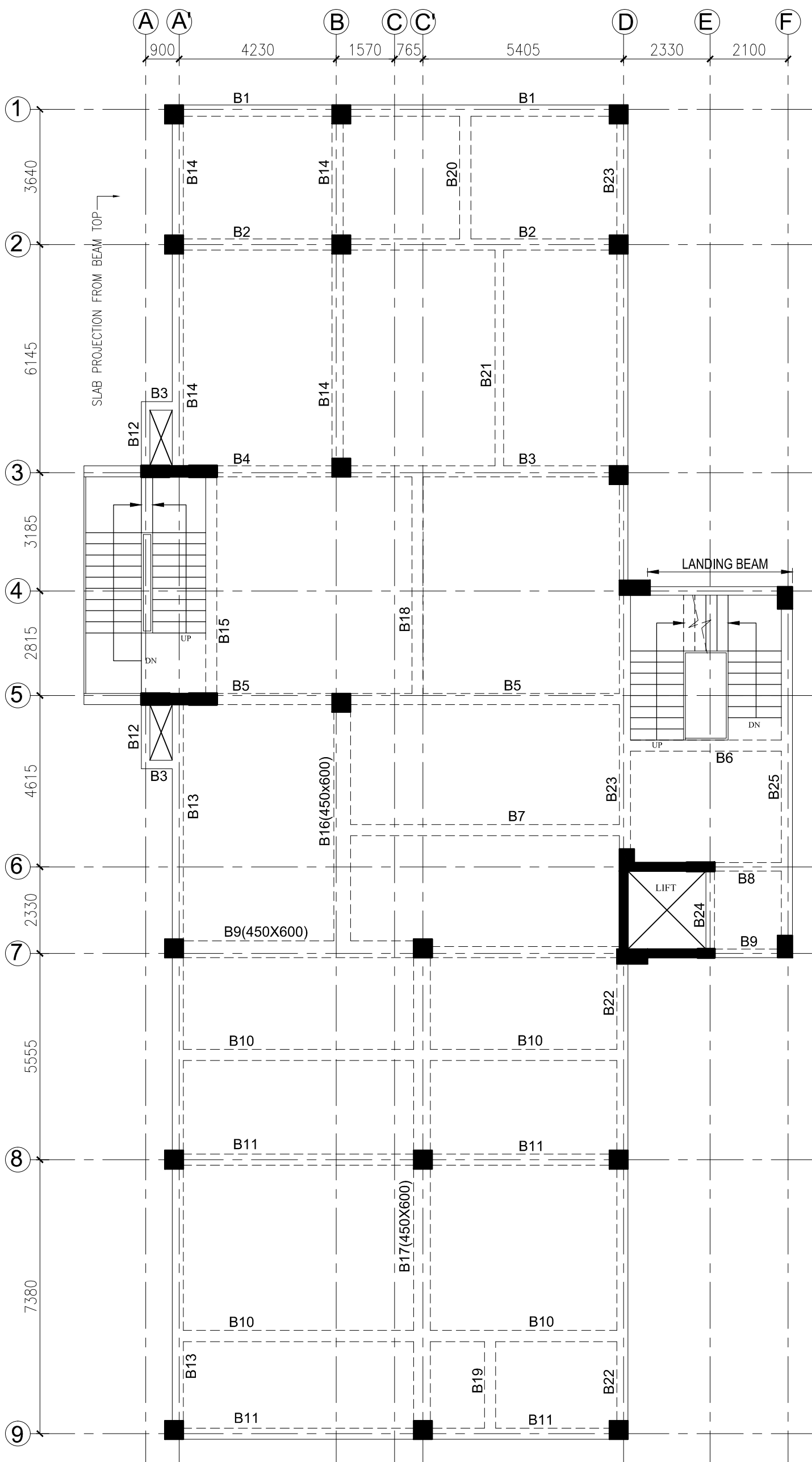
ARCHITECTURE  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

Structural Consultant:  
**ABL Structural Consultants Pvt. Ltd.**  
 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

Title: **STAIR CASE DETAIL**  
**ST-02**

Drawn	Dealt	Checked	Org. no.
A.Malik	D.K.	B.K. SINGH	ST-06
Date	Scale	REV.	
07.07.2020	1:100	R-00	

- FOR TENDER
- ADVANCE COPY
- FOR APPROVAL
- GOOD FOR CONSTRUCTION



**FIRST FLOOR LVL. FRAMING PLAN**

**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX. UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO I.S.-1786 :2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART I) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING, THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**

**ADMINISTRATIVE BUILDING**

CLIENT D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

**Structural Consultant:**

**ABL Structural Consultants Pvt. Ltd.**



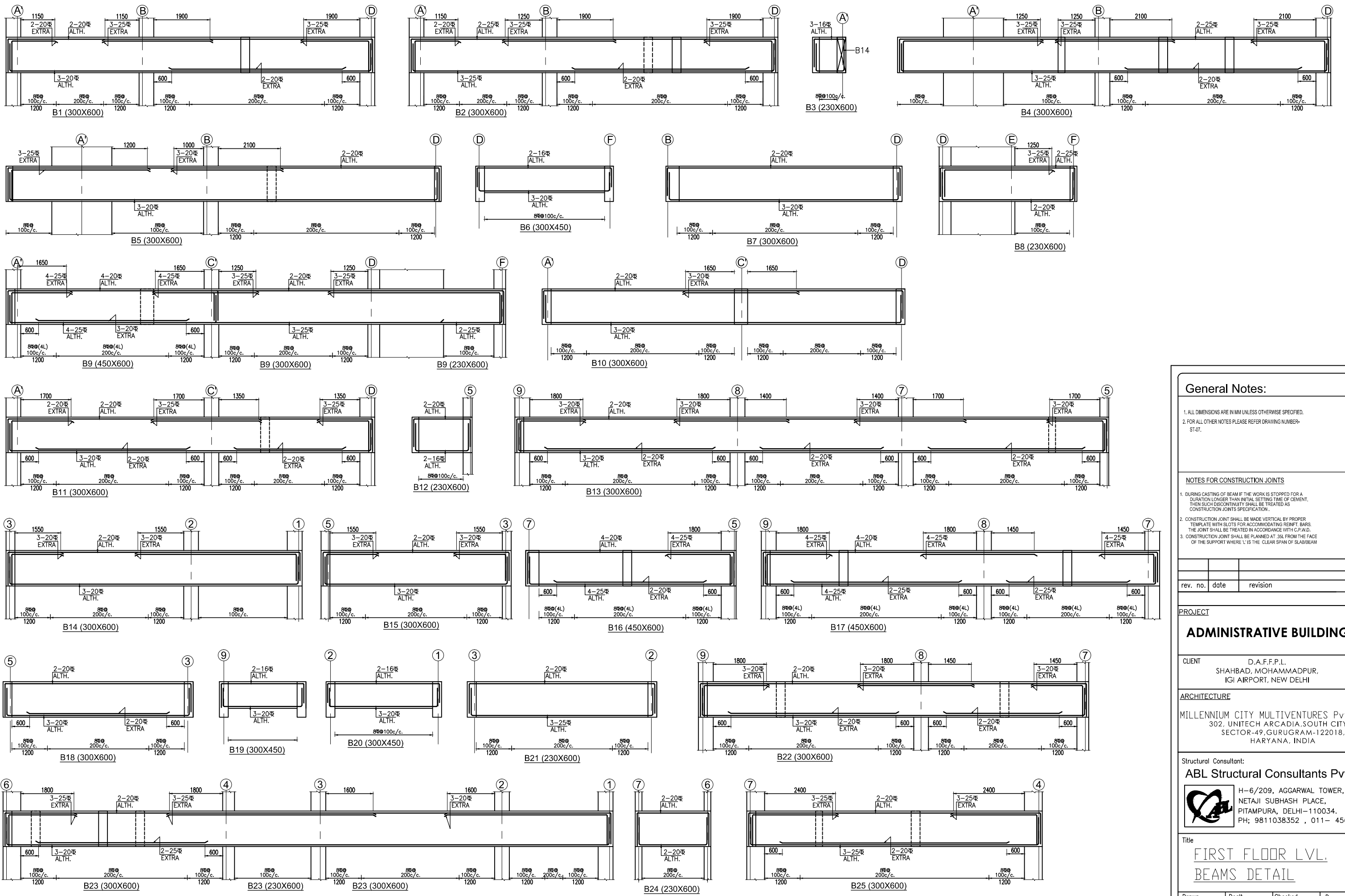
H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**Title**

**FIRST FLOOR LVL.  
FRAMING PLAN**

Drawn	Dealt	Checked	Dr. no.
A.Malik	D.K.	B.K. SINGH	ST-07
Date	Scale	REV.	
07.07.2020	1:100	R-00	

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| <input checked="" type="checkbox"/> FOR TENDER | <input type="checkbox"/> ADVANCE COPY          |
| <input type="checkbox"/> FOR APPROVAL          | <input type="checkbox"/> GOOD FOR CONSTRUCTION |



**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. FOR ALL OTHER NOTES PLEASE REFER DRAWING NUMBER-ST-07.

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .3SL FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision


**PROJECT**

**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTURE**  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA,SOUTH CITY-II,  
SECTOR-49,GURUGRAM-122018,  
HARYANA, INDIA

**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

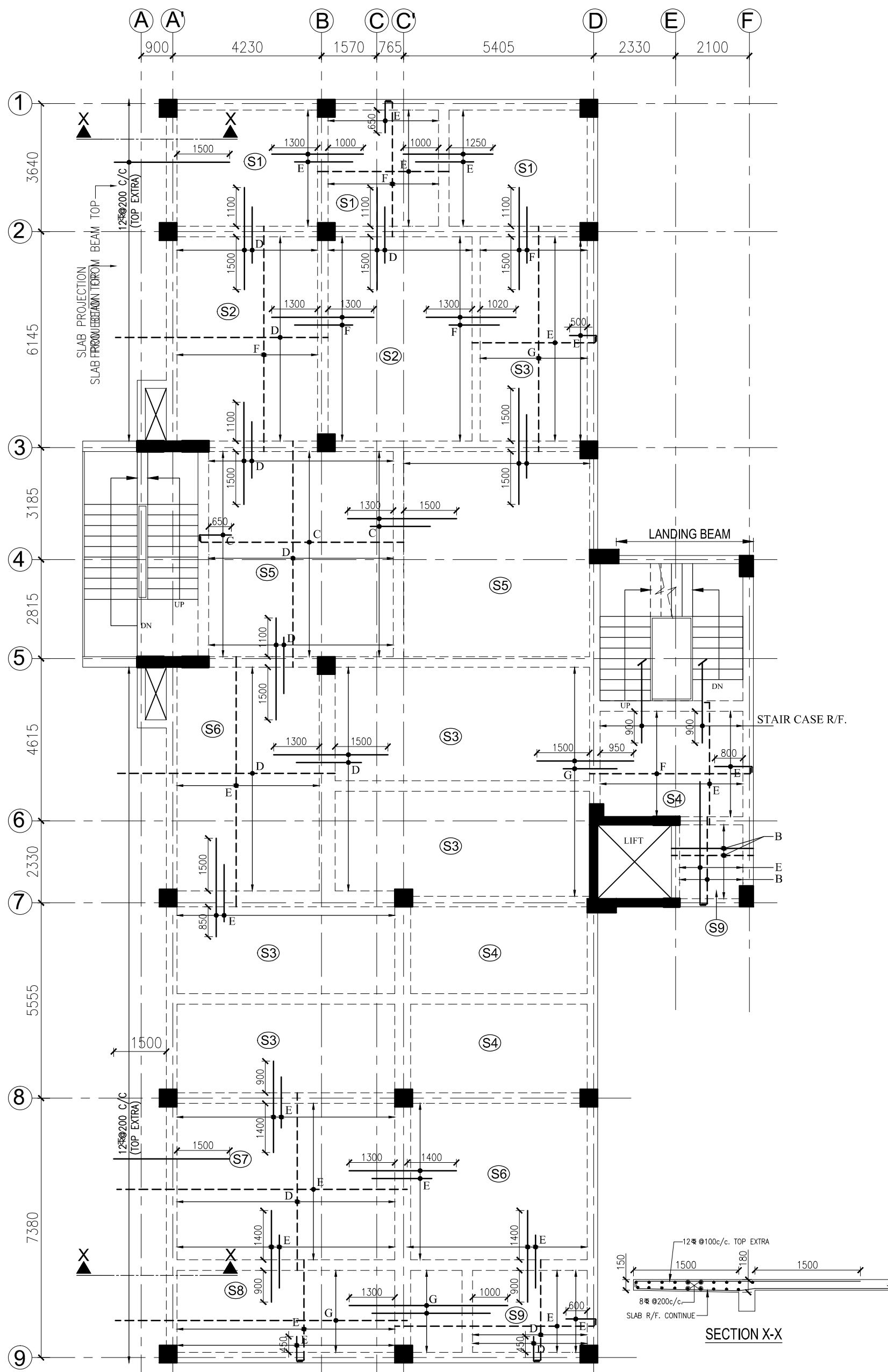
 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**Title**  
FIRST FLOOR LVL.  
BEAMS DETAIL

Drawn A.Malik	Dealt D.K.	Checked B.K. SINGH	Org. no. ST-08
Date 07.07.2020	Scale 1:100	REV. R-00	

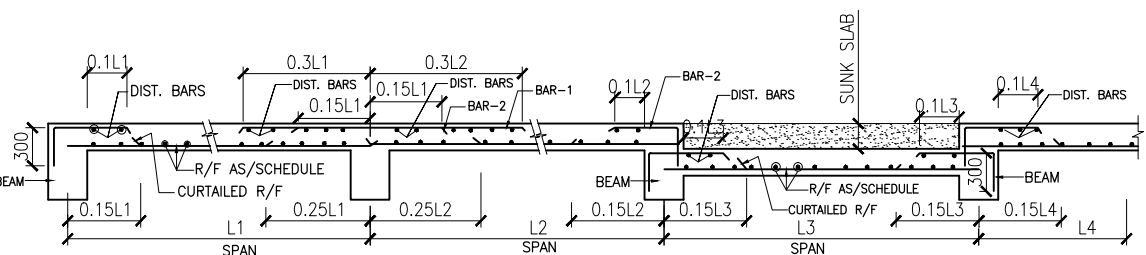
- FOR TENDER     ADVANCE COPY  
 FOR APPROVAL     GOOD FOR CONSTRUCTION





**FIRST FLOOR LVL. SLAB R/F. PLAN**

ALL DISTRIBUTION BARS- 8 @ 6"C/C WHEREVER REQUIRED



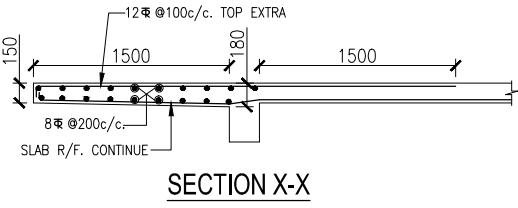
**TYP. SECTION OF SLAB R/F DETAILS - STRAIGHT BARS**

DISTRIBUTION BARS- 8 @ 6"C/C WHEREVER REQUIRED

SLAB MARK	SLAB THICKNESS
S1	130
S2	130
S3	130
S4	130
S5	150
S6	150
S7	150
S8	130
S9	130

LEGEND:-	
	SHOWING TOP BAR
	SHOWING BOTTOM BAR

LEGEND FOR :- TOP & BOTTOM REINFORCEMENT	
A=8 @ 120 C/C	
B=8 @ 150 C/C	
C=10 @ 100 C/C	
D=10 @ 120 C/C	
E=10 @ 150 C/C	
F=10 @ 180 C/C	
G=10 @ 200 C/C	



**SECTION X-X**

**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786 2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS: 1893 (PART II) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @ 100 C/C UPTO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**ADMINISTRATIVE BUILDING**

CLIENT: D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

ARCHITECTURE: MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

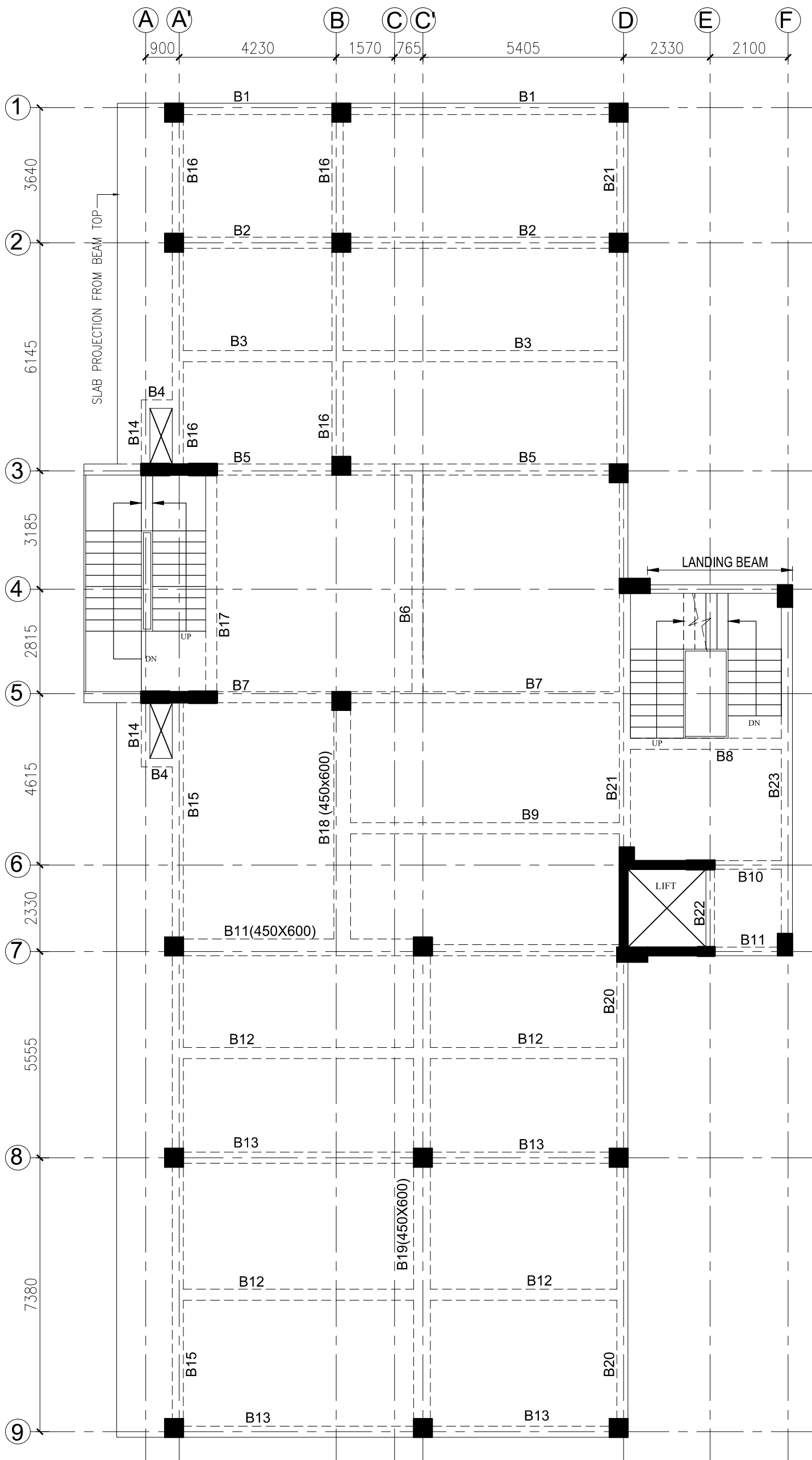
Structural Consultant:  
**ABL Structural Consultants Pvt. Ltd.**

H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**FIRST FLOOR LVL. SLAB R/F. PLAN**

Drawn	Dealt	Checked	Drg. no.
A.Malik	D.K.	B.K. SINGH	ST-09
Date	Scale	REV.	
07.07.2020	1:100	R-00	

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- ADVANCE COPY
- FOR APPROVAL
- GOOD FOR CONSTRUCTION



SECOND FLOOR LVL. FRAMING PLAN

**General Notes:**

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rev. no.	date	revision

**PROJECT**


**ADMINISTRATIVE BUILDING**

CLIENT D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

**Structural Consultant:**

**ABL Structural Consultants Pvt. Ltd.**

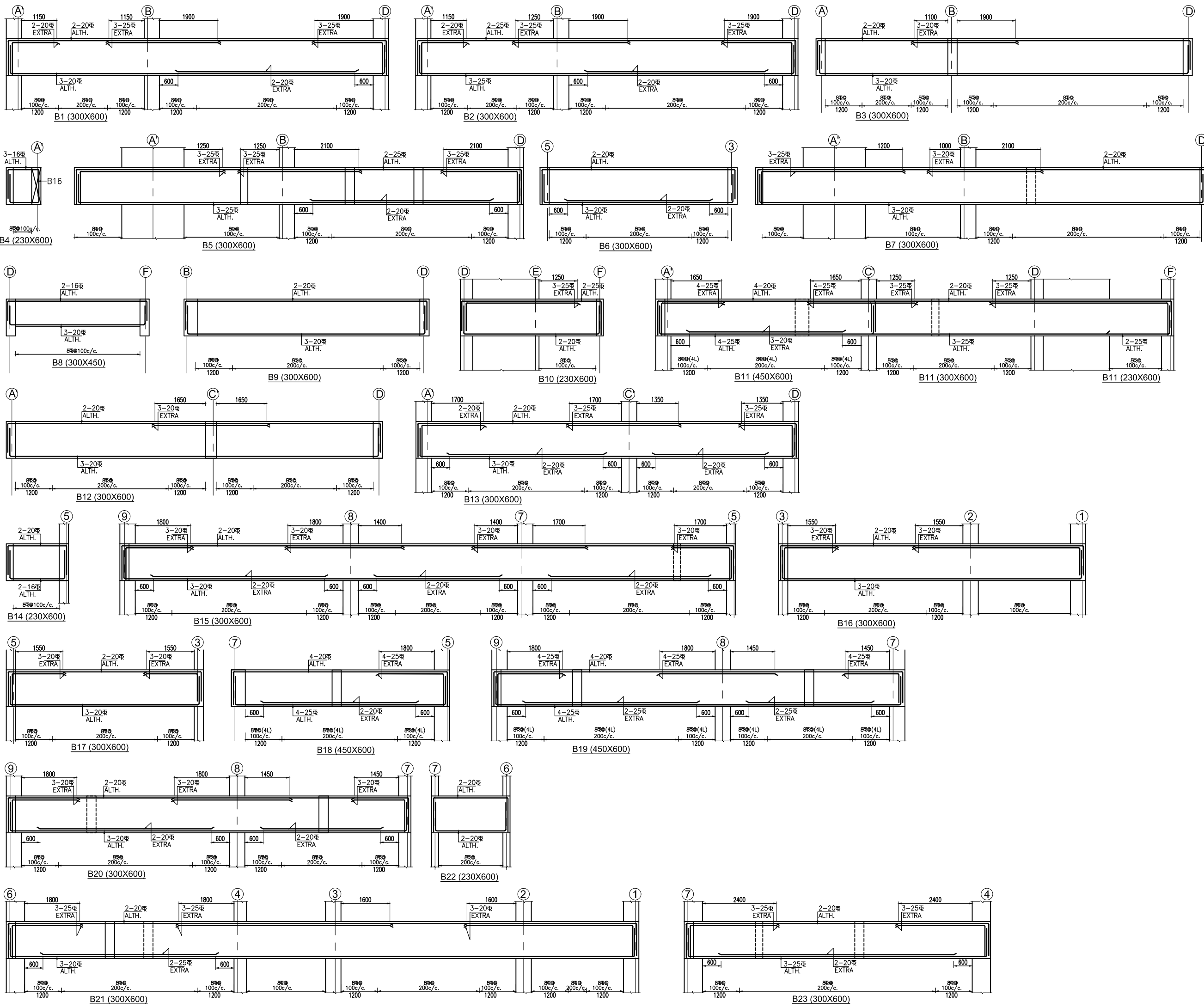
 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**Title**

SECOND FLOOR LVL.  
FRAMING PLAN

Drawn	Dealt	Checked	Dr. no.
A.Malik	D.K.	B.K. SINGH	
Date	Scale	REV.	
07.07.2020	1:100	R-00	ST-10

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| <input type="checkbox"/> FOR APPROVAL          | <input type="checkbox"/> GOOD FOR CONSTRUCTION |



**General Notes:**

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rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

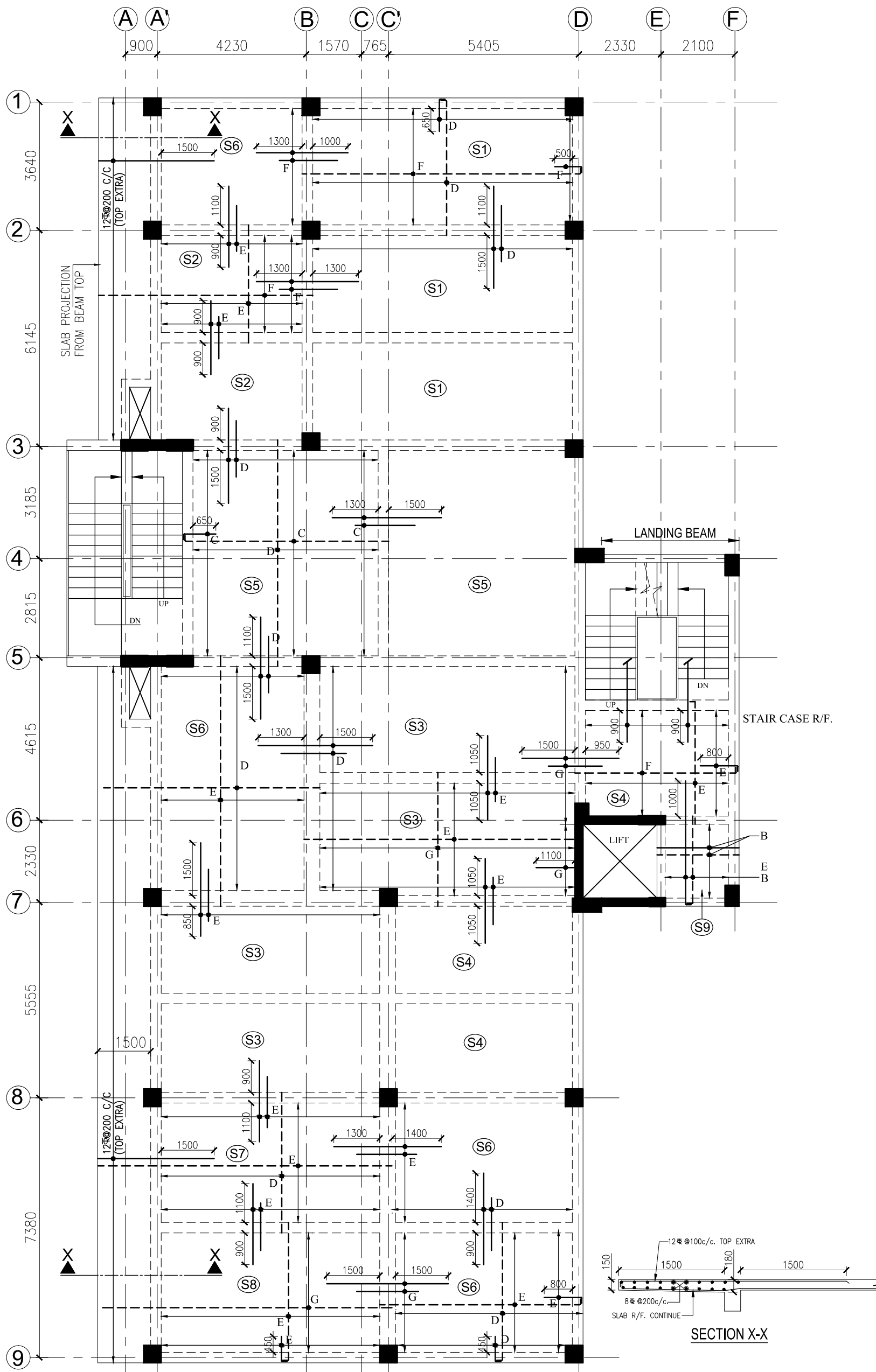
**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title**  
 SECOND FLOOR LVL.  
 BEAMS DETAIL

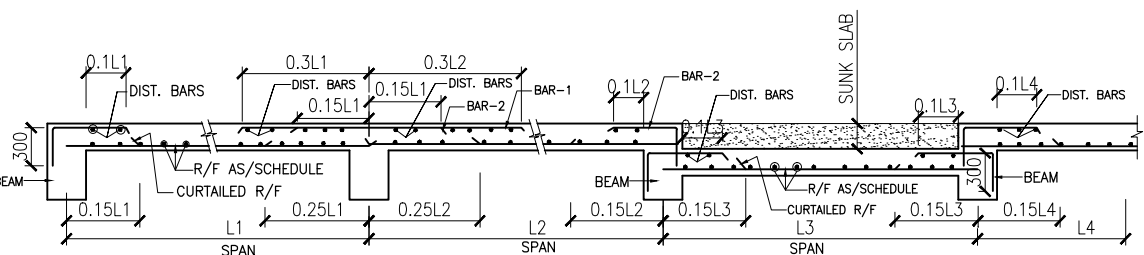
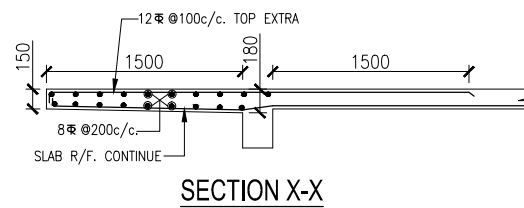
Drawn	Dealt	Checked	Org. no.
A.Malik	D.K.	B.K. SINGH	ST-11
Date	Scale	REV.	
07.07.2020	1:100	R-00	

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 FOR APPROVAL     GOOD FOR CONSTRUCTION



**SECOND FLOOR LVL. SLAB R/F. PLAN**

ALL DISTRIBUTION BARS- 8#6 C/C WHEREVER REQUIRED



**TYP. SECTION OF SLAB R/F DETAILS - STRAIGHT BARS**  
DISTRIBUTION BARS- 8#6 C/C WHEREVER REQUIRED

SLAB MARK	SLAB THICKNESS
S1	130
S2	130
S3	130
S4	130
S5	150
S6	150
S7	150
S8	130
S9	130

**LEGEND:-**  
 ——— SHOWING TOP BAR  
 - - - SHOWING BOTTOM BAR

**LEGEND FOR :- TOP & BOTTOM REINFORCEMENT**  
 A=8# @120 C/C  
 B=8# @150 C/C  
 C=10# @100 C/C  
 D=10# @120 C/C  
 E=10# @150 C/C  
 F=10# @180 C/C  
 G=10# @200 C/C

**General Notes:**

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**NOTES FOR CONSTRUCTION JOINTS**

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3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**  
 MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
 302, UNITECH ARCADIA, SOUTH CITY-II,  
 SECTOR-49, GURUGRAM-122018,  
 HARYANA, INDIA

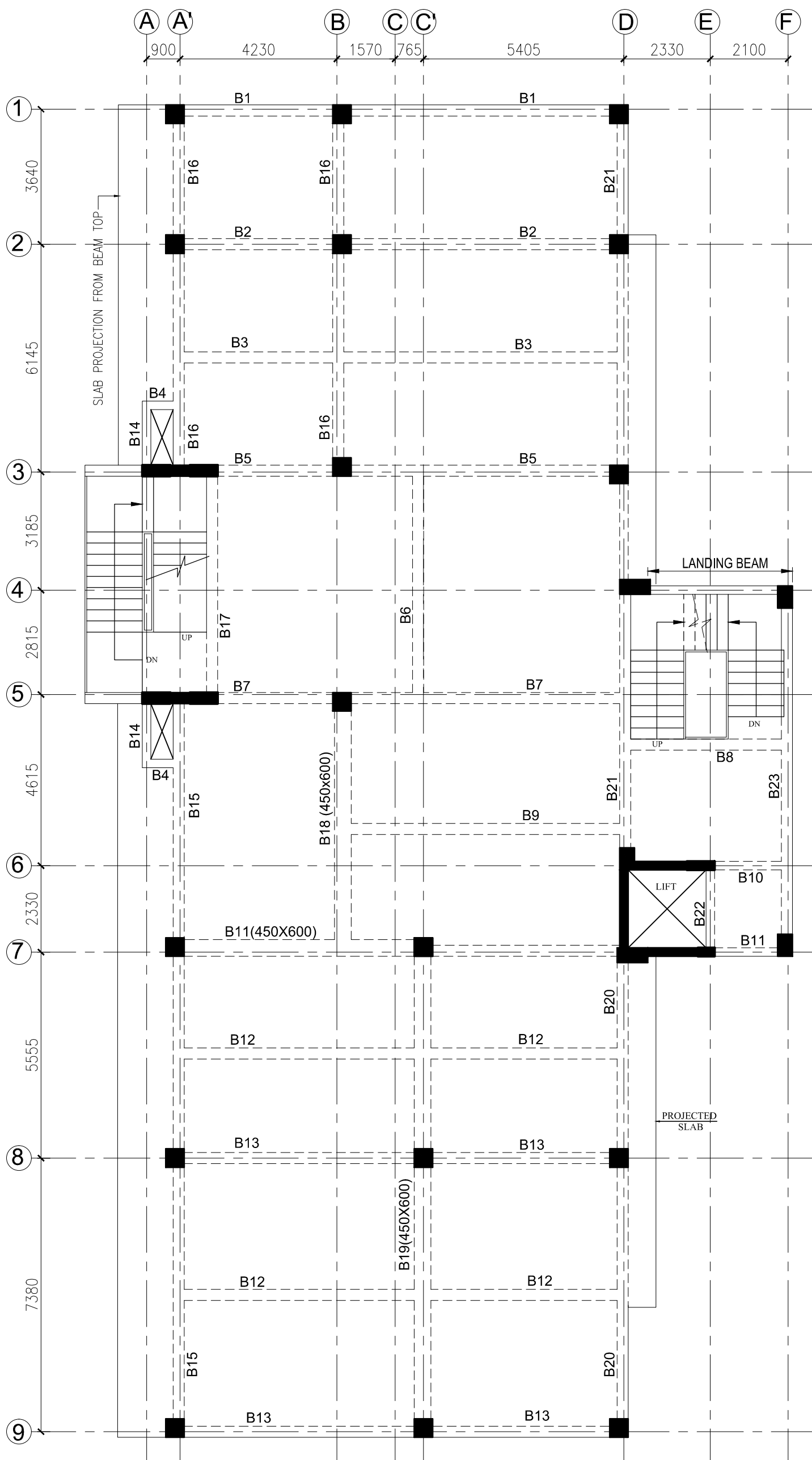
**Structural Consultant:**  
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H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title**  
**SECOND FLOOR LVL.**  
**SLAB R/F. PLAN**

Drawn	Dealt	Checked	Drw. no.
A.Malik	D.K.	B.K. SINGH	ST-12
Date	Scale	REV.	
07.07.2020	1:100	R-00	

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- ADVANCE COPY
- FOR APPROVAL
- GOOD FOR CONSTRUCTION



THIRD FLOOR LVL. FRAMING PLAN

General Notes:

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rev. no.	date	revision


PROJECT

**ADMINISTRATIVE BUILDING**

CLIENT D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

ARCHITECTURE

Structural Consultant:  
**ABL Structural Consultants Pvt. Ltd.**

 H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

Title  
**THIRD FLOOR LVL.  
FRAMING PLAN**

Drawn	Dealt	Checked	Dr. no.
A.Malik	D.K.	B.K. SINGH	ST-13
Date	Scale	REV.	
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| <input type="checkbox"/> FOR APPROVAL          | <input type="checkbox"/> GOOD FOR CONSTRUCTION |



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rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

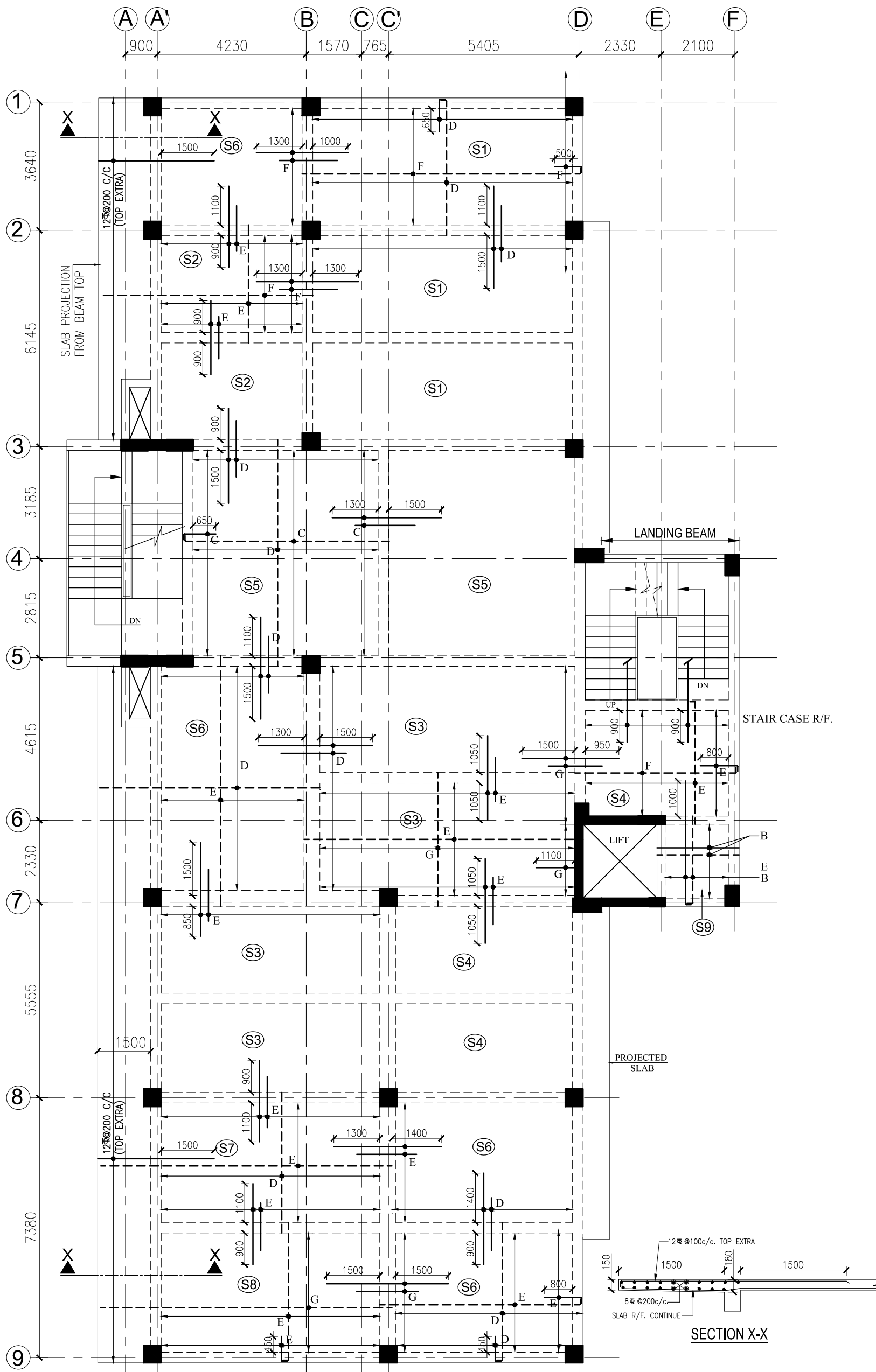
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 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title**  
 THIRD FLOOR LVL.  
 BEAMS DETAIL

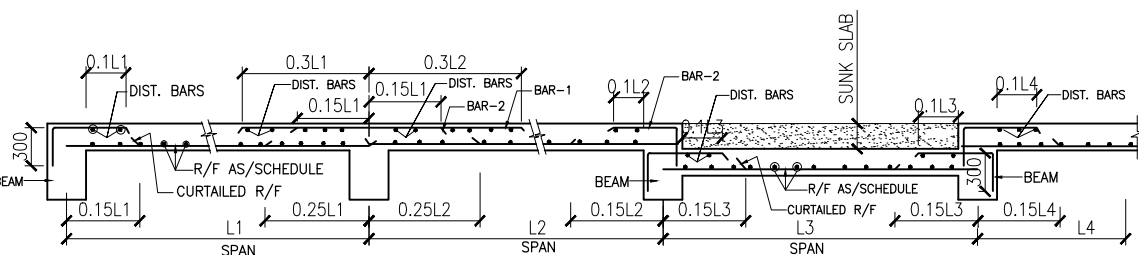
Drawn A.Malik	Dealt D.K.	Checked B.K. SINGH	Org. no. ST-14
Date 07.07.2020	Scale 1:100	REV. R-00	

- FOR TENDER
- ADVANCE COPY
- FOR APPROVAL
- GOOD FOR CONSTRUCTION



### THIRD FLOOR LVL. SLAB R/F. PLAN

ALL DISTRIBUTION BARS- 8φ6 C/C WHEREVER REQUIRED



TYP. SECTION OF SLAB R/F DETAILS - STRAIGHT BARS

DISTRIBUTION BARS- 8φ6 C/C WHEREVER REQUIRED

SLAB MARK	SLAB THICKNESS
S1	130
S2	130
S3	130
S4	130
S5	150
S6	150
S7	150
S8	130
S9	130

LEGEND:-  
 ——— SHOWING TOP BAR  
 - - - - - SHOWING BOTTOM BAR

LEGEND FOR :-  
 TOP & BOTTOM REINFORCEMENT

A=8φ@120 C/C  
 B=8φ@150 C/C  
 C=10φ@100 C/C  
 D=10φ@120 C/C  
 E=10φ@150 C/C  
 F=10φ@180 C/C  
 G=10φ@200 C/C

### General Notes:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX, UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786 2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION  
 A) PILE/PILE CAP = 75 mm  
 B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)  
 C) BEAM = 25mm  
 D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS: 1893 (PART II) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

### NOTES FOR CONSTRUCTION JOINTS

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

### PROJECT

**ADMINISTRATIVE BUILDING**

CLIENT D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

### ARCHITECTURE

### Structural Consultant:

**ABL Structural Consultants Pvt. Ltd.**

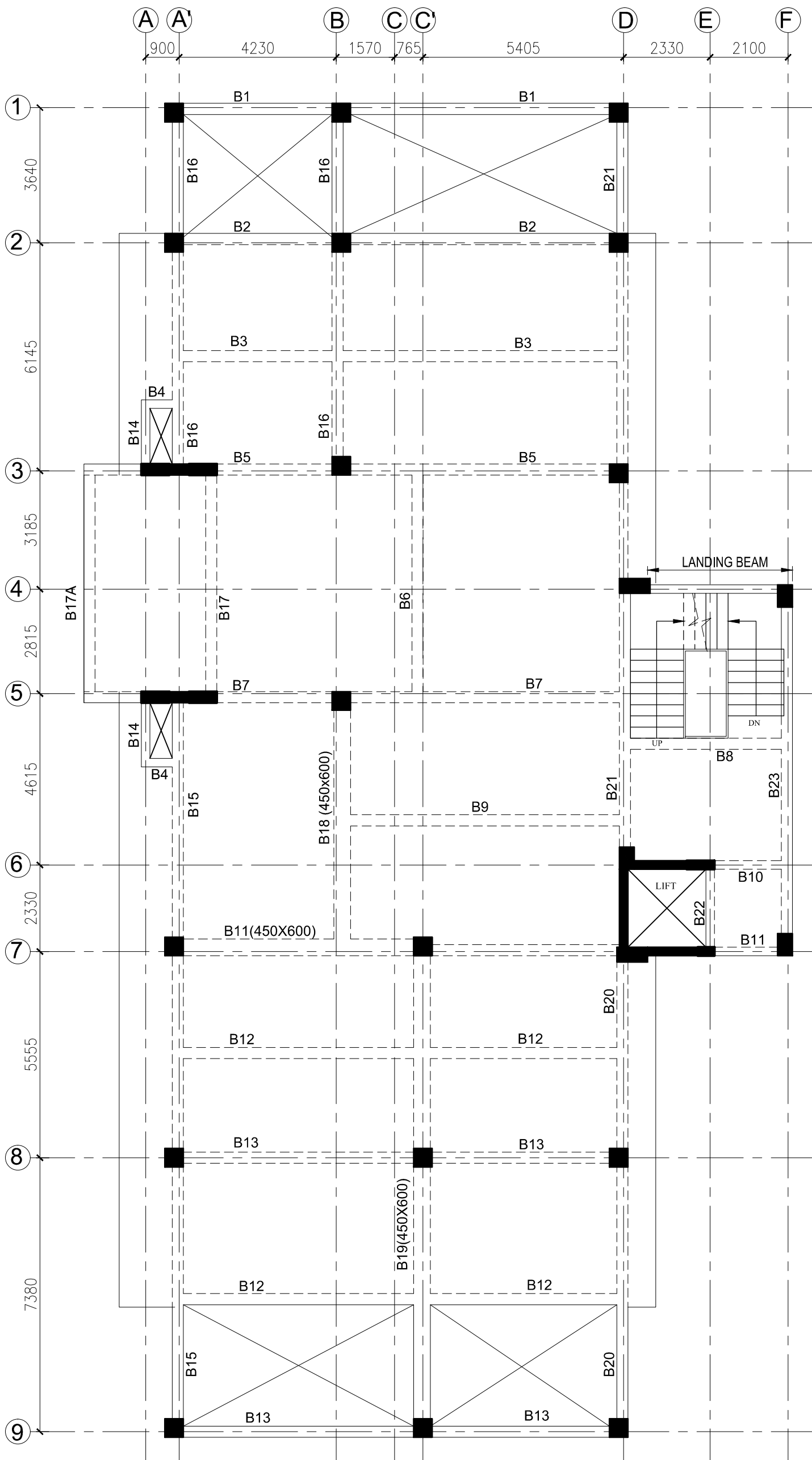


H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

Title  
**THIRD FLOOR LVL.  
 SLAB R/F. PLAN**

Drawn	Dealt	Checked	Drg. no.
A.Malik	D.K.	B.K. SINGH	ST-15
Date	Scale	REV.	
07.07.2020	1:100	R-00	

- FOR TENDER       ADVANCE COPY  
 FOR APPROVAL       GOOD FOR CONSTRUCTION



TERRACE FLOOR LVL. FRAMING PLAN

**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX. UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO I.S.-1786 :2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART I) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING, THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**

**ADMINISTRATIVE BUILDING**

CLIENT D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

**Structural Consultant:**

**ABL Structural Consultants Pvt. Ltd.**



H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

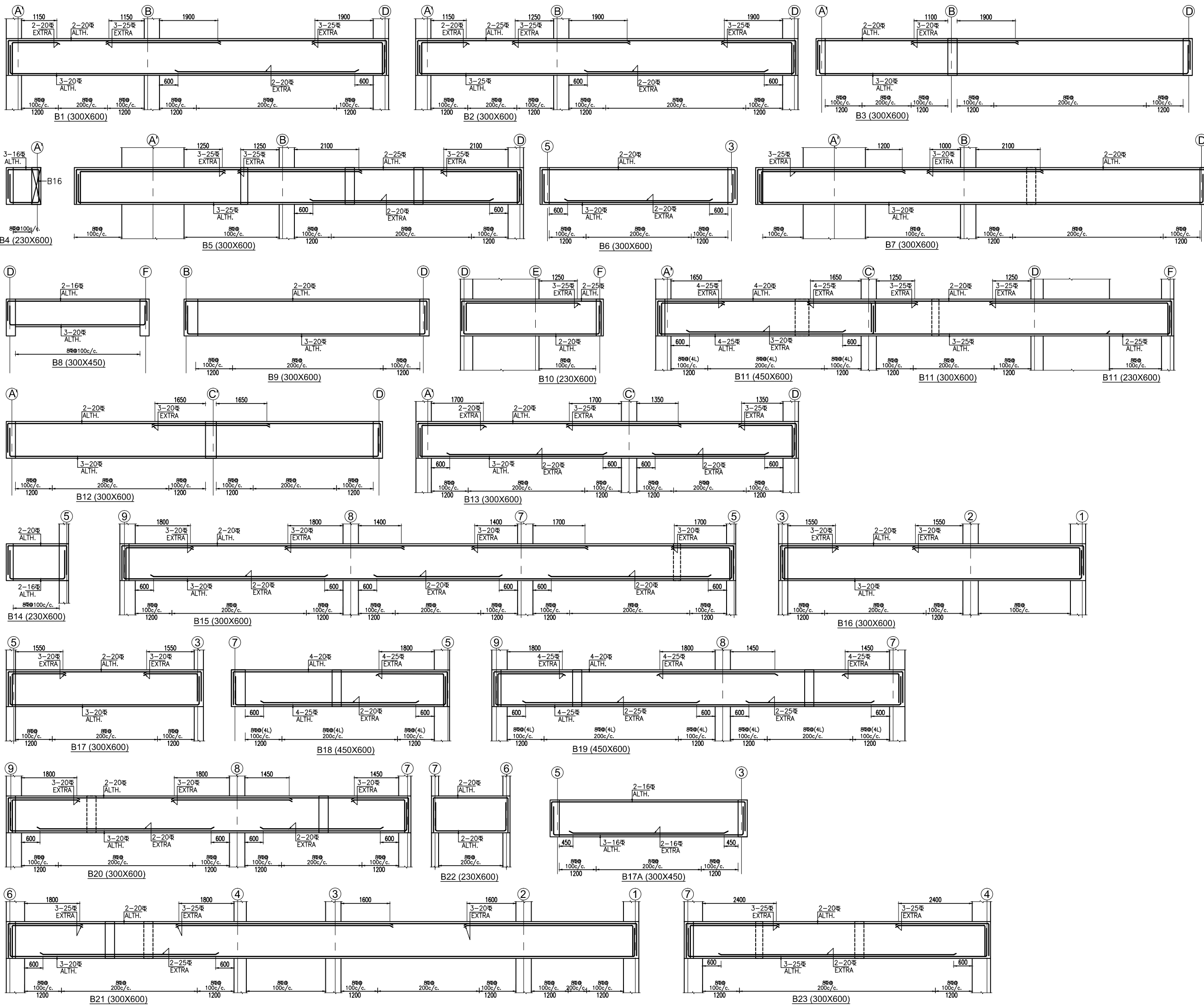
**Title**

TERRACE FLOOR LVL.  
FRAMING PLAN

Drawn A.Malik	Dealt D.K.	Checked B.K. SINGH	Dr. no. ST-16
Date 07.07.2020	Scale 1:100	REV. R-00	

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- GOOD FOR CONSTRUCTION





**General Notes:**

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
- ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
- ALL R.C.C. WORK SHALL BE IN M-45 GRADE MIX UNLESS OTHERWISE MENTIONED.
- Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO IS-1786-2008 SHALL BE USED IN ALL RCC WORK.
- REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PIE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
- LAP DEVELOPMENT LENGTH FOR ALL REIN. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
- BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS 1893 (PART II) : 2016
- NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
- COLUMNS COINCIDING WITH R.C.C. WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
- THE SPACING OF TIES WITHIN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
- THE SPACING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
- THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
- THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPARATELY.

**NOTES FOR CONSTRUCTION JOINTS**

- DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINT'S SPECIFICATION.
- CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINFT. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
- CONSTRUCTION JOINT SHALL BE PLANNED AT .33L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM


rev. no.	date	revision

**PROJECT**  
**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

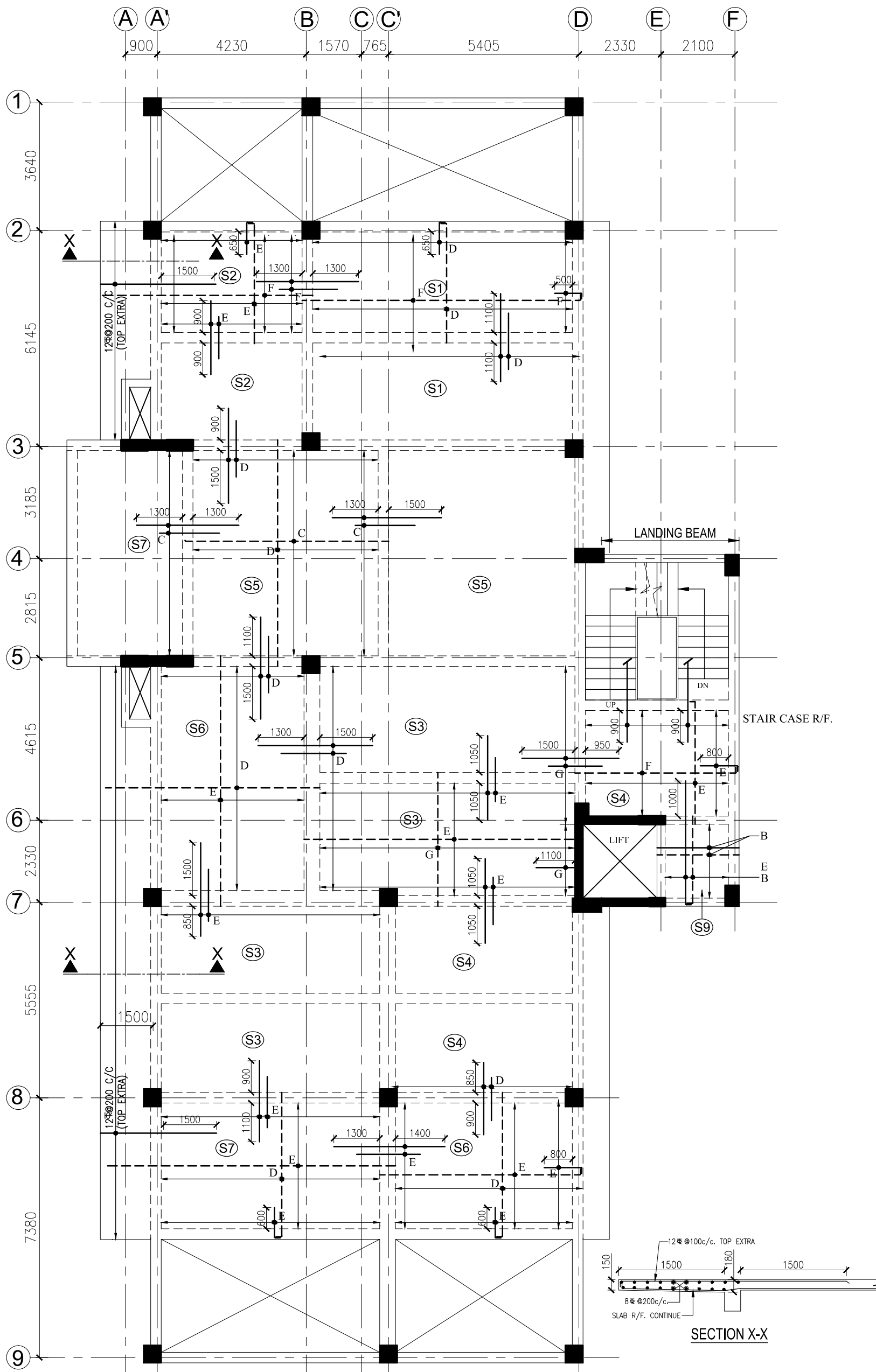
**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**

 H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title**  
 TERRACE FLOOR LVL.  
 BEAMS DETAIL

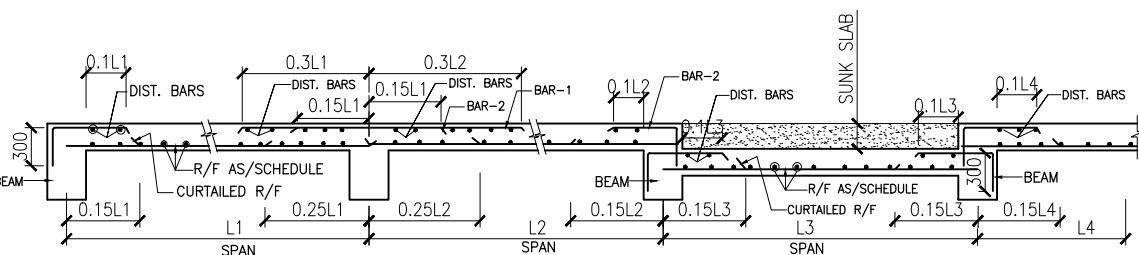
Drawn A.Malik	Dealt D.K.	Checked B.K. SINGH	Org. no. ST-17
Date 07.07.2020	Scale 1:100	REV. R-00	

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**TERRACE FLOOR LVL. SLAB R/F. PLAN**

ALL DISTRIBUTION BARS- 8#6 C/C WHEREVER REQUIRED



**TYP. SECTION OF SLAB R/F DETAILS - STRAIGHT BARS**

DISTRIBUTION BARS- 8#6 C/C WHEREVER REQUIRED

SLAB MARK	SLAB THICKNESS
S1	130
S2	130
S3	130
S4	130
S5	150
S6	150
S7	150
S8	130
S9	130

**LEGEND:-**  
 ——— SHOWING TOP BAR  
 - - - - - SHOWING BOTTOM BAR

**LEGEND FOR :-**  
 TOP & BOTTOM REINFORCEMENT

A=8# @120 C/C  
 B=8# @150 C/C  
 C=10# @100 C/C  
 D=10# @120 C/C  
 E=10# @150 C/C  
 F=10# @180 C/C  
 G=10# @200 C/C

**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
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4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX, UNLESS OTHERWISE MENTIONED.
5. Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFORMING TO IS-1786 2008 SHALL BE USED IN ALL RCC WORK.
6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION  
 A) PILE/PILE CAP = 75 mm  
 B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)  
 C) BEAM = 25mm  
 D) SLAB = 20mm
7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS: 1893 (PART II) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
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13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**

**ADMINISTRATIVE BUILDING**

CLIENT: D.A.F.F.P.L.  
 SHAHBAD, MOHAMMADPUR,  
 IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

**Structural Consultant:**

**ABL Structural Consultants Pvt. Ltd.**



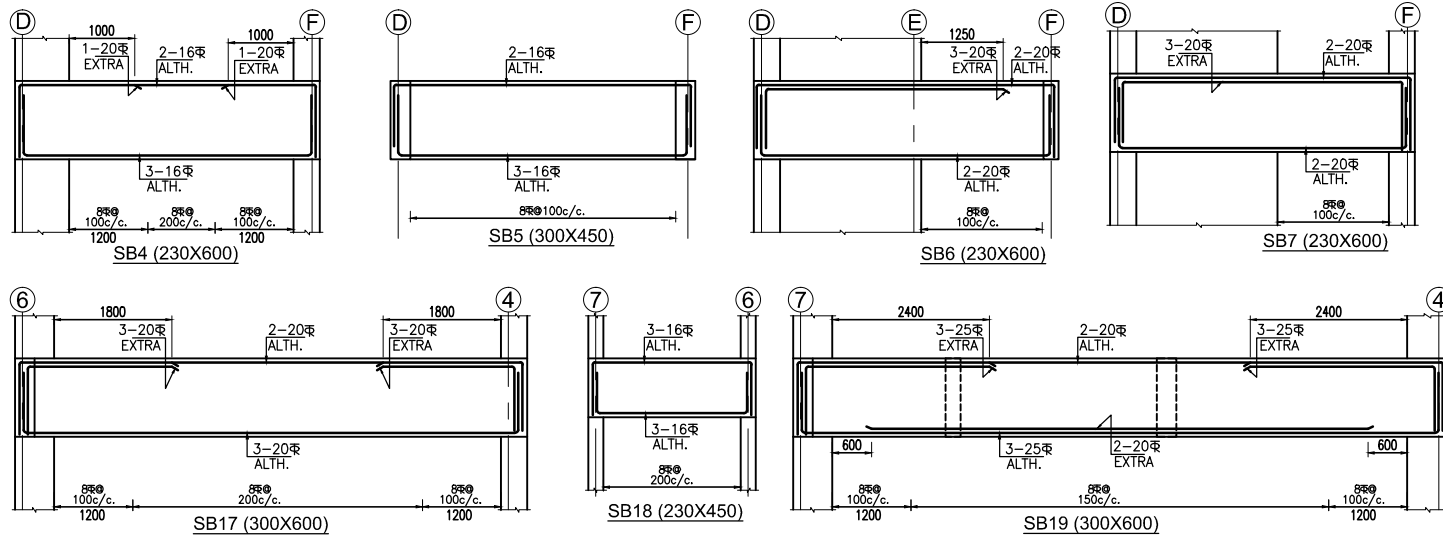
H-6/209, AGGARWAL TOWER,  
 NETAJI SUBHASH PLACE,  
 PITAMPURA, DELHI-110034.  
 PH: 9811038352 , 011- 45650222.

**Title**

TERRACE FLOOR LVL.  
 SLAB R/F. PLAN

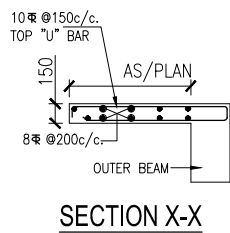
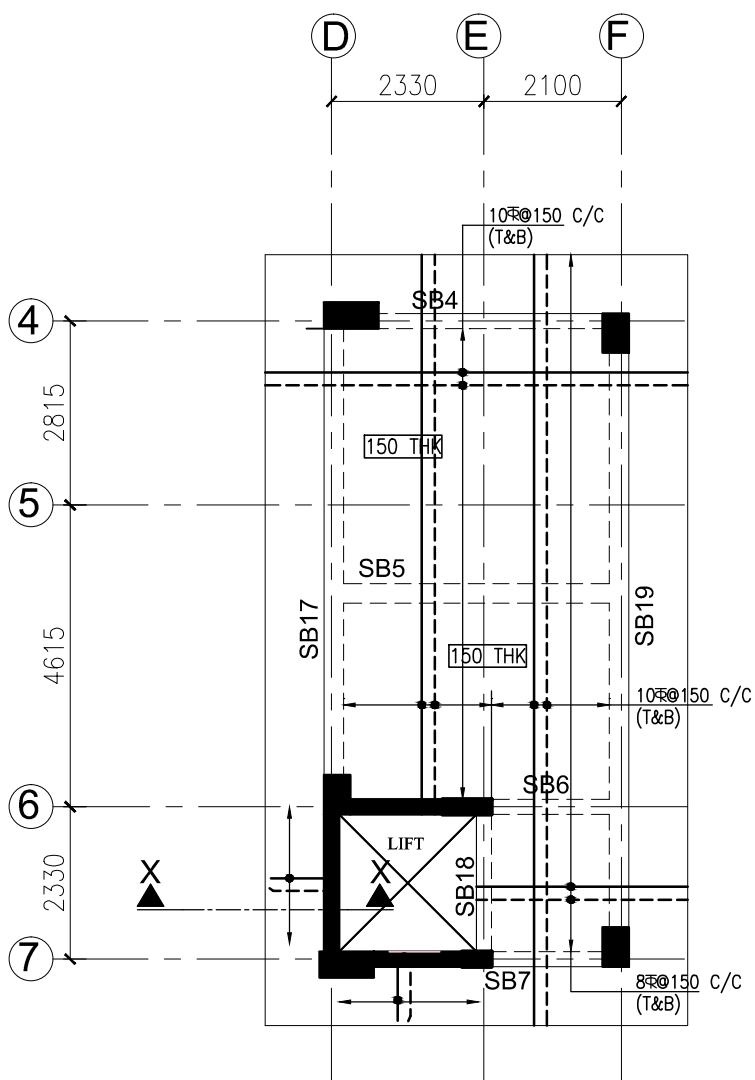
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A.Malik	D.K.	B.K. SINGH	ST-18
Date	Scale	REV.	
07.07.2020	1:100	R-00	

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 FOR APPROVAL       GOOD FOR CONSTRUCTION



**General Notes:**

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
4. ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX. UNLESS OTHERWISE MENTIONED.
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6. REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
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7. LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
8. BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART 1) : 2016
9. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
10. COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
11. THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
12. THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
13. THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING, THE STIRRUP SPACING SHALL NOT EXCEED 150MM
14. THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY



**MUMTY LVL. FRAMING PLAN**

**NOTES FOR CONSTRUCTION JOINTS**

1. DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION.
2. CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINF. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
3. CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

**PROJECT**

**ADMINISTRATIVE BUILDING**

CLIENT D.A.F.F.P.L.  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

**ARCHITECTURE**

**Structural Consultant:**

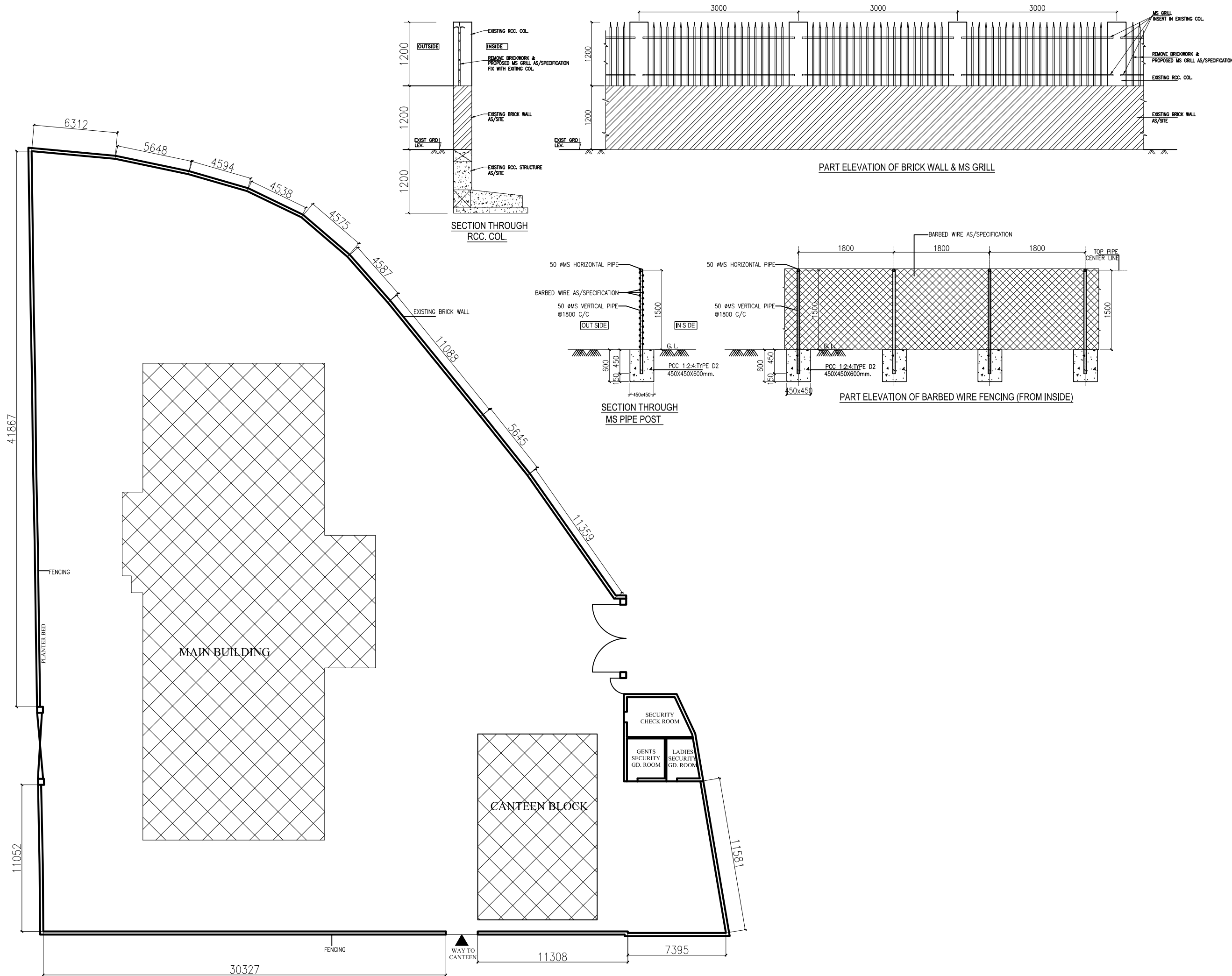
**ABL Structural Consultants Pvt. Ltd.**

H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**MUMTY FRAMING PLAN  
AND DETAILS**

Drawn	Dealt	Checked	Dr. no.
A.Malik	D.K.	B.K. SINGH	ST-19
Date	Scale	REV.	
07.07.2020	1:100	R-00	

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<input type="checkbox"/> FOR APPROVAL	<input type="checkbox"/> GOOD FOR CONSTRUCTION



# BOUNDARY WALL PLAN

## General Notes:

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
- ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
- ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX, UNLESS OTHERWISE MENTIONED.
- Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5 % CONFIRMING TO I.S.-1786 :2008 SHALL BE USED IN ALL RCC WORK.
- REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS- AND AS PER I.S. CODE PROVISION
  - A) PILE/PILE CAP = 75 mm
  - B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)
  - C) BEAM = 25mm
  - D) SLAB = 20mm
- LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS, SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
- BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART I) : 2016
- NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
- COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
- THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
- THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
- THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
- THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

### NOTES FOR CONSTRUCTION JOINTS

- DURING CASTING OF BEAM IF THE WORK IS STOPPED FOR A DURATION LONGER THAN INITIAL SETTING TIME OF CEMENT, THEN SUCH DISCONTINUITY SHALL BE TREATED AS CONSTRUCTION JOINTS SPECIFICATION .
- CONSTRUCTION JOINT SHALL BE MADE VERTICAL BY PROPER TEMPLATE WITH SLOTS FOR ACCOMMODATING REINFT. BARS. THE JOINT SHALL BE TREATED IN ACCORDANCE WITH C.P.W.D.
- CONSTRUCTION JOINT SHALL BE PLANNED AT .35L FROM THE FACE OF THE SUPPORT WHERE 'L' IS THE CLEAR SPAN OF SLAB/BEAM

rev. no.	date	revision

### PROJECT

**ADMINISTRATIVE BUILDING**

**CLIENT** D.A.F.F.P.L  
AVIATION FUELLING STATION  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

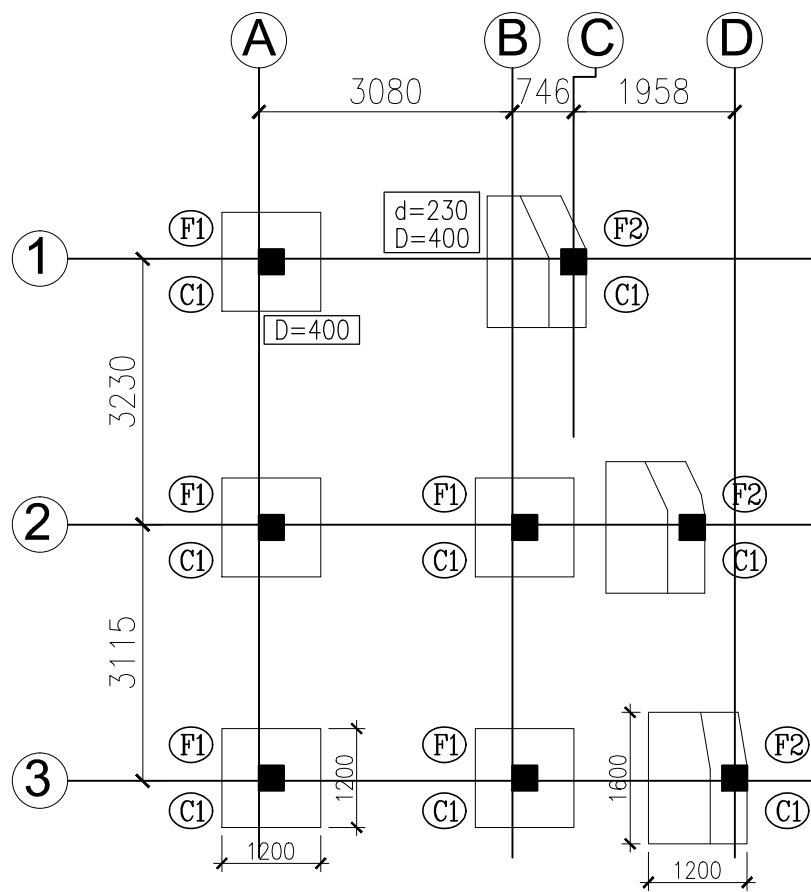
**ARCHITECTURE**  
MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA, SOUTH CITY-II,  
SECTOR-49, GURUGRAM-122018,  
HARYANA, INDIA

**Structural Consultant:**  
**ABL Structural Consultants Pvt. Ltd.**  
H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

**Title**  
BOUNDARY WALL PLAN & DETAILS

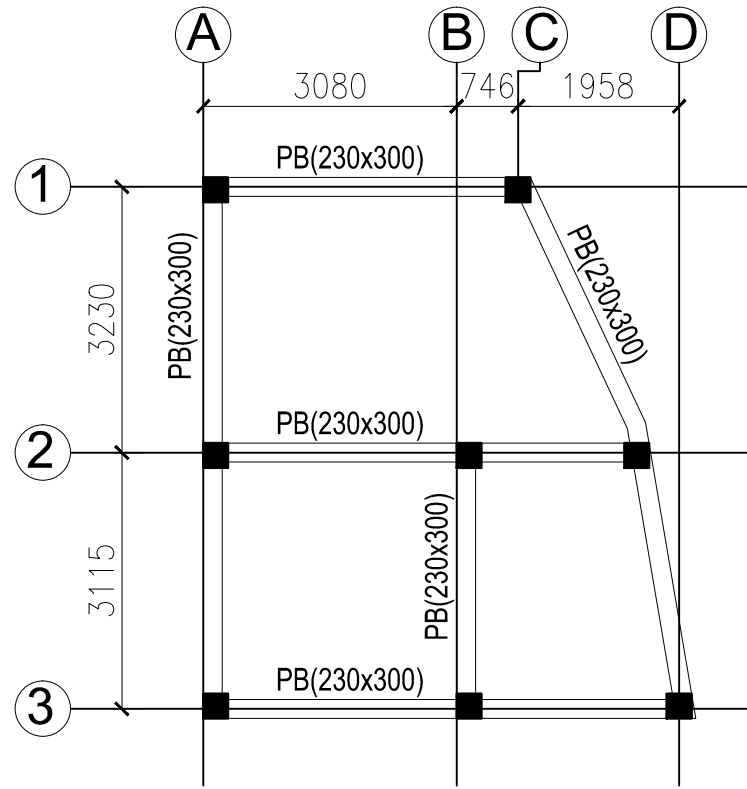
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A.Malik	D.K.	B.K. SINGH	ST-20
Date	Scale	REV.	
07-07-2020	1:100	R-00	

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<input type="checkbox"/> FOR APPROVAL	<input type="checkbox"/> GOOD FOR CONSTRUCTION

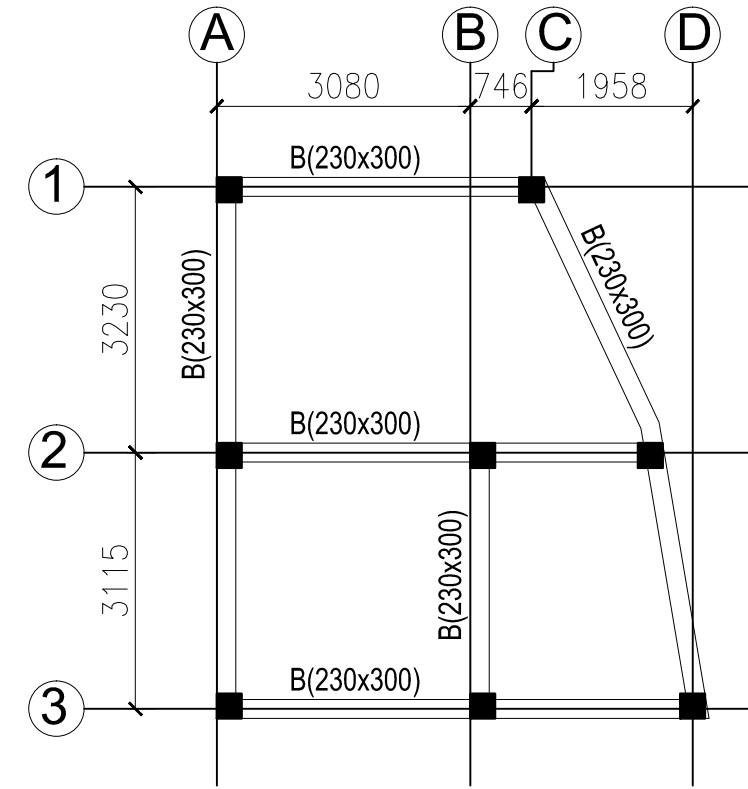


FOUNDATION PLAN

ALL COLUMNS ARE 300x300 U.N.O.

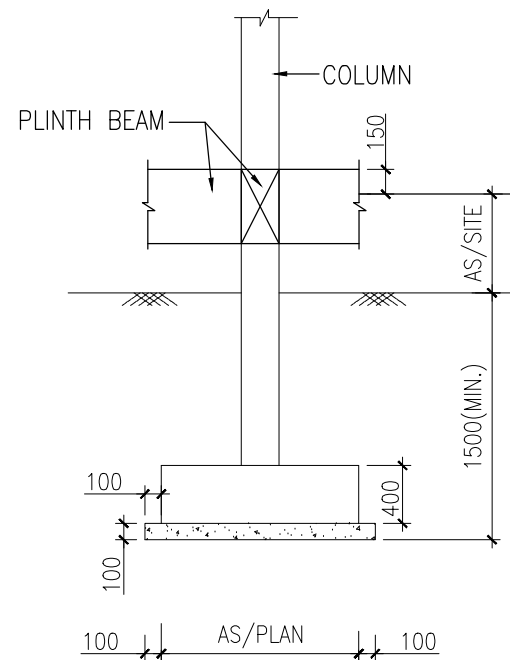


PLINTH PBEAM FRAMING PLAN

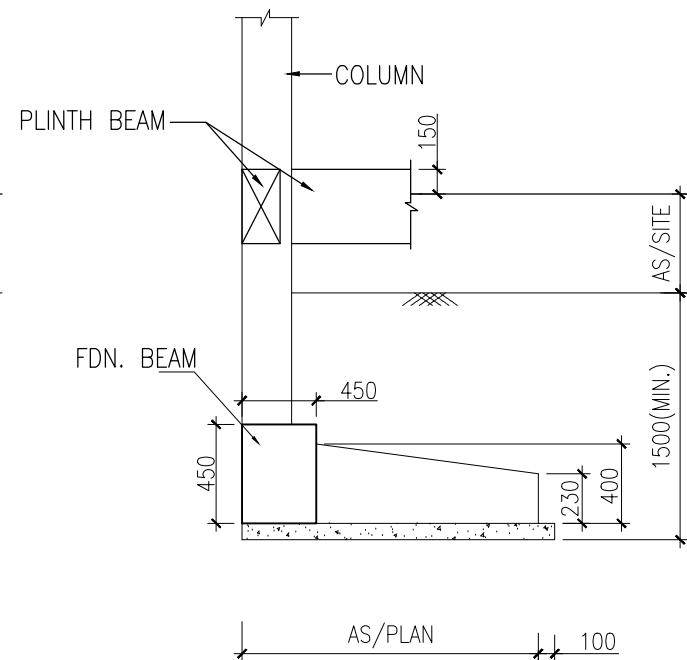


TERRACE FLOOR LVL. FRAMING PLAN

ALL SLABS ARE 125 THK. U.N.O.



TYP. SECTION FTG. F1



TYP. SECTION FTG. F2

General Notes:

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
- ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED NEITHER THE BARS SHALL BE COUNTED NOR THE DIMENSIONS SCALED FROM THE DRAWING.
- ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT RECONCILED BEFORE EXECUTION.
- ALL R.C.C. WORK SHALL BE IN M-25 GRADE MIX. UNLESS OTHERWISE MENTIONED.
- Fe-500 HIGH STRENGTH DEFORMED BARS OR TMT HAVING ELONGATION MORE THAN 14.5% CONFIRMING TO I.S.-1786. 2008 SHALL BE USED IN ALL RCC WORK.
- REINFORCEMENT SHALL HAVE CONCRETE COVER (EXCLUSIVE OF PLASTER OR OTHER DECORATIVE FINISH) AS FOLLOWS - AND AS PER I.S. CODE PROVISION  
A) PILE/PILE CAP = 75 mm  
B) COLUMN=40MM (FOR OUTER FACE OF LATERAL TIES)  
C) BEAM = 25mm  
D) SLAB = 20mm
- LAP / DEVELOPMENT LENGTH FOR ALL REINF. BARS, SHALL BE 49 x DIA OF THE BARS FOR M25 MIX OF CONC. LAPS SHALL BE STAGGERED AND AVOIDED AT THE POINT OF MAXIMUM BENDING MOMENT.
- BUILDING HAS BEEN DESIGNED FOR SEISMIC ZONE - IV AS PER IS:1893 (PART I) : 2016
- NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE OF THE LAP IS NOT LESS THAN 1.3 TIMES .THE DEVELOPMENT LENGTH AS MENTIONED IN NOTE NO. (7).
- COLUMNS COINCIDING WITH RCC WALL AT PERIPHERY SHOULD HAVE STIRRUPS SPACING @100 C/C UPTO GR. FL. LVL.
- THE SPACING OF TIES WITH IN THE JOINTS AND ON EITHER SIDE OF JOINTS UP TO A DISTANCE OF 600 MM SHALL BE 100MM
- THE SPLICING OF LONGITUDINAL BARS IN COLUMN SHALL BE DONE IN MIDDLE HALF OF COLUMN LENGTH.
- THE MINIMUM LENGTH OF SPLICE IS 1000 MM IN THE ZONE OF SPLICING. THE STIRRUP SPACING SHALL NOT EXCEED 150MM
- THE DETAILING OF REINFORCEMENT IN JOINTS SHOULD BE STRICTLY AS THE DETAILS OF JOINTS MADE AVAILABLE SEPERATELY

NOTES FOR CONSTRUCTION JOINTS

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rev. no.	date	revision

PROJECT

**ADMINISTRATIVE BUILDING**

CLIENT

D.A.F.F.P.L.  
AVIATION FUELLING STATION  
SHAHBAD, MOHAMMADPUR,  
IGI AIRPORT, NEW DELHI

ARCHITECTURE

MILLENNIUM CITY MULTIVENTURES Pvt.Ltd.  
302, UNITECH ARCADIA,SOUTH CITY-II,  
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HARYANA, INDIA

Structural Consultant:

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H-6/209, AGGARWAL TOWER,  
NETAJI SUBHASH PLACE,  
PITAMPURA, DELHI-110034.  
PH: 9811038352 , 011- 45650222.

Title

ALL STRUCTURE DETAILS  
GUARD ROOM

Drawn	Dealt	Checked	Org. no.
A.Malik	D.K.	B.K. SINGH	ST-21
Date	Scale	REV.	
07-07-2020	1:100	R-00	

<input checked="" type="checkbox"/> FOR TENDER	<input type="checkbox"/> ADVANCE COPY
<input type="checkbox"/> FOR APPROVAL	<input type="checkbox"/> GOOD FOR CONSTRUCTION



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## ANNEXURE V – DEVIATION SHEET

EXCEPTION AND DEVIATIONS STATEMENT				
S.NO.	PAGE NO. OF TENDER DOCUMENT	CLAUSE NO.	SUBJECT	DEVIATIONS

Bidder shall list all the deviations in the following given format only on their Letterhead. The Deviation sheet should be submitted along with technical bid.

In case no deviation sheet is submitted along with technical bid, it would be concluded that bidder has accepted all specifications, terms and conditions.

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Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## ANNEXURE VI – DECLARATION SHEET

Date:

### **DECLARATION**

We, M/s \_\_\_\_\_ hereby, unconditionally accept all terms & conditions of TENDER NO. : DAFFPL/MOD/FF/2020-21/05 (JOB: TENDER FOR CONSTRUCTION OF NEW ADMINISTRATIVE BUILDING) including Scope of job, quantities, completion period, terms & condition without any deviations.

Sign & Stamp of Bidder

Note: In case of deviations (whether technical or commercial) the above declaration should not be submitted and the deviations should be mentioned separately on bidders letter head with the heading “DEVIATION SHEET”. In absence of “DEVIATION SHEET”, it would be concluded that bidder has submitted his offer as per tender specifications, terms & conditions. Corrections in tender booklet will not be accepted.

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Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## ANNEXURE-VII

### **PROFORMA OF BANK GUARANTEE (EARNEST MONEY DEPOSIT)**

(On Non-Judicial Stamp paper for appropriate value)

BANK GUARANTEE NO. :

BANK GUARANTEE AMOUNT:

CLAIM:

(Till 120 days from date of submission of Proposal)

TENDER NO. /DATE:

JOB DESCRIPTION/

LOCATION:

### **Tender Security No. [\*]**

Name and Address of the Beneficiary: Delhi Aviation Fuel Facility (Private) Limited  
Aviation Fuelling Station, Shahabad Mohammadpur, IGI Airport, New Delhi – 110 061, India

We [*name and address of the issuing bank*] have been informed that [*Name of the Interested party*] (hereinafter called the “Interested Party”) is submitting a proposal for the Award of the Works in response to a Request for Proposal (“RFP”) by Delhi Aviation Fuel Facility (P.) Ltd. (“DAFFPL” or ‘Beneficiary’) for [*Insert description of work*] (“Works”). The conditions of the RFP, which are set out in a documents entitled Request for Proposal dated [*Please insert*] require its offer to be supported by a Tender Security.

At the request of the Interested Party, we hereby irrevocably undertake to pay you without demur, the Beneficiary, any sum or sums not exceeding Rs. \_\_\_\_\_ [*Please insert*].

Upon receipt by us of your demand in writing and your written statement (in the demand) stating that:

- 1) The Interested Party has, without written consent of DAFFPL, withdrawn its offer after the latest time specified for its submission and before the expiry of its period of validity; or
- 2) The Interested Party has refused to accept the correction of errors in nits offer in accordance with the instructions to Interested parties contained in the RFP; or

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Sign & Stamp of Bidder





## **DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**

- 3) DAFFPL entered in to the contract with the Interested party but the Interested party has failed to deliver the **COMPOSITE BANK GUARANTEE (SECURITY DEPOSIT & PERFORMANCE)** in compliance with the Contract conditions; or
- 4) The Interested Party has failed to enter into the Contract within 30 (Thirty) days of being required to do so by the Tender Officer.

Any demand for payment must contain your signature(s). The demand must be received by us at this office on or before the expiry of the earliest of the following dates, when this security guarantee shall expire and shall be returned to us:

- a) Date of issue of letter communicating to the Interested Party that it has not qualified for the contract or the Proposal submitted by the Interested Party is unsuccessful or the TENDER is withdrawn and/or cancelled by the Beneficiary; or
- b) 7 (seven) days after the date of delivery of an acceptable performance bond complying with the Contract conditions and execution of the Contract after the award of the works to the Interested Party; or
- c) 120 (One hundred twenty) days from the last date of submission of Proposal in accordance with the TENDER.

Date:

Signature:

Designation:

Name of the Branch

---

Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## ANNEXURE-VIII

### **PROFORMA OF COMPOSITE BANK GUARANTEE (SECURITY DEPOSIT & PERFORMANCE)**

(On Non-Judicial paper of Rs. 100/-value)

To,

DAFFPL

Dear Sirs,

M/s .....have taken tender for the work .....for DAFFPL,.

The tender Conditions of Contract provide that the Contractor shall pay a sum of Rs. .... (Rupees ..... ) as security deposit & performance guarantee in the form therein mentioned. The form of payment of security deposit & performance guarantee includes guarantee executed by Scheduled Bank at New Delhi, undertaking full responsibility to indemnify DAFFPL, in case of default. The said party ..... have approached us at and their request and in consideration of the premises we ..... having our office at ..... have agreed to give such guarantees as hereinafter mentioned.

1. We -----hereby undertake and agree with you that if default shall be made by M/s. -----in performing any of the terms and conditions of the tender or in payment of any money payable to Daffpl. We shall on demand pay to you, without demur, protest or requiring you to seek recourse to M/s \_\_\_\_\_, in such matter as to you may direct the said amount of Rupees ----- only or such portion thereof not exceeding the said sum as you may from time to time require.
2. You will have the full liberty without reference to us and without effecting this guarantee, postpones for any time or from time to time the exercise of any of the powers and rights conferred on you under the contract with the said -----and to enforce or to forbear from endorsing any powers of rights or by reason of time being given to the said -----which under law relating to the sureties would but for provision have the effect of releasing us.
3. Your right to recover the said sum of Rs. ----- (Rupees -----) from us in manner aforesaid will not be affected or suspended by reason of the fact that any dispute or disputes have been raised by the said M/s. -----

\_\_\_\_\_  
Sign & Stamp of Bidder



## DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

- and/or that any dispute or disputes are pending before any officer, tribunal or court.
4. The guarantee herein contained shall not be determined or affected by the liquidation or winding up dissolution or change of constitution or insolvency of the said -----but shall in all respect and for all purposes be binding operative units payment of all money due to you in respect of such liabilities is paid.
  5. Our liability under this guarantee is restricted to Rupees -----our guarantee shall remain in force until -----unless a suit or action to enforce a claim under Guarantee is filed against us within six months from -----(which is date of expiry of guarantee) all our rights under the said guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there under.
  6. NOT WITHSTANDING anything hereinbefore contained our liability under this Bank Guarantee is restricted to Rupees -----( Rupees -----).This Bank Guarantee shall be valid up to -----and we are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before.
  7. This guarantee is to be returned to us within fifteen (15) days from the date it ceases to be in force. If the guarantee is not returned to us within the date of aforementioned it shall be automatically cancelled.
  8. We have power to issue this guarantee in your favour under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney dated -----granted to him by the Bank.

Yours faithfully

-----Bank  
By its Constituted Attorney  
Signature of a person duly  
Authorized to sign on behalf of the bank

---

Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## Annexure- IX

### Form of Letter of Undertaking

[On the letterhead of the Interested Party]

#### **Letter of Undertaking**

**Date:**

Delhi Aviation Fuel Facility (Private) Limited  
Aviation Fuelling Station, Shahabad Mohammadpur,  
IGI Airport, New Delhi – 110 061, India

**Re:**

The undersigned Interested Party acknowledges that the TENDER issued is confidential and personal to the undersigned Interested Party and hereby undertakes and agrees as follows:

1. **“Confidential Information”** means the TENDER and everything contained therein, all documentation, data, particulars of the Works and technical or commercial information made by (or on behalf of) Delhi Aviation Fuel Facility (Private) Limited or obtained directly or indirectly from Delhi Aviation Fuel Facility (Private) Limited or its representatives by the undersigned Interested Party or which is generated by the undersigned Interested Party or any information or data that the undersigned Interested Party receives or has access to, as a result of the TENDER, as being confidential information of Delhi Aviation Fuel Facility (Private) Limited, provided that such term does not include information that (a) was publicly known or otherwise known to undersigned Interested Party prior to the time of such disclosure, (b) subsequently becomes publicly known through no act or omission by undersigned Interested Party or any person acting on its behalf.
2. The undersigned Interested Party shall maintain the confidentiality of Confidential Information in accordance with procedures adopted by the undersigned Interested Party in good faith to protect confidential information of third parties delivered to it, provided that the undersigned Interested Party may deliver or disclose Confidential Information to its authorized representatives who agree to hold confidential the Confidential Information substantially in accordance with the terms of this Undertaking.
3. The undersigned Interested Party shall not at any time whatsoever:
  - (i) Disclose, in whole or in part, any Confidential Information received directly or indirectly from the Delhi Aviation Fuel Facility (P) Limited to any third party.

---

Sign & Stamp of Bidder



## **DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**

(ii) Reproduce, publish, transmit, translate, modify, compile or otherwise transfer the Confidential Information.

4. In case the Proposal of the undersigned Interested Party is not accepted and immediately upon the acceptance of the Proposal of any of the other Interested Party, the undersigned Interested Party, shall:

(i) Return all Confidential Information including without limitation, all originals, copies, reproductions and summaries of Confidential Information; and

(ii) Destroy all copies of Confidential Information in its possession, power or control, which are present on magnetic media, optical disk or other storage device, in a manner that ensures that the Confidential Information is rendered unrecoverable.

5. The undersigned Interested Party shall certify to Delhi Aviation Fuel Facility (Private) Limited that it has returned or destroyed such Confidential Information to the Delhi Aviation Fuel (Private) Limited within two (2) days of such a request being made by Delhi Aviation Fuel (Private) Limited.

**Name of Interested Party's**

**Signature of Authorized Representative**

---

Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## Annexure X

### **DECLARATION to be submitted along with Technical Bid**

(M/s. \_\_\_\_\_) hereby declare / clarify that we have not been banned or delisted by any government or quasi Government agencies or Public Sector Undertakings.

Stamp & Signature of the bidder

**NOTE:** If a bidder has been banned by any Government or quasi Government agencies or PSUs, this fact must be clearly stated with details. If this declaration is not given along with the technical bid, the tender will be rejected as non-responsive.

---

Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## Annexure XI

**To become eligible for tender, the tenderer shall have to furnish three affidavits as under**

I/We.....Prop. /Partner/Director of..... registered address ..... undertake and confirm that eligible similar works 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 Company, then I/we shall be debarred for tendering in DAFFPL contracts in future forever. Also, if such a violation comes to the notice of Company before date of start of work, the Engineer- in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

I/We.....S/o.....R/o.....  
..... hereby declare that:

i) I have submitted the requisite EMD amount in the form of a DD in favour of Delhi Aviation Fuel Facility Private Limited.

ii) In case of my tender is not accepted as per terms & condition of Tender and for any refund is made to me against the EMD after the due deductions if any, the DD shall be returned to me if I don't qualify in pre-qualification process or after the award of the work to the successful bidder in case I qualify but don't get awarded the work.

DAFFPL shall not be responsible in any way for none crediting of EMD amount in the account of DAFFPL by due date and time as mentioned in Tender.

I/We.....S/o.....

R/o ..... do hereby solemnly affirm and declare as under:

i) That I am sole proprietor/Partner of M/s....., R/o.....

ii) That returns of GST department have been duly filed and no dues are pending of the department up to last financial year.

iii) That this is my true and correct statement.

---

Sign & Stamp of Bidder



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## Annexure XII

### Form of Advance Payment Guarantee

Advance Payment Guarantee No: [                      ]

To: Delhi Aviation Fuel Facility Private Limited

#### WHEREAS

- (A) By an Order dated on or about the date of this Guarantee (and referred to herein as the “**Contract**”) DAFFPL has appointed [                      ] (the “**Contractor**”) for undertaking the Procurement and Construction of New Administrative Building, at DAFFPL, New Delhi (hereinafter defined as “**Project**”).
- (B) DAFFPL has agreed to pay the Contractor the sum of [Rs.                      ] Rupees) as an advance payment of sums due to the Contractor under the Contract (the “**Advance Payment**”).
- (C) Pursuant to the Order, the Contractor is obliged to procure an advance payment guarantee (hereinafter referred to as the “**Guarantee**”) in the manner hereinafter appearing in the sum of the Advance Payment.

In consideration of accepting our obligations herein contained in discharge of the Contractor’s obligation to provide such Guarantee, and in consideration of your paying to the Contractor following receipt of this Guarantee the Advance Payment we [                      Bank] of [                      ] hereby irrevocably and unconditionally agree to make payment to you of any amount up to or equal to the Advance Payment and accordingly covenant with you and agree as follows:

1. Upon receipt of a written demand or demands by you upon us in the form set out in Appendix 1 (“**Demand**”), from time to time or at any time and without being entitled or obliged to make any enquiry of you, or the Contractor, and without the need for you to take legal action against or to obtain the consent of the Contractor, and notwithstanding any objection by the Contractor or any other third party and without any proof or conditions and without any demur, reservation, contest, recourse or protest and without any right of set-off, deduction or counterclaim, we shall forthwith pay to you the amount or amounts specified in such demand or demands, not exceeding in aggregate the Advance Payment, it being confirmed that you may make as many separate demands hereunder as you think fit. Such payment or payments shall be made by transfer to an account in your name at such bank in such place as you shall direct. You shall not be obliged to exercise any other right or remedy you may have before making a demand under this Guarantee.

---

Sign & Stamp of Bidder





## DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

2. The written demand referred to in paragraph 1 shall be deemed to be sufficiently served on us if you deliver to us at the address as set out in paragraph 7 a demand in the form set out in **Appendix 1** attached (the “**Form of Demand**”).
3. Subject to paragraph 1 above, on receiving the Demand, we shall forthwith pay to you the sum so demanded to the place or account set out in the Demand.
4. Subject to paragraph 1 above, your Demand shall be conclusive evidence (and admissible as such) of our liability to pay you and of the amount of the sum or sums which we are liable to pay you. Our obligation to make payment under this Guarantee shall be a primary, independent and absolute obligation and we shall not be entitled to delay or withhold payment for any reason. Our obligations hereunder shall not be affected by any act, omission, matter or thing which but for this provision might operate to release or otherwise exonerate us from our obligations hereunder in whole or in part, including without limitation and whether or not known to us or you:
  - 4.1 any time or waiver granted to the Contractor;
  - 4.2 the taking, variation, compromise, renewal or release of or refusal or neglect to perfect or enforce any rights, remedies or securities against the Contractor;
  - 4.3 any legal limitation, disability or incapacity relating to the Contractor;
  - 4.4 any variation of or amendment to the Contract or the Works or any other document or security so that references to the Contract in this Guarantee shall include each such variation and amendment;
  - 4.5 any unenforceability, invalidity or frustration of any obligation of the Contractor or any other person under the Contract or any other document or security waiver by you of any of the terms provisions conditions obligations and agreements of the Contractor or any failure to make demand upon or take action against the Contractor;
  - 4.6 any other fact, circumstance, provision of statute or rule of law which might, were our liability to be secondary rather than primary, entitle us to be released in whole or in part from our undertaking; and
  - 4.7 any petition for the winding up of the Contractor has been admitted and a liquidator or provisional liquidator has been appointed or an order of bankruptcy or an order for the winding up or dissolution of the Contractor has been made by a Court of competent jurisdiction;
5. This Guarantee shall remain in full force and effect till [Date] or until the expiry of 28 (twenty-eight) days from the date which the full amount of the Advance

---

Sign & Stamp of Bidder



## DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

Payment shall have been repaid, whichever is earlier. Subject thereto, this Guarantee shall expire when the Advance Payment is paid by us to you in accordance with paragraph 1.

6. We acknowledge and agree that the benefits of this Guarantee may not be transferred or assigned by us. The benefits of this Guarantee may however be assigned in full by the Employer to any person to whom all the benefits of the Contract are transferred, and to the Lenders (being the financial institutions, banks, funds and/or trusts who provide or refinance the debt component of the cost of the Project (including guarantees, risk participation facility, take-out facility and other forms of credit enhancement) and includes any subscriber to/trustee for the holders of debentures/bonds or other securities issued by the Employer to meet or contribute to the cost of such project) or to any agent, representative or trustee acting on their behalf, their assignees and successors in title which will include the right to make second or subsequent assignments. We undertake that following receipt of a notice of any such assignment to make any payments made hereunder in accordance with the directions of such assignee.

6.1 Any demand, notice or other communication given in connection with or required by this Guarantee shall be made in writing (entirely in the English language) and subject to paragraph 7.2 shall be delivered to, or sent by pre-paid registered post, or email or facsimile transmission to:

(a) Delhi Aviation Fuel Facility Private Limited at:

(b) the Guarantor at

[*address and fax no.*] marked for the attention of the [        ];

or such other address as may be notified in writing from time to time.

6.2 Any such demand, notice or communication shall be deemed to have been duly served:

(a) if delivered by hand, when left at the property address for service;

(b) if given or made by pre-paid registered post or email or facsimile transmission, when received,

provided in each case that if the time of such deemed service is either after 5.00 p.m. on a Business Day (being a day other than a Sunday or a public holiday on which banks are open for domestic business in the city of Delhi) or other than on a Business Day service shall be deemed to occur instead at 9.00 a.m. on the next following Business Day.

---

Sign & Stamp of Bidder



**DELHI AVIATION FUEL FACILITY PRIVATE LIMITED**

7. This Guarantee shall be governed by and construed in accordance with the laws of the Republic of India and the parties to this Guarantee hereby submit to the jurisdiction of the Courts of New Delhi for the purposes of settling any disputes or differences which may arise out of or in connection with this Guarantee, and for the purposes of enforcement under this Guarantee.

**IN WITNESS** whereof this Guarantee has been executed and delivered as a Deed on the Day of [ ] 201[ ].

SIGNED as a Deed )  
 by [ ] )

As the Attorney )  
 and on behalf of [ Bank] )  
 in the presence of: )



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## FINANCIAL BID

### SCHEDULE OF PRICES

The Bidder shall quote for the entire Works, such that the total Tender (lump sum) price *inter-alia* covers break ups of the price of all cost centres and applicable taxes thereon, if any, along with all its risks, obligations and liabilities set out in or to be reasonably inferred from the Tender Documents in respect of the procurement, supply, construction, erection, installation, setting to work, testing, pre commissioning, successful commissioning and completion of the Works, all in accordance with the requirements of the tender and applicable laws.

In the Schedule of Prices, the bidder shall quote all prices showing all taxes, duties, levies, and charges separately. The bidder shall also give a breakdown and details of such prices *vis-à-vis* each of the cost centre/items as itemized in the Schedule of Prices. The Works shall be executed by the Contractor for a total Tender (lump sum) price as provided basis the Schedule of Prices.

***The Bill of Quantities shall only serve the limited purpose of deriving the basis on which the lump sum price has been arrived.***

The prices quoted by the bidder shall not be subject to adjustment during the term of the Contract.

#### PREMABLE

1. The Schedule of Prices includes the following:
  - (i) the Tender total comprising an aggregate of the following:
    - a) **Section A** - Supply
    - b) **Section B** - Execution

It is clarified that the Tender total, once formalized, will be a lump sum price inclusive of taxes. Conversely, the aggregate of the lump sum prices of Section A and Section B shall constitute the Tender Total.

- (ii) Bill of Quantities for the entire Works for the limited purpose of understanding how the lump sum price has been derived. Bill of quantities (*as attached*) is tentative and only for guidance purposes.

#### 2. Price Adjustment

All prices are firm and fixed for the duration of the Contract and are not subject to escalation for any cause, except as otherwise provided in the Contract. Payment of the Tender Total (lump sum price) comprising Sections A and Section B as per above Schedule of Prices, shall constitute full payment for performance of the Works and covers all costs of whatever nature incurred by the Contractor in accomplishing the Works in accordance with the provisions of the Contract.

The Contractor shall maintain all Works in progress until it is accepted. Contractor shall repair, rework or replace as necessary any work damaged or lost due to normal wear and tear, anticipated events, or conditions within its control. No separate payment shall be made for such maintenance costs which are deemed included in the original Contract Sum. Any failure to maintain the Works shall be considered a defect in accordance with the Conditions of tender.



# DELHI AVIATION FUEL FACILITY PRIVATE LIMITED

## B. THE TENDER TOTAL

The Tender Total comprises:

The Fixed Lump Sum of this Contract is: Section A + Section B, where

Section	Description	Amount in Rs	Taxes in Rs	Total Amount in Figures	Total Amount in Words
A	SUPPLY				
B	ERECTION				
C	TOTAL				

Arithmetic errors will be rectified, and the total Tender amount will need to be corrected on the following basis:

- (i) If there is a discrepancy between the unit rate and the amount that is obtained by multiplying the unit rate and quantity, the unit rate shall prevail and the amount will be corrected unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit rate, in which case the amount as quoted will govern and the unit rate corrected.
- (ii) If there is a discrepancy between the total amount in the Schedule of Prices and the sum of various amounts in that schedule, the sum of various amounts in that schedule shall prevail and the total amount will be corrected.

**THE BIDDERS ARE REQUIRED TO NOTE THAT THE CONTRACT SHALL BE AWARDED AND THE WORKS SHALL BE EXECUTED ON A LUMP SUM PRICE BASIS AND NOT ON UNIT RATE BASIS AND THE UNIT RATES PROVIDED IN THE BILL OF QUANTITIES HAVE BEEN PROVIDED ONLY FOR THE PURPOSE OF PROVIDING THE BASIS OF DERIVING THE LUMP SUM PRICE. BIDDERS MUST NOTE THAT THE BILL OF QUANTITIES IS SOLELY FOR GUIDANCE PURPOSES.**