

**TENDER FOR**  
**PROPOSED CONSTRUCTION OF**  
**HIGH ALTITUDE CLOUD PHYSICS LABORATORY (HACPL)**

**FOR**

**INDIAN INSTITUTE OF TROPICAL METEOROLOGY, PUNE**  
**AT – MAHABALESHWAR, DIST – SATRARA, MAHARASHTRA.**

**ARCHITECHTURAL & PROJECT MANAGEMENT CONSULTANTS:**

**M/s ARCHIVISTA ENGINEERING PROJECTS PVT. LTD.**

**PUNE**

**VOLUME – I**

**TECHNICAL BID**

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**INDIAN INSTITUTE OF TROPICAL METEOROLOGY  
PASHAN, PUNE-411 008**

**Tender No. CE//IITM/Project/NDB/2012-13/10**

**e-TENDER NOTICE**

Director, Indian Institute of Tropical Meteorology, Dr. Homi Bhabha Road, Pashan, Pune-411 008,(India) . Invites sealed separate tenders for following work (Part-I – Technical Bid, Part-II – Commercial Bid) in separate sealed covers from reputed and experienced contractors Contractors registered in the approved list of contractors of PWD/MES/ CPWD/ Railways/P&T/Industrial contractors' inappropriate class for following work.

**Name of work: Construction of High Altitude Cloud Physics Laboratory (HACPL)  
Building for Indian Institute of Tropical Meteorology  
at Mahabaleswar, Satara Dist. Maharashtra.**

Tender documents can be down loaded from e – procurement web site <http://eprocure.gov.in> or from the institute website <http://www.tropmet.res.in/> and can also be obtained from the civil wing of the institute. The bidder has to submit the tender document fee of **Rs 5000-/, (Rs Five thousand only)** in the favour of Director, IITM Pune.

**Date of issue of tender documents** : **17/12/2012**  
**Pre - Bid Meeting** : **26/12/2012 at 1100 hrs.**  
**Venue of Pre-Bid meeting** : Indian Institute of Tropical Meteorology,  
Dr. Homi Bhabha Road Pashan Pune-411008  
**Last date of receipt of Tender at IITM, Pune:** **08/01/2013 at 1230 hrs.**  
**Opening of Tenders (Technical Bids only):** **08/01/2013 at 1500 hrs.**

The Institute reserves the right to reject any or all tenders without assigning any reason thereof.

Civil Engineer  
For Director  
Email:[anupam@tropmet.res.in](mailto:anupam@tropmet.res.in)



**PART – 1**

**TENDER NOTICE.**

Sealed item rate tenders **In TWO COVER systems i.e. Envelope-1 “TECHNICAL BID” and Envelope-2 “COMMERCIAL BID”** are invited by the undersigned from reputed and experienced contractors for the civil and allied works of construction of **HIGH ALTITUDE CLOUD PHYSICS LABORATORY** for INDIAN INSTITUTE OF TROPICAL METEOROLOGY.

NAME OF WORK	: PROPOSED CONSTRUCTION OF HIGH ALTITUDE CLOUD PHYSICS LABORATORY FOR INDIAN INSTITUTE OF TROPICAL METEOROLOGY AT MAHABALESHWAR, DIST – SATARA, MAHARASHTRA.
PERIOD OF SALE OF BIDDING DOCUMENT	: <b>FROM 17/12/2012. TO 07/01/2013</b>
LAST DATE AND TIME FOR RECEIPT OF BIDS	: <b>08/01/2013 TIME 12:30 hrs</b>
DATE AND TIME FOR PRIBID MEETING	: <b>26/12/2012 TIME 11:00 hrs</b>
DATE AND TIME OF OPENING OF TECHNICAL BIDS	: <b>08/01/2013 TIME 15:00 hrs</b>
PLACE OF OPENING OF TECHNICAL BIDS	: OFFICE OF THE DIRECTOR, INDIAN INSTITUTE OF TROPICAL METEOROLOGY DR HOMI BHABA ROAD, PASHAN, PUNE.
OFFICER INVITING BIDS	: THE DIRECTOR, INDIAN INSTITUTE OF TROPICAL METEOROLOGY DR HOMI BHABA ROAD, PASHAN, PUNE.

Salient Features :

Name of Work	PROPOSED CONSTRUCTION OF HIGH ALTITUDE CLOUD PHYSICS LABORATORY FOR INDIAN INSTITUTE OF TROPICAL METEOROLOGY AT MAHABALESHWAR, DIST – SATARA, MAHARASHTRA.
Period of Completion	Eight Months

2. Tender documents can be purchased from the office of The Director, Indian Institute of Tropical Meteorology Dr Homi Bhaba Road, Pashan, Pune, Maharashtra. India

A	Cost of Tender Documents (Non-Refudable)	Rs. 5000/- [Rs. Five thousand only] By Demand Draft drawn from any Nationalized or Schedule Bank in India payable at Pune in favour of The Director, Indian Institute of Tropical Meteorology Dr Homi Bhaba Road, Pashan, Pune, Maharashtra. India
B	Period of Issue of Tender Documents	FROM 17/12/2012 TO 07/01/2013 (During office hours)
C	Earnest Money Deposit (EMD)	<b>Rs. 5,75,000=00(Rupees Five lack seventy five thousand only)</b> By Demand Draft drawn from any Nationalized or Schedule Bank in India payable at Pune in favour of The Director, Indian Institute of Tropical Meteorology Dr Homi Bhaba Road, Pashan, Pune, Maharashtra. India (or) By Irrevocable Bank Guarantee from any Nationalized or Scheduled Banks in India.
D	Last date for submission of bids	08/01/2013 at 12:30 hrs
E	Opening of Technical bid	08/01/2012 at 15:00 hrs.

\*Only one set of document will be issued. Contractors have to take additional copies.

- Any clarifications will be entertained during office hours on working days.
- IITM, Pune reserves the right to accept/reject any one /all the tenders without assigning any reason thereof. Further IITM Pune reserves the right of allocating works to more than one agency.

General Terms - The Contractor must quote the rates both in figures and words. All erasures and alterations made while dated initials of the contractor must attest filling the tender. Over writing of figures is not permitted. Failure to comply with either of these conditions will render the tender liable for rejection. No advice for any change in rate or conditions received after the opening of the tender will be entertained. Errors in rates quoted and amount quoted shall be dealt with in the following manner. In the event of a discrepancy between the rates quoted in words and the rates in figures, the former shall be deemed to be correct.

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

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

The tender total shall be accordingly amended except that there shall be no rectification of any errors, omissions, or wrong estimate, in the prices inserted by the contractor in the schedule of quantities.

Where alternative items (R/O) are given, only the rates in figures and words are to be entered and not the amounts thereof. A tender, which does not show the rates in figures and words for alternative items are liable to be rejected. The Owner /Consultant reserves the rights to take into account any of the alternative items during the execution of the work, partly or fully as required.

The Contractors must obtain for themselves on their own responsibility and at their own expense all the information which may be necessary, including risks, contingencies and other circumstances to enable them in making a proper tender and for entering into a contract, and must examine the drawings, specifications and inspect the site of the work and acquaint themselves with all local conditions, access to the work site, nature of the work and all the matters pertaining thereto before submitting the tender. They can also get any clarifications required from the /Consultant, before tendering, by contacting them at their office during working hours.

The Schedule of Quantities is only probable quantities and is liable to alterations by omission, deductions or additions to any extent. Payments will be made on the actual quantities of work done at accepted unit rate. Each tender should contain not only the rates but also the value of each items of work entered in a separate column and all the items should be totaled in order to show the aggregate value of the entire tender. Corrections, which are not attested, may entail the rejection of the tender. Rates should be quoted both in figures and words in the columns specified.

The rates quoted shall include all expenditure involved in providing contributions towards provision for Provident Fund / ESI wherever applicable, Insurance coverage for all the works, Labour cum third party risk also (i.e. Car policy, Workmen's compensation Policy and third party liability)

The calculations made by the Contractors should be based upon quantities of several items of work, which are furnished for the tender's convenience in the bill of quantities, but it must be clearly understood that the contract is a unit rate contract and not a lump sum contract. The Owner does not in any way assure or guarantee that the said probable quantities are correct or that the work would correspond thereto. The items of work irrespective of the quantities, which may vary, shall be carried out at the same accepted tender rates and no escalation in the rates will be entertained whatsoever.

Within Three days of the receipt of the intimation from the Owner/Consultant of the acceptance of the tender, the successful Contractor shall be bound to implement and contract by signing the agreement within seven days in accordance with the draft agreement and the schedule of conditions, along with other conditions that may be mutually agreed to, subsequent to the receipt of the tender, but the written acceptance by the Owner/Consultant of the tender will constitute a binding whether such a formal contract is or is not subsequent entered into.

All compensations or other sums of money payable by the Contractor to the Owner under the terms of this contract will be deducted from the bill amounts or from the Retention Money, if the amount so permits and the Contractor shall unless such retention money has become otherwise payable, within ten days after such deductions, make good in cash the amount so deducted.

The Contractor shall carry out all the works strictly in accordance with the drawing, details and instructions of the Consultant / Owner. If in the opinion of the /Consultant, charges have to be made in the design, and they desire the Contractor to carry out the same, the Contractor shall be, bound to comply. The /Consultant's decisions in such cases shall be final. Compensation if payable for this change will solely be at the discretion of the /Consultant.

The Contractor is bound to carry out any items of work as instructed by the /Consultant if such items of work are deemed necessary by the /Consultant / Owner for the completion of the job even though such items are not included in the Schedule of Quantities and rates. The /Consultant will issue schedule of instructions in respect of such additional items and their quantities in writing with the prior consent in writing of the Owner. Contractor shall forward the rate analysis in writing to /Consultant who will review and forward the same with comments to the Owner.

The Contractor shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work whatever the cause of delay may be, including delays arising out of modifications to the work entrusted to him or in any Sub-contracts connected therewith or delays in awarding contracts for other trades of the project or in commencement of completion of such other works or in procuring Government controlled or other building materials or for any other reason whatsoever and the Owner shall not be liable for any claim in respect thereof. The /Consultant does not accept liabilities for any sum besides the tender amount, subject to such variations as are provided for herein and as instructed by /Consultant / Owner.

The successful Contractor must co-operate and co-ordinate the work with the work of all the other Contractors appointed by the Owner, so that the work shall proceed with the least possible delay and to the satisfaction acceptance of the /Consultant / Owner.

The Contractors' co-ordination with other Contractors appointed by the Owner is essential to maintain smooth progress of work and any delays, which in the opinion of the /Consultant is due to non co-ordination and in efficient management of the Contractor, will not be entertained for any extension of time.

The /Consultant / Owner will acknowledge the tenders received.

The price quoted, time required for the completion, and the standard of workmanship and technical and financial capabilities of the Contractors will be the main criteria for considering the tenders.

The Owner do not bind themselves to accept the lowest or any tender and reserve themselves that right to accept or reject any or all the tenders, whether in the whole or in part without assigning any reason for doing so.

Every Contractor shall furnish along with the tender the latest Income Tax Clearance Certificate without which this tender is likely to be rejected.

### NON TENDERED ITEMS

The rate of extra items shall be worked out in accordance with the following Rules

- a. The rates for the extra items shall be derived from the rate of an appropriate item of the similar class for which the rate has already been accepted, where same can be directly derived.
- b. The contractor shall be bound to carry out any extra items of work as per site requirement. The rate for extra items shall be derived from the rate already quoted. Where the items are not specified in the BOQ the rate shall be worked out at cost of material+labour+10% overheads, wastage and transportation & profit.
- c. Wherever applicable the basic rate difference in materials (mentioned in tender) shall be payable plus-minus without any profits, overheads etc., on said rate difference.
- d. Variation and Non- Tendered items, if any, shall be carried out under specific written instruction by architects and prior sanction by the Institute.

The rates furnished in the schedule of quantities will apply for the entire project. Any items of work which is not covered in the schedule of quantities which may be required to be carried out on site shall be executed by the Contractor and payment for such items of work shall be based on the rates that may be derived from the rates quoted for similar comparable items or as finalized by /Consultant.

### GUARANTEE

The contractor shall guarantee that the items supplies are in full accordance with the requirements of enquiry specifications any additions / revisions / deviations in the same as agreed between Owner / /Consultant / Contractor as per various documents.

Schedule for completion of work in the form of "PERT CHARTS" and the Contractors should give "BAR CHARTS" within ten days of starting the work.

Time of completion and very good quality of all finished works should be treated as "ESSENCE" of this contract. The Contractor must conceive and adhere to these requirements while quoting for this tender.

**ROYALTY CHARGE** – The contractor shall quote their offer including royalty charges required for construction material as well as required for execution of work as per standard local rules. Proof of challans for royalty paid shall be submitted along with monthly bills, failing which the certain cost will be kept from every running account bill and the same will be released only after submission of satisfactory proof of royalty challans.

### Addendums or Corrigenderums

The /Consultant may issue Addendums or Corrigenderums at any time prior to the date for submission of the tender and these will form the part of the contract. This notice inviting tenders will form part of the Tender Document.

### DECLARATION

I / WE hereby declare that I / we have read and understood in the language known to me/us the above instructions for the guidance of the contractors.

**SIGNATURE OF THE CONTRACTOR**  
**LOCATION DATE**

**STAMP OF CONTRACTING FIRM**

**INSTRUCTIONS  
TO  
CONTRACTORS**

**PART – 2**

**INSTRUCTIONS TO CONTRACTORS**

## 1. GENERAL

This contract comprises with the Instructions to Contractor, General Terms and Conditions of Contract, Special Conditions of Contract (SCC), Safety rules & regulations, Technical Specifications, Drawings, Bill of Quantities, Agenda / Corrigendum etc. which are also part of the Contract and the Contract Documents.

## 2. LOCATION OF SITE

The site for the civil and allied works for Proposed construction of HIGH ALTITUDE CLOUD PHYSICS LABORATORY is located at Gat no - 134/70 Sector 1, next to Primary Health Centre Campus, Off masjid Road, Mahabaleshwar, Dist - Satara, in state of Maharashtra, India.

## 3. SITE VISITS

The Contractor is deemed to have visited the site of work at his own cost, before submitting the tender, in order to acquaint self with the general terrain of site, subsoil conditions, access to site, working space within allotted premises, and other conditions like availability and quality of water, labour, construction materials and matters related to construction work. Non familiarity with the site conditions will not be considered as the basis for any claim for additional compensation, extension of time for completion, any claim whatsoever or for not carrying out the work in conformity with the Drawings and Specifications.

4. The Contractor shall register as Contractor under the provisions of the Contract Labour (Regulation & Abolition) Act 1970 and the Contract Labour (Regulation and Abolition) rules 1974 and obtain necessary Labour license under the above Acts. The Contractor shall have his own code numbers for payment of ESI and PF contributions of his employees under Employees State Insurance Act 1948 and the Employees Provident Fund and Family Pension Funds Act 1952 respectively.

It is hereby declared that the Contractor for the purposes of this contract is an independent Contractor and that the persons employed or engaged by the Contractor in connection with the execution of the work by the Contractor or otherwise in pursuance of this contract shall be the employees of the Contractor and not that of the company. The Contractor shall make it clear to the persons employed or engaged by him at the time of their employment that the Contractor is their employer and shall in particular, in all cases, where letters of appointments or other similar letters or documents are given to the persons, specify in such letters or documents that the Contractor is their employer. The Contractor shall indemnify and keep indemnified the company against all actions, suits, proceedings, claims and demands whatsoever that may be brought or made against the company by or on behalf of any persons, body, bodies authority or authorities whomsoever and whatsoever and all dues, penalties, levies, taxes, losses, damages, cost, charges, expenses, or other liabilities whatsoever which the company may now or hereafter be liable to pay, incur or sustain by reason of or in consequence of the company being held or considered to be the employer of any such person or persons.

## 6. LOCAL LAWS AND REGULATIONS

It would be the full responsibility of the Contractor to abide by all local laws, regulations etc. prevailing from time to time, prevailing and in effect from time to time during the contract period.

**7. ARTICLES OF VALUE FOUND**

All gold, silver and minerals 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 the property of the Owner, and the Contractor shall duly preserve the same to the satisfaction of the Architect/Consultant and shall from time to time deliver the same to such person or persons indicated by the Owner.

**8. GUARANTEE**

In addition to the guarantee against defects, the Contractor shall arrange to endorse the related manufacturers' guarantee, test certificates for bought out items of his supply in the Owner's name at no extra cost. Endorsement of all material with stamp number, should match the documents such as challans etc.

**9. QUOTE RATE ITEMS**

The Contractor shall quote only rates for items wherever it is marked with quote rate item (R/O) in the 'Quantity' column. For items where neither quantity nor "R/O" / "Rate only" is indicated, Contractor should not indicate rate as these items are not going to be operated.

**10. RIGHT TO ACCEPT OR REJECT TENDER**

The Owner reserves the right to accept or reject any or every tender without assigning any reasons whatsoever / or to negotiate with the Tenderer(s) in the manner the Owner considers suitable.



**GENERAL CONDITIONS  
OF  
CONTRACT**

## **PART – 3**

### **GENERAL CONDITIONS OF CONTRACT**

#### **1. DEFINITIONS**

1.1 The contract document shall consist of the various documents listed under clause 2.0 here below.

1.2 The owner, the contractor and the Architect/Customers representative are those mentioned as such in the Agreement and shall include their legal representatives, assigns or successors. They are treated throughout the Contract document as if each were of the singular number and masculine gender.

1.3 The “Site” shall mean the site of the Contract Works including any building and erections thereon and any other land allotted by the Owner / Architect/Customers representative for Contractors’ use.

1.4 The term “Sub-Contractor”, as employed herein, includes those having a direct contact with the Contractor and it includes one who furnishes materials worked to a special design according to the plans or specifications of the work but does not include one who merely furnishes materials, not so worked. Anyone doing work on a piece rate basis shall be deemed a Sub-Contractor.

1.5 “Written Notice” shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an office of the Corporation for whom it is intended, or if delivered at or sent by registered mail to the last business address known to him who gives the notice.

1.6 The term “Work” of the Contractor or Sub-Contractor includes labour or material or both.

1.7 “Clerk of Works” shall mean the person appointed by the Architect/Customers representative to inspect and certify measurement of the works at site and for supervising the works on site.

1.8 All the time limits stated in the Contract Document are the essence of the Contract.

1.9 The law of the place of work shall govern the construction under this contract.

1.10 The “Date of Virtual Completion” of the Work or specified portion of the work is the date when construction is sufficiently completed, in accordance with the Contract Documents as modified by any change or variation order agreed to by the parties, so that the Owner can take over such completed work and occupy for the intended use of that portion, as per certificate issued by Architect/Customers representative.

## **2. CONTRACT DOCUMENT:**

The following documents shall constitute the Contract Document:

- 1) Articles of Agreement, executed by the Owner and the Contractor.
- 2) Notice Inviting Tender.
- 3) Instructions to Contractors and Special Conditions and Additional Special Conditions of Contract.  
Form of Tender, submitted by the Contractor.
- 4) General Conditions of Contract.
- 5) General Specifications, Common Specifications.
- 6) Detailed item specifications.
- 7) Drawing submitted with the tender in terms of clause 3.0 of the Tender Notice and subsequently revised / modified by Architect/Customers representative.
- 8) Contract Bills, including all modifications thereof incorporated before execution of the agreement.
- 9) Letter accompanying the tender, (if any).
- 10) Correspondences (if any) between the parties here to after submission of the tender till completion of work and the Owners' Letter of Acceptance of the tender.
- 11) Letter of Acceptance of the tender (or Work Order) issued to the Contractor by the Owner.
- 12) Further drawings and / or instructions issued by the Architect/Customers representative / Owner from time to time relating to the Works.
- 13) Samples, Shop Drawings and Progress Charts referred to in clause 12 and 13 herein below.

The Contract Document is complementary. What is called for in any one shall be as binding as if called for by all.

The original Contract Document shall remain in the custody of the Owner so as to be available at all reasonable times for the inspection of the Architect/Customers representative or of the Contractor. Immediately after the execution of the Contract Document, one copy of the Contract Document shall be supplied to the Contractor, without any charge.

As soon as is possible after the execution of this Contract, two copies of the Specifications, Drawings, descriptive Schedules or other such documents necessary for use in carrying out the Work shall be

supplied to the Contractor, without any charge. Provided that nothing contained in the said Specifications, Descriptive Schedules or other documents shall impose any obligations beyond those imposed by the contract document namely, the Contract Drawing, the Contract Bills, the Articles of Agreement and the General Conditions of Contract.

After the award of the Contract, the Contractor shall be supplied two copies of all such further drawings and details as may be prepared by the Architect/Customers representative / Owner from time to time as the work proceeds and as are reasonably necessary either to explain or amplify the contract drawings or to enable the contractor to carry out and complete the work in accordance with this general conditions of contract. These Drawings/ Documents will be provided to the Contractor without any charge.

At the Site of Work, the contractor shall keep one copy of the Specifications, Drawings, Descriptive Schedules or other such documents referred to in Clauses 2.4 and 2.5 above and written instructions referred to in clauses 8.0, 15.2 and 29.0 herein below so as to be available to the Architect/Customers representative / Owner or their representative/s at all reasonable times.

None of the documents mentioned here, shall be used by the Contractor for any purpose other than this Contract. Neither the Contractor nor any of his Sub-Contractor shall divulge or use any of the prices in the Contract Bills except for the purpose of this Contract.

Before the issue of Final Certificate under clause herein below, the Contractor, if so requested by the Architect/Customers representative, shall immediately return to the Architect/Customers representative all Drawings, Details, Specifications, Descriptive Schedules and other such documents that bear the Architect/Customers representative's name.

### **3. TYPE OF CONTRACT**

The Contract shall be an item rate Contract. The Contractor shall be paid for the actual quantity of work done, as measured at Site as per approved Contract Drawings at the accepted Contract Rates as provided in the Contract Bills.

### **4. SCHEDULE OF QUANTITIES**

The quantities given in the schedule of quantities are provisional and are meant to indicate the intent of the work and to provide a uniform basis for tendering. The Architect/Customers representative and / or the Owner, reserves the right to increase or decrease any of the quantities or to totally omit any item of work and the contractor shall not claim any extra or damages on these grounds.

The quality and quantity of work included in the Contract sum shall be deemed to be that which is set out in the Contract Bills which bills unless otherwise expressly stated in respect of any specified item, shall be deemed to have been prepared in accordance with the principles of the standard method of measurement of building works last before issued by the Indian Standard Institution but save as aforesaid nothing contained in the contract bills shall override, modify or affect in that which is contained in any of the clauses of this General Conditions of Contract.

Any error in description or in quantity or omission of items from the Contract Bills shall not vitiate this Contract but shall be treated as a 'Variation' under Clause 26.0 of the General Conditions of Contract.

## **5. CONTRACT DRAWINGS**

In general, the Drawings shall indicate dimensions, positions and type of construction, the Specifications shall indicate the qualities and the methods and the Bill of Quantities shall indicate the quantum and the rate for each item of work. Any work indicated on the drawings, but not mentioned in the specification or vice-versa shall be furnished as though fully set forth in both. Work not specifically detailed, called for, marked or specified shall be the same as similar parts that are detailed, marked or specified.

The Contractor's work shall not deviate from the Drawings and the Specifications. The Architect/Customers representative's interpretation of these documents shall be final and without appeal. Errors or inconsistencies discovered by the Contractor in the Drawings and Specifications shall be promptly brought to the attention of the Architect/Customers representative through the Clerk of Works for interpretation or correction. Local conditions, which may affect the work, shall likewise be brought to the Architect/Customers representatives' attention. If at any time, it is discovered that work is being done which is not in accordance with the Contract Drawings and Specifications, the Contractor shall correct the work immediately. The Contractor shall not carry on work except with the knowledge of the Clerk of Works.

Figured dimensions on the scale drawings and large size details shall take precedence over small scale drawings. Any work done before receipt of such details, if not in accordance with the same, shall be removed and replaced or adjusted by the Contractor at his own expense to the satisfaction of the Architect/Customers representative / Owner. This General condition shall apply with equal force to all the work including authorized extra works.

All Drawings, Bill of Quantities and Specifications, including copies thereof furnished to the Contractor are the property of the Architect/Customers representative. They shall not be used on any other work and shall be returned to the Architect/Customers representative and Owner on request upon completion or termination of the contract.

## **6. CONTRACT SUM**

The contract sum shall not be adjusted or altered in any way whatsoever other than in accordance with the express provisions of this General Conditions of Contract and subject to clause 5.2 above, any error (whether arithmetic or otherwise) in the computation of the Contract Sum shall be deemed to have been accepted by the parties hereto.

## **7. SCOPE AND INTENT**

### **Scope**

The general character and the scope of work is illustrated and defined by the signed Drawings, the Specifications and the Bill of Quantities attached herewith. If the Contractor finds any discrepancy in or divergence between the Contract Drawings, Specifications and / or the Contract Bills, he shall immediately

notify the Architect/Customers representative / Owner in writing specifying the discrepancy or divergence and the Architect/Customers representative / Owner shall issue instructions in this regard.

The Contractor shall carry out and complete the work in every respect in accordance with the Contract and with the directions of and to the reasonable satisfaction of the Architect/Customers representative / Owner. The Architect/Customers representative may, in his absolute discretion and from time to time issue further drawings, details and / or written instructions, written directions and written explanations all of which are collectively referred to as Architect/Customers representative's Instructions. All such drawings and instructions shall be consistent with Contract Document, true developments thereof and reasonably inferable there from.

#### **Intent**

This intension of the document is to include all labour and materials, equipment and transportation necessary for the proper execution of the work. Materials of work described in words, which so applied have a well-known technical or trade meaning, shall be held to refer to such recognized standard.

### **8. ARCHITECT/CUSTOMERS REPRESENTATIVES' INSTRUCTIONS**

The Contractor shall forthwith comply with and duly execute any such works comprised in such instructions issued to him by the Architect/Customers representative in regard to any matter for which the Architect/Customers representative is expressly empowered by these conditions to issue instructions. Provided always that verbal instructions, directions and explanations given to the Contractor (or his work representative) by the Architect/Customers representative shall be confirmed in writing, more particularly if involving any variation.

If within seven days after receipt of a written notice from the Architect/Customers representative, requiring compliance with an instruction the Contractor does not comply herewith, then the Owner may employ and pay other persons to execute any work whatsoever which may be necessary to give effect to such instructions and all cost incurred with such employment shall be recoverable from the Contractor by the Owner as a debt or may be deducted by him from any monies due or to become due to the Contractor under this Contract.

Upon receipt of the instruction issued to him by the Architect/Customers representative, the Contractor may request the Architect/Customers representative to specify in writing the provision of these conditions which empowers the issue of the said instruction. The Architect/Customers representative shall forthwith comply with any such request and if the contractor shall thereafter comply with the said instruction, then the issue of the same shall have been deemed for all purposes of this contract.

All instructions issued by the Architect/Customers representative shall be in writing with copy to the Owner. Any instruction issued orally shall be with immediate effect, but shall be confirmed in writing by the Contractor to the Architect/Customers representative within seven days and if not dissented from in writing by the Architect/Customers representative to the Contractor within seven days from receipt of the Contractors' confirmation, shall take effect as from the expiration of the latter said seven days.

Provided always

That if the Architect/Customers representative within seven days of giving such an oral instruction shall himself confirm the same in writing, the Contractor shall not be obliged to confirm as aforesaid and the said instruction shall take effect as from the date of the Architect/Customers representatives' confirmation.

That if neither the Contractor nor the Architect/Customers representative shall confirm such an oral instruction in the manner and the time aforesaid but the Contractor shall nevertheless comply with the same, then the Architect/Customers representative may confirm the same in writing at any time prior to the issue of the Final Certificate and the said instruction shall thereupon be deemed to have taken effect on the date on which it was issued.

The Clerk of Works shall maintain a register / memo book of all verbal instructions and changes issued at site.

## **9. FACILITIES AND CO-OPERATION**

In the case of works indicated on the Drawings but not included in the Contract, the Contractor shall provide necessary facilities and co-operation for any Sub-Contractor or supplier who may be approved by the Owner. The Contractor shall do all cutting, filling or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other Contractors shown upon or reasonably implied by the Drawings and Specifications for the completed structure and he shall make good all such cutting, filling or patching after completion of works of other Contractors as the Architect/Customers representative may direct. Any cost caused by the defectively or ill-timed work shall be borne by the party responsible. The Contractor shall not endanger any work by cutting, excavating or otherwise altering the work and shall not cut out or alter the work of any other Contractor save with the written and express Consent of the Owner / Architect/Customers representative.

## **10. POSSESSION**

The Contractor shall be allowed admittance to the site on the "Date of Commencement" stated in the Appendix hereto and he shall thereupon and forthwith begin the work and shall regularly proceed with and complete the same on or before the date of completion stated in the Appendix hereto subject nevertheless to the provision for extension of time hereinafter contained.

Any treasures, coins, objects of antiquity or any other objects of value which may be found at site shall be handed over to the Architect/Customers representative immediately.

## **11. SAMPLES AND SHOP DRAWINGS**

After the award of the Contract, the Contractor shall furnish to the Clerk of Works for the approval of the Owner / Architect/Customers representative with such promptness as to cause no delay in his work or in that of any other Sub-Contractor, samples and shop drawings required by the Specifications or by the Owner / Architect/Customers representative. Such samples shall be delivered free of cost.

The Architect/Customers representative shall check and approves such samples, with reasonable promptness only for conformity with the design concept of the works and for compliance with the

information in the Contract Documents. The work shall be carried out in accordance with the approved samples.

## **12. PROGRESS CHART**

The Contractor shall prepare progress charts and submit the same for approval of the Architect/Customers representative and for his record within ten days of the award of the Contract. The charts shall indicate the "Accepted dates" of commencement and completion of each of the items of the work and shall be in a form approved by the Architect/Customers representative. The charts shall also indicate the scheduling of samples, shop drawings and the approvals. The charts as approved by the Architect/Customers representative will form part of the Contract.

## **13. ACCESS FOR OWNER / ARCHITECT/CUSTOMERS REPRESENTATIVE TO THE WORK**

The Owner / Architect/Customers representative and their representatives shall have access to the works and the workshops or other place of the Contractor where work is being carried out for the Contract and when work is to be so prepared in workshops or other places of a Sub-Contractor (whether or not a nominated Sub-Contractor as defined in clause 32 herein below.) at all reasonable times. The Contractor shall have a term in the Sub-Contract so as to secure a similar right of access to those workshops or placed for the Owner / Architect/Customers representative and his representatives and shall do all things reasonably necessary to make the right effective.

## **14. ARCHITECT/CUSTOMERS REPRESENTATIVE'S STATUS AND DECISIONS**

The Architect/Customers representative shall be the Owners' representative during the construction period. The Architect/Customers representative shall periodically visit the site to familiarize himself generally with the progress and the quality of the work and to determine in general if the work is proceeding in accordance with the Contract Document. He shall not be required to make exhaustive or continuous on site inspection to check the quality or quantity of the work and he shall not be responsible for the Contractors' failure to carry out the construction work in accordance with the Contract Document. During such visits and on the basis of his observations while at the site he shall keep the Owner informed of the progress of the work, shall endeavor to guard the Owner against defects and deficiencies in the work of the Contractor and he shall condemn work which fails to conform to the Contract Document. Architect/Customers representative shall have authority to act on behalf of the Owner only to the extent expressly provided in the Contract Document or otherwise in writing which shall be shown to the Contractor. He shall have authority to stop the work, whenever such stoppage may be necessary in his reasonable opinion, to ensure the proper execution of the Contract. The Architect/Customers representative shall be in the first instance the interpreter of the conditions of this contract and the judge of its performance. He shall side neither with the Owner nor with the Contractor but shall use his powers under the Contract to enforce its faithful performance by both. In case of the termination of the appointment of the Architect/Customers representative, the Owner shall appoint a capable and reputable Architect/Customers representative against whom the Contractor shall make no reasonable objection and whose status under the Contract shall be that of the former Architect/Customers representative. Any dispute in connection with such appointment shall be subject to Arbitration.

### **Decision:**



The Architect/Customers representative shall within a reasonable time make decisions on all claims of the Owner or the Contractor and all other matters relating to the execution and progress of the work of the interpretation of the Contract Document. The Architect/Customers representative may in his absolute discretion and from time to time issue further drawings, details and / or written instructions, written directions and written explanations in regard to:

- Variation or modifications of the design.
- The quality or quantity of works or the additions or omissions or substitution of any work.
- Any discrepancy in or divergence between the drawings and / or specifications.
- The removal and / or re-examination of any works executed by the Contractor.
- The dismissal from the works of any persons employed thereon.
- The opening up for inspection of any work covered up.
- The amending and making good of any defects under defects liability period.
- The removal from the site of any material therefore.
- Assignment and sub letting.
- Delay and extension time.
- The postponement of any work to be executed under the provision of this Contract.

### **Dismissal**

The Contractor shall on the request of the Owner / Architect/Customers representative immediately dismiss from the works any person employed thereof by him who may in the opinion of the Owner / Architect/Customers representatives be incompetent or misconducts himself and such person shall not be again employed on the work without the permission of the Owner / Architect/Customers representative.

### **15. CLERK OF WORKS**

The Contractor shall afford the Clerk of Works every facility and assistance for inspecting the works and materials and for checking and measuring time and materials. Neither Clerk of Works nor any representative of the Architect/Customers representative shall have power to set out works or to revoke, alter, enlarge or relax any requirements of the Contract or to sanction any day work, additions, alterations, deviations or omissions, or any extra work whatever except in so far as such authority may be specifically conferred by a written order of the Architect/Customers representative / Owner.

The Clerk of Works or any representative of the Architect/Customers representative shall have power to give notice to the Contractor or to his representative of non approval of any work or materials and such work shall be suspended or the use of such materials shall be discontinued until the decision of the Architect/Customers representative is obtained. The works will from time to time be examined by the Architect/Customers representative and the Clerk of Works or the Architect/Customers representative's representative but such examination shall not in any way exonerate the Contractor from the obligation to remedy any defects which may be found to exist at any stage of the works or after same is completed. Subject to the limitations of this clause the Contractor shall take instructions only from the Architect/Customers representative / Owner.

## **16. CONTRACTORS' FIELD ORGANIZATION AND EQUIPMENT**

The Contractor shall constantly keep on his work during its progress one qualified and competent Works Manager acceptable to the Owner / Architect/Customers representative (assisted by a team of Architect/Customers representatives, Supervisors and Technicians) who will be responsible for the carrying out of the works to the true meaning of Drawings, Specifications, Schedule of Quantities and Architect/Customers representative's instructions and directions, to the satisfaction of the Owner / Architect/Customers representative. Any directions or instructions given to him (or to his assistants) by the Owner / Architect/Customers representative shall be deemed to have been issued to the Contractor. Attention of the Contractor is called to the importance of requesting instructions from the Architect/Customers representative before undertaking any work where Architect/Customers representatives' directions of instructions are required. Any such work done in advance of such instructions will be liable to be removed, at no extra cost to the Owner/Architect/Customers representative.

### **Equipment:**

The contractor shall provide and install all necessary barricades, hoists, ladders, staging, scaffoldings, tools, tackles, plants, instruments, equipment etc and all transport for labour, materials and plant necessary for the proper carrying on execution, completion and maintenance of the work to the satisfaction of the Architect/Customers representative / Owner.

### **Security:**

The Contractor shall make his own security arrangements to guard the site and works at all times, at his own expense. The security arrangements shall be adequate to maintain strict control on the movement of material and labour. The Contractor shall extend the security arrangements to guard the materials stores and / or fixed on the premises by the Sub-Contractors.

### **Storage of Materials:**

The contractor shall provide, erect, maintain and remove after completion of the works, proper temporary sheds for the storage and protection of the materials etc. and also for the execution of work which may be prepared on the site.

### **Sanitary Conveniences:**

The contractor shall provide and erect all necessary temporary sanitary convenience for the site staff and the workmen and maintain it in a clean orderly condition, clear away and deodorize the ground after removal.

### **Scaffolding, Staging, Guard Rails etc.:**

The contractor shall provide all necessary temporary scaffoldings, staging, platforms, guardrails, stairs etc (with sufficiently strong and adequate supports suitable for particular situations) which shall be required during constructions. The temporary access to the various parts of the works shall be rigid and strong enough to avoid chance of mishaps. The arrangement proposed shall be subject to the approval of the

Owner / Architect/Customers representative. (Contractor shall use MS pipe / Acro material. Bamboos will not be accepted as scaffolding material.)

#### **17. Rates:**

The contractor shall quote individual item rates separately as basic price, excise duty, sales tax (VAT or CST), works contracts/service tax .All taxes and duties to be as applicable.

#### **18. STATUTORY OBLIGATIONS, NOTICES, FEES AND CHARGES**

The Contractor shall comply with and give all notices required by any Government Authority and instrument, rule or order made under any Act of Parliament or any regulation or bye-law of any local authority relating to the work or with whose system the same is or will be connected. The Contractor, before making any variation from the Contract Drawings or Contract Bills necessitated by such compliance, shall give to the Owner / Architect/Customers representative a written notice specifying and giving reasons for such variations and the Owner / Architect/Customers representative may issue instructions in regard thereto. If, within ten days of having given the said written notice, the Contractor does not receive any instruction in regard to the matters therein specified, he shall proceed with the work conforming to the Act of Parliament, instrument, rule, order, regulations or bye-law in question and any variation thereby necessitated shall deemed to be a variation required by the Owner / Architect/Customers representative.

The contractor shall pay and indemnify the Owner against liability in respect of any fees or charges (including any rates and taxes) legally demandable under any Act of Parliament, instrument, rule or order or any regulation or bye-law or any local authority in respect of the work.

#### **19. ROYALTIES AND PATENT RIGHTS**

All royalties or other sums payable in respect of the supply and use in carrying out the work as desired by or referred to in the Contract Bills of any patented articles, process or inventions shall be deemed to have been included in the Contract Sum and the Contractor shall indemnify the owner from and against all claims, proceedings, damages, costs and expenses which may be brought or made against the owner or to which he may be put by reason of the contractor infringing or being held to have infringed any patent rights in relation to any such articles, processes and inventions.

#### **20. ASSIGNMENT OR SUB-LETTING**

The contractor shall not assign or sub-let any part of this contract without the written consent of the Owner / Architect/Customers representative. Such consent shall not be unreasonably withheld by Owner / Architect/Customers representative to the prejudice of the Contractor.

#### **21. SUB CONTRACTOR**

Before awarding any Sub-Contract, the Contractor shall notify the Owner / Architect/Customers representative in writing the names of the sub contractors proposed for the principal parts of the work

and for such other parts as the Architect/Customers representative may direct. Contractor shall not employ any sub-contractor to whom the Owner / Architect/Customers representative may have reasonable objection. The Owner / Architect/Customers representative, however, shall have power to obtain estimate and select other agencies to carry out any of the work as described below:

All specialists, merchants, tradesmen and others executing any works or supplying and fixing any goods who may be nominated or selected by the Owner / Architect/Customers representative shall be deemed to be sub contractors employed by the contractor and are to be referred as nominated sub contractors. No nominated Sub-Contractor shall be employed on or in connection with the work against whom the contractor shall make reasonable objection or (save where the owner / Architect/Customers representative and contractor shall otherwise agree) who will not enter into a contract providing :-

That the nominated Sub-Contractor shall carry out and complete the sub contract works in every respect to the reasonable satisfaction of the Contractor and of the Owner / Architect/Customers representative and in conformity with all the reasonable directions and requirements of the Contractor.

That the nominated Sub-Contractor shall observe, perform and comply with all the provisions of this contract on the part of the Contractor to be observed performed and complied with (other than clause 43 herein below) so far as they relate and apply to the sub-contract works or to any portion of the same.

That the nominated Sub-Contractor shall indemnify the Contractor against the same liabilities in respect of the sub contract as those for which the Contractor is liable to indemnify the Architect/Customers representative under this Contract.

That the nominated Sub-Contractor shall indemnify the Contractor against claims in respect of any negligence, omission or default of such Sub-Contractor, his servants or agents or any misuse by him or them of any scaffolding or other plant and shall insure himself against any such claims and produce the policy or policies and premium receipts as and when required by the Contractor or Architect/Customers representative.

The payment in respect of any work, materials or good comprised in the Sub-Contract shall be made within fourteen days after receipt by the contractor of the Architect/Customers representative's certificate under clause 26 herein below which states as due an amount calculated by including the total value of such work, materials or goods and shall when due be subject to the retention by the contractor of the sums mentioned in clause 21.1.7 herein below.

That the sub-contract work shall be completed within the period or (where they are to be completed in sections) periods therein specified, that the Contractor shall not without the written consent of the Owner / Architect/Customers representative grant any extension of time for the completion of the Sub-Contractors' work or any section thereof and that the Contractor shall inform the Owner / Architect/Customers representative of any representation made by the nominated Sub-Contractor as to the cause of any delay in the progress of completion of the sub contract work or of any section thereof.

That the Architect/Customers representative shall retain from the sum directed by the Architect/Customers representative having been included in the calculation of the amount as due in any certificate issued under clause 26 herein below in respect of the total value of work, materials or goods

executed or supplied by the nominated sub contractor the percentage of such value named in the Appendix hereto as 'Retention Percentage' up to a total amount not exceeding a sum which bears the same ratio to the sub-contract price as the unreduced sum named in the appendix hereto as 'Limit of Retention Fund' bears to the contract sum, and that the Contractors' interest in any sums so retained (by whomsoever held) shall be fiduciary as trustee for the nominated Sub-Contractor (but without obligation to invest); that the nominated Sub- Contractors' beneficial interest in such sums shall be subject only to the right of the Contractor to have recourse thereto from time to time for payment of any amount which he is entitled under the Sub-Contract to deduct from any sum due or to become due to the nominated Sub-Contractor, they shall be paid in full if paid within fourteen days of the date fixed for their release in the Sub-Contract.

Before using any certificate, the Architect/Customers representative may request the Contractor to furnish to him reasonable proof that all amounts included in the calculation of the amount stated as due on previous certificates in respect of the total value of work materials or goods executed or supplied by any nominated Sub-Contractor have been duly discharged and if the Contractor fails to comply with request, the Architect/Customers representative shall issue a certificate to that effect and thereupon the Owner may himself pay such amount to any nominated Sub-Contractor concerned and deduct the same from any sums due or to become due to the Contractor.

Neither the existence nor the exercise of the foregoing powers nor anything else contained in this General Conditions of Contract shall render the owner in any way liable to any nominated Sub-Contractor.

Where the Contractor in the ordinary course of his business directly carried out works for which Prime Cost or Provisional Sums are included in the Contract Bills and the Owner / Architect/Customers representative is prepared to receive tenders from other Contractor for such items, then the Contractor shall be permitted to tender for the same or any of the items without prejudice to the Architect/Customers representatives' right to reject the lowest or any tender. If the Contractors' tender is accepted he shall not sublet the work without the written consent of the Owner / Architect/Customers representative.

It shall be a condition of any tender accepted under Clause 21.4 above the clause 25 herein below shall apply in respect of the item work included in the tender as if for the reference therein to the Contract Drawings and the Contract Bills there were references to the equivalent documents included in or referred to in the Tender.

The Contractor shall allow for general attendance upon Sub-Contractors including free use of plant, scaffolding etc and is to allow them the use of sanitary conveniences, facilities for storing materials, other amenities and affording them all reasonable facilities for carrying out their contracts.

## **22. PRIME COST**

Such sums shall be understood to mean the net cost to be defrayed as Prime Cost after deducting any trade or other discount and shall include Sales Tax (where applicable) and other taxes, duties, levies and the cost of packing, carriage and delivery. Provided that where in the opinion of the Architect/Customers representative the Contractor has incurred expenses for special packing or special carriage, such special expenses shall be allowed as part of the sums actually paid by the Contractor.

Such sums shall be expended in favor of such persons as the Architect/Customers representative shall instruct and all specialists, merchants, tradesmen or others who are nominated by the Architect/Customers representative to supply materials or goods are hereby declared to be suppliers to the Contractor and are referred to in this General Conditions of Contract as "Nominated Suppliers" provided that the Architect/Customers representative shall not (save where the Architect/Customers representative and Contractor otherwise agree) nominate as a supplier a person who will not enter into a contract of sale which provided (inter alia):

That the materials or goods to be supplied shall be to the reasonable satisfaction of the Owner / Architect / Customers representative.

That the nominated supplier shall make good by replacement or otherwise any defects in the materials or goods supplied which appear within such period as is therein mentioned and shall not bear any expenses reasonably incurred by the Contractor as a direct consequence of such defects, provided that:

Where the materials or goods have been used or fixed such defects are not such that examination by the Contractor sought to have revealed them before using or fixing. Such defects are due solely to defective workmanship or material in the goods supplied and shall not have been caused by improper storage by the Contractor or misuse or by any act or neglect of either the Contractor, the Owner / Architect/Customers representative.

### **23. ARTISTS AND TRADESMEN**

The Contractor shall permit the execution of work not forming part of this contract by artists, tradesmen or others engaged by the Architect/Customers representative. Every such person shall for the purpose of clause 40 herein below be deemed to be a person for whom the owner is responsible and not be a Sub-Contractor.

### **24. SEPARATE CONTRACTS**

The Owner reserves the right to let other Contractors in connection with his work under similar general conditions. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and execution of their work and shall properly connect and co-ordinate his work with theirs. If any part of the Contractors' or Sub-Contractor's work depends for proper execution or results upon the work of any other Contractor or Sub-Contractor, the Contractor shall inspect and promptly report to the Architect/Customers representative any defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the other Contractors' works as fit and proper for the reception of his work, except as to defects which may develop in the other Contractors' or Sub-Contractor's work. After the execution of his subsequent work the Contractor shall measure work already in place and shall at once report to the Architect/Customers representative / Owner of any discrepancy between the executed work and the Drawings.

## **25. VARIATIONS, PROVISIONAL AND PRIME COST SUMS**

Where work cannot properly be measured and valued, the Contractor shall be allowed day work rates on the prices prevailing when such work is carried out (unless otherwise provided in the Contract Bills)

At the rates if any, inserted by the Contractor in the Contract Bills or when no such rates have been inserted, at the rates prevailing in the market for material and labour and at the control rates for the controlled materials including in all cases the rate for delivery of the material at the work.

Provided that in any case voucher specifying the time daily spent upon the work (and the workmen's names, if required by the Clerk of Works) and the materials employed shall be delivered for verification to the Architect/Customers representative or his authorized representative not later than the end of the week following that in which the work has been executed.

Effect shall be given to the measurement and valuation of Variations in Interim Certificates and by adjustment of the Contract Sum, and effect shall be given to the measurement and valuation of work for which a provisional sum is included in the Contract Bills under the said clause in Interim Certificate and by adjustment of the Contract Sum in accordance with clause 26 herein below.

## **26. CERTIFICATES AND PAYMENT**

At the 'Period of Interim Certificate' named in the Appendix hereto, the Architect/Customers representative shall issue a certificate stating the amount due to the Contractor from the Owner and the Contractor be entitled to payment therefore within the 'Period of Honoring Certificates' named in the appendix hereto. Interim Certificates shall be made by the Architect/Customers representative not more than once a month based on the 'quantities' certified by the Clerk of Work against Running Bills presented (in quadruplicate) by the Contractor.

The amount stated as due in an 'Interim Certificate' shall subject to any agreement between the parties as to stage payments, be the total value of the work properly executed and of the materials and goods (for materials as per clause 32 of Notice Inviting Tenders) delivered to or adjacent to the work for use thereon up to and including a date not more than seven days before the date of said certificates less any amount the Owner is bound to make statutory deduction towards income tax (TDS) etc. less any amount which shall be retained by the owner (as provided in clause 26.3 herein below) and less any installments previously paid under these conditions, provided that the value of the unfixed materials and goods as agreed upon included in such certificate shall only be up to (75%) of the value of the unfixed materials and goods as and from such time as they are reasonably, properly and not prematurely brought to or placed adjacent to the work and then only if adequately protected against weather or other casualties.

The amounts retained by virtue of clause 26.2 above shall be subject to the following rules:

26.3.1 The Owners' interest in any amounts so retained shall be fiduciary as Trustee for the Contractor (but without obligation to invest) and the Contractors' beneficial interest therein shall be subject only to the right of the Architect/Customers representative to have recourse thereto from time to time for



payment of any amount which he is entitled under the provisions of this contract to deduct from any sum due or to become due to the Contractor.

26.3.2 On the issue of the Certificate of virtual completion, the Architect/Customers representative shall issue an Interim Certificate for one month of total amounts then so retained and the Contractor shall be entitled to payment of the said money within the 'Period of Honoring Certificate' named in the appendix hereto.

The measurement and valuation of the work shall be completed within the 'Period of Final Measurement and Valuation' stated in the appendix hereto and the Contractor shall be supplied with a copy of the priced 'Bills of Variation' not later than the end of said period and before the issue of the Final Certificate under clause 26.7 herein below.

Either before or within a reasonable time after Virtual Completion of the work, the Contractor shall send to the Architect/Customers representative all documents necessary for the purposes of the computations required by these conditions including all documents relating to the accounts of nominated Sub-Contractors and Nominated Suppliers.

So soon as is practicable but before the expiration of the 'Period for issue of Final Certificate' stated in the appendix hereto or from completion of making good defects under clause 37 herein below or from receipt by the Architect/Customers representatives of the documents referred to in clause 26.5 above whichever is the latest, the Architect/Customers representative shall issue the Final Certificate. The Final Certificate shall state:

The sum of the amount paid to the Contractor under Interim Certificates and the amount named in the said appendix as limit of Retention Fund and

The Contract Sum adjusted as necessary in accordance with the terms of this General Conditions of Contract and the difference (if any) between the two sums shall be expressed in the said Certificate as a balance due to the Contractor from the Owner or to the Owner from the Contractor as the case may be and subject to any deductions authorized by this General Conditions of Contract, the said balance shall as from the fourteenth day after the issue of the said Certificate be a debt payable as the case may be by the Owner to the Contractor or by the Contractor to the Owner.

Unless a written request to concur in the appointment of an Arbitrator shall have been given under clause 50 herein below by either party before the Final Certificate has been issued or by the Contractor within twenty eight days after such issue, the said Certificate shall be conclusive evidence in any proceedings arising out of this Contract (whether by arbitration under clause 50 herein below or otherwise) that the works have been properly carried out and completed in accordance with the terms of this contract which require an adjustment to be made to the contract sum, except and in so far as any sum mentioned in the said certificate is erroneous by reason of :

26.7.1 Fraud, dishonesty or fraudulent concealment relating to the works, or any part thereof, or to any matter dealt with in the said certificate, or



26.7.2. Any defect (including any omission) in the works, or any part thereto which reasonable inspection or examination at any reasonable time during the carrying out of the Works or before the issue of the said Certificate would not have disclosed; or

26.7.3. Any accidental inclusion or exclusion of any work, materials, goods or figures in any computation or any arithmetical error in any computation.

Save as aforesaid no certificates of the Architect/Customers representative shall of itself be conclusive evidence that any works materials or goods to which it relates are in accordance with this contract.

The Contractor, before settlement of payment against Final Bill, shall sign and deliver to the Owner, either in the measurement books or otherwise, as may be required a valid release and discharge from any and all claims and demands whatsoever from the Owner for all matters arising out of this contract, except in respect of Defects Liability under clause 37.

## **27. CLAIM FOR EXTRA**

When any instruction or decision given at site involves an extra or whereby the Contractor may plan to claim an extra, it shall be the responsibility of the Contractor to inform the Owner / Architect/Customers representative of the extra amount and get written authorization from the Owner / Architect/Customers representative before proceeding with the work involved.

Any modification carried out for expediting or simplifying work at the request of the Contractor or his representatives shall not be taken as the basis for claiming an extra. However, if such modification shall also involve an extra, the rate for such modification shall be settled in advance and written authorization obtained by the Contractor from the Owner / Architect/Customers representative before proceeding with the work involved. If no such information is given by the Contractor in writing to the Owner / Architect/Customers representative, such modification shall not be accepted as the basis for extra charge.

## **28. DEDUCTION FOR UNCORRECTED WORK**

If the Architect/Customers representative deems it inexpedient to correct work damaged or not done in accordance with the contract, an equitable deduction from the Contract Sum as may be decided by the Architect/Customers representative shall be made.

## **29. FLUCTUATIONS**

The prices shall be firm and not subject to any changes and will be free from any variation till the actual completion of the project.

## **30. UNFIXED GOODS AND MATERIALS**

Unfixed materials and goods intended for, delivered to and placed on or adjacent to the work shall not be removed except for use upon the work unless the Architect/Customers representative / Owner has consented in writing to such removal. Such consent shall not be unreasonably withheld by Owner /

Architect/Customers representative. Where the value of any such materials or goods has in accordance with clause 26.2 above been considered for payment of an advance to the Contractor, such materials and goods shall become the property of the Architect/Customers representative, but subject to clause 42.2 herein below, the Contractor shall remain responsible for loss or damage to the same.

### **31. MATERIAL AND WORKMANSHIP**

All materials and workmanship unless otherwise specified shall be as per the relevant code of IS specifications and other applicable codes and of approved type and the Contractor shall immediately remove from the work any material and / or workmanship which in the opinion of the Architect / Customers representatives are defective or unsuitable and shall substitute proper materials and / or workmanship at his own cost. The term approval used in connection with this contract shall mean the approval of the Owner / Architect/Customers representatives.

The Contractor shall submit satisfactory evidence as to the kind and quality of material if required.

Where special makes or brands are called for they are mentioned as standard. Others of equal quality may be used provided approval is first obtained in writing from the Owner / Architect/Customers representatives. Unless substitutions are requested, no deviation from the specifications will be permitted. Failure to propose the substitution of any article within thirty days after the award of the Contract will be deemed sufficient cause for denial of the request for substitution.

The Contractor shall indicate and submit evidence in writing of those materials or articles called for in the Specification that are not obtainable for installation in the work within the time limits of the Contract. Failure to indicate the above, within thirty days after the award of the Contract, will be deemed sufficient cause for the denial of request for the extension of the Contract time.

All materials shall be delivered so as to ensure speedy and uninterrupted progress of the work. Such material shall be stored so as to cause no obstruction and so as to prevent overloading of any portion of the structure and the Contractor shall be entirely responsible for damage or loss by weather or other causes.

Within thirty days after the award of the contract the Contractor shall submit for approval of the Owner / Architect/Customers representatives a complete list of all materials he and his Sub-Contractors propose to use in the work of definite brand or make which differ in any respect from those specified, also the particular brand of any article where more than one is specified as a standard. He shall also list item not specifically mentioned in the specification but which are reasonably inferred and necessary for the completion of work.

#### **Inspection**

All materials and workmanship shall be subject to inspection, examination and test by the Owner / Architect/Customers representatives and or / any inspecting authority of the Owner at any and all times during and / or after manufacture and / or construction. The Owner / Architect/Customers representatives and or any inspecting authority of the owner shall have the right to reject defective

material and workmanship or require its correction. Rejected workmanship shall be satisfactorily replaced with proper material without additional charge and the Contractor shall promptly segregate and remove the rejected material from the works. If the Contractor fails to proceed at once with the replacement of rejected materials and / or the correction of the defective workmanship, the Owner shall get such work carried out on his own and charge the cost thereof to the Contractor, or may terminate the right of the Contractor to proceed further with the work.

The Contractor shall furnish promptly without additional charge all reasonable facilities, labour and materials necessary for the safe and convenient inspection and test that may be required by the Owner / Architect/Customers representatives and / or the inspecting authority of the owner. Stage-wise review of progress / expediting at Vendors' / Sub-Vendors' works shall be carried out by Purchaser / Purchaser's authorized representatives during the period of manufacture of these equipment.

### **32. DEFECTS**

The Contractor shall make good at his own cost and the satisfaction of the Architect/Customers representatives, all defects, shrinkages, settlements or other faults arising in the opinion of the Architect/Customers representatives from the work of materials not being in accordance with the drawings or specifications or schedule of quantities or the instructions of the Owner / Architect/Customers representative, which may appear within "Defects Liability Period" referred to in the appendix hereto shall be specified and can be amended and made good by the Contractor at his own cost unless the Owner shall decide that the amount to be paid for such amending and making good and in case of default if the incidental thereto shall be made good and borne by the Contractor and such damage, loss or expense shall be recoverable from him by the Owner or may be deducted by the Owner upon the Architect/Customers representatives' certificate in writing from any moneys due to the Contractor a sum to be determined by the Architect/Customers representatives as equivalent to the cost of amending such work and in the event of the 'Retention Amount' being insufficient, the bank guarantee submitted in lieu of cash retention will be encashed, if this amount is also insufficient, recover the balance from the Contractor together with any expenses the Owner may have incurred in connection therewith.

### **33. POSSESSION OF SITE, COMPLETION, AND POSTPONEMENT**

On the "Date of Commencement" stated in the appendix hereto possession of the Site shall be given to the Contractor who shall thereupon begin the works and regularly and diligently proceed with the same and who shall complete the same on or before the "Date of Completion" stated in the appendix hereto subject nevertheless to the provisions for extension of time contained.

The Owner / Architect/Customers representatives may issue instructions in regard to the postponement of any work to be executed under the provisions of this Contract.

If at any time or times before Virtual Completion of the work, the Owner with the consent of the Contractor shall take possession of any part or parts of the same for his own use and / or for handing over to any other Contractor agency for carrying out, his work referred or implied elsewhere in the contract.

Such part or parts shall not be deemed to be virtually complete.

Virtual completion of such part or parts would occur on the completion of the last element of work in such part or parts under this contract.

The Contractor shall not claim that such part or parts are complete and request refund of payments in lieu thereof.

### **34. EXTENSION**

Upon it becoming reasonably apparent that the progress of the work is delayed, the Contractor shall forthwith (within a maximum period of seven days) give written notice of the cause of the delay to the Owner / Architect / Customers representatives and if, in the opinion of the Architect / Customers representative, the completion of the work is likely to be or has been delayed beyond the "Date of completion" stated in the Appendix hereto or beyond any extended time previously fixed under this clause.

By force majeure, or

By reason of any exceptionally inclement weather, or

By reason of loss or damage occasioned by any one or more of the contingencies referred to in clause 42.0 herein below or

By reason of civil commotion, local combination of workmen strike or lockout affecting any of the trades employed upon the works or any of the traders engaged in the preparation manufacture or transportation or any of the goods or materials required for the work, or

By reason of Architect/Customers representative's / and or the Owner's instructions issued under clauses 24.0, 25.1 and / or 33.2 above or

By reason of the Contractor not having receiving in due time necessary instructions, drawings, details or levels from the Owner / Architect/Customers representative for which he specifically applied in writing on a date which having regard to the date of completion stated in the appendix hereto or to any extension of time then fixed under clause 35.1 herein was neither unreasonably distant from nor unreasonably close to the date on which it was necessary for him to receive the same, or

By delay on the part of nominated Sub-Contractors or nominated suppliers which the Contractor has taken all practicable to avoid or reduce, or

By delay on the part of artists, tradesmen or others engaged by the Owner in executing work not forming part of this contract, or

By reason of the opening up for inspection of any work covered up or of the testing of any of the works, materials or goods in accordance with clause 31.7 above (including making good in consequence of such opening up or testing) unless the inspection of test showed that the work materials or goods were not in accordance with this Contract, or

By reason of the Contractors' inability for reason beyond his control and which he could not reasonably have foreseen at the date of this Contract to secure such labour, goods or materials as are essential to the proper carrying out works, then the Architect/Customers representative shall so soon as he is able to estimate the length of the delay beyond the date or time aforesaid make in writing a fair and reasonable extension of time for completion of works, provided always that the contractor shall use constantly his best endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Owner / Architect/Customers representative to proceed with the work.

The Contractor will forfeit his claim for extension if he does not report the cause of the delay in completion date within seven days of the date of occurrence.

### **35. DAMAGES FOR NON COMPLETION**

If the Contractor fails to complete the work by the 'Date of Completion' stated in the appendix hereto or within any extended time fixed under relevant clause of this General Conditions of Contract, the Owner certifies in writing that in his opinion the works ought to have been completed, the Contractor shall pay or allow to the Owner a sum calculated at the rate stated in the appendix hereto as 'Liquidated Damages' for the period during which the said work shall so remain or have remained incomplete and the Owner may deduct such damages from any monies otherwise payable to the Contractor under this contract.

### **36. VIRTUAL COMPLETION AND DEFECTS LIABILITY PERIOD**

As soon as the works are virtually complete, the Contractor shall inform the fact to the Architect/Customers representative / Owner and if in the opinion of the Architect/Customers representative the works are practically completed, he shall forthwith issue a certificate to that effect and Virtual Completion of the Work shall be deemed for all the purpose of this contract to have taken place on the day named in such certificate.

Any defects shrinkages or other faults which shall appear within the Defects Liability Period stated in the Appendix hereto and which are due to materials and workmanship not in accordance with this contract shall be specified by the Architect/Customers representative in a "Schedule of Defects" which he shall deliver to the Contractor not later than fourteen days after the expiration of the said Defects Liability Period and within a reasonable time after receipt of such "Schedule of Defects" the defects, shrinkages and other faults therein specified shall be made good by the Contractor and (unless the Architect/Customers representative shall otherwise instruct in which case the Contract Sum shall be adjusted accordingly) entirely at his own cost.

Notwithstanding Clause 36.2 above, the Owner / Architect/Customers representative may whenever he considers it necessary to do so, issue instructions requiring any defects, shrinkages, or other fault which shall appear within the Defects Liability Period named in the Appendix hereto and which is due to materials and workmanship not in accordance with this contract to made good and the Contractor shall within a reasonable time (which shall be specified in such instructions of the Owner / Architect / Customers representative) after receipt of such instructions comply with the same (and unless the Owner / Architect / Customers representative shall otherwise instruct in which case the Contract Sum shall be adjusted accordingly) entirely at his own cost. Provided that, no such instruction shall be issued after fourteen days from the expiry of the said Defects Liability Period.

When in the opinion of the Architect/Customers representative any defects, shrinkages or other faults which he may have required to be made good under clauses 36.2 and 36.3 above shall have been made good he shall issue a certificate to that effect and completion of making good such defects, shrinkages or other faults shall be deemed for all the purposes of this contract to have taken place on the day named in such certificate.

In no case shall the Contractor be required to make good at his own cost any damages which took place before Virtual Completion of the works.

### **37. LOSS AND EXPENSE CAUSED BY DISTURBANCE OF REGULAR PROGRESS OF THE WORK**

If upon written application being made to him by the Contractor, the Owner / Architect/Customers representative is of the opinion that the Contractor has been involved in direct loss and / or expenses for which he would not be reimbursed by a payment made under other provision in this contract by reason of the regular progress of the works or of any part thereof having been materially affected by:

37.1.1 The Contractor not having receiving in due time necessary instructions, drawings, details of levels from the Architect/Customers representative for which he specially applied in writing on a date which having regard to the "Date of Completion" stated in the appendix hereto was neither unreasonably distant from nor unreasonably close to the date on which it was necessary for him to receive the same or,

37.1.2 The opening up for inspection of any work covered up or the testing of any work material or goods in accordance with relevant clause stated above (including making good in consequence of such opening up or testing) unless the inspection or test showed that the work materials or goods were not in accordance with this contract or,

37.1.3 Any discrepancy or divergence between the contract drawings, and / or the contract bills, or

Delay on the part of the artists, tradesmen or others engaged by the Architect/Customers representative in executing work not forming part of this contract, or

Architect/Customers representative's instructions issued in regard to the postponement of any work to be executed under the provisions of this contract and if the written application is made within a reasonable time of it becoming apparent that the progress of the work or of any part thereof has been affected as aforesaid :

Then the Architect/Customers representative shall ascertain the amount of such loss and/or expense. Any amount from time to time so ascertained shall be added to the amount which would otherwise be stated as due in such certificate.

The provisions of clause 37.1 above are without prejudice to any other rights and remedies which the Contractor may possess.

### **38. PAYMENT WITHHELD**

38.1 The Architect/Customers representatives may withhold or on account of subsequently discovered evidence nullify the whole or a part of any certificate to such extent as may be necessary in his reasonable opinion to protect the Owner from loss on account of:

Defective work not remedied.

Failure of the Contractor to make payments properly to Sub-Contractor or for materials or labour.

A reasonable doubt that the contract can be completed for the balance then unpaid.

Damage to another Contractor or Sub-Contractor.

Claims filed on reasonable evidence indicating probable filing of claims.

38.2 When the above grounds are removed, payment shall be made for amount/s withheld because of them.

### **39. INJURY TO PERSONS AND PROPERTY OF ARCHITECT/CUSTOMERS REPRESENTATIVE**

39.1 The Contractor shall be liable for and shall indemnify the Owner against any liability, loss, claim or proceedings whatsoever arising under any statute or at common law in respect of personal injury to or the death of any person whomsoever arising out of the works, unless due to any act or neglect of the Owner or of any person for whom the Architect/Customers representative is responsible.

39.2 The Contractor shall be liable for and shall indemnify the Owner against and liability, loss, claim or proceedings in respect of any injury to or damage whatsoever to any property real or personal in so far as such injury or damage arises out of or by reason of the carrying out of the works and provided always that the same is due to any negligence, omission or default of the Contractor, his servants or agents of any Sub-Contractor, his servant or agent.

### **40. INSURANCE AGAINST INJURY TO PERSONS AND PROPERTY**

Without prejudice to his liability to indemnify the Owner under clause 39 above, the Contractor shall take all the insurance (car policy with third party liability and workmen's compensation policy.) at his cost in the joint names of the Contractor and Owner and maintain until virtual completion of the works.

40.1.1. Such insurances as are necessary to cover the liability of the Contractor or as the case may be of such Sub-Contractor in respect of personal injuries or deaths arising out of or in the course of or caused by the carrying out of the work; and

40.1.2 Such insurances as may be specifically required by the Contract Bills in respect of injury or damage to any property real or personal at site arising out of or in the course of or by any negligence, omission or default of the contractor, his servants or agents. The cost of all materials supplied by the owner shall be covered in the insurance policy.

The Contractor shall produce or cause any Sub-Contractor to produce for inspection the relevant policy or policies of insurance together with the receipts in respect of premiums paid under such policy or policies as and when required so to do by the Owner / Architect/Customers representative provided always that as and when may be reasonably required by the Owner / Architect/Customers representatives the production by either the Contractor or any Sub-Contractor or a current certificate of insurance from the company of firm which shall have issued the policy or policies aforesaid shall be a good discharge of the Contractors' obligation to produce or to cause the production of the policy or policies and the receipt in respect of premium paid.



Should the Contractor or any Sub-Contractor make default in insuring or in continuing to insure as provided in clauses 40.1 and 40.2 above or does not take the insurance policies, the Owner shall himself insure against any risk with respect to which the default shall have occurred and may deduct a sum equivalent to the amount paid in respect of the premium from any monies due to or become due to the Contractor.

#### **41. INSURANCE OF THE WORKS AGAINST FIRE ETC.**

The Contractor at his cost shall in joint names of the Owner and Contractor insure against loss or damage by fire, storm, lighting, flood, earthquake, aircraft or anything dropped their from, aerial objects, riot and civil commotion for the full value thereof all works executed and all unfixed materials and goods intended for, delivered to and placed on or adjacent to the work, including the cost of all materials supplied by the Owner for the work which is in the custody of the Contractor, but excluding temporary building plant, tools and equipment owned or hired by the Contractor or any Sub-Contractor and shall keep such work materials and goods so incurred until virtual completion of the work. Such insurances shall be with insures approved by the Owner / Architect/Customers representative and the Contractor shall deposit with the Owner / Architect/Customers representative the policy or policies and the receipts in respect of insuring or continuing to insure as aforesaid the Owner may himself insure against any risk with respect of which the default shall have occurred and deduct a sum equivalent to the amount paid by him in respect of premium from any monies due to or to become due to the Contractor. Provided always that if the Contractor shall independently of his obligations under this contract intern a policy of insurance which covers (inter alia) the said work, materials, and goods against the aforesaid contingencies to the full value thereof then the maintenance by the Contractor of such policy shall if the Owners' interest is endorsed thereon, be a discharge of the Contractors' obligation to insure in the joint names of the Owner and the production by the Contractor as and when may reasonably be required by the Owner / Architect/Customers representative of a current certificate of insurance from the company or firm which shall have issued the said policy shall be discharge of the Contractor's obligation to deposit with the Owner / Architect/Customers representative a policy or policies and the receipts in respect of premium paid.

Upon settlement of any claim by the insurance companies under the insurance aforesaid, the Contractor with due diligence shall restore work damaged, replace or repair unfixed materials or goods which have been destroyed or injure, remove or dispose off any debris and proceed with carrying out and completion of work. All monies received from such insurance shall be paid to the Contractor by installment under certificates of the Architect/Customers representative issued at the 'Period of Interim Certificates' named in appendix hereto. The Contractor shall not be entitled to payment in respect of the restoration of work damaged, the replacement and repair of any unfixed materials or goods and the removal and disposal of debris other than the monies received under the said insurance.

#### **42. DETERMINATION BY THE OWENR**

Default: If the Contractor shall make default in any one or more of the following respect, that is to say:

If he without reasonable cause wholly suspends the carrying out of the work before completion thereof,  
or



If he fails to proceed regularly and diligently with the works, or

If he refuses or persistently neglects to comply with a written notice from the Owner / Architect/Customers representative requiring him to remove defective work or improper materials or goods and by such refusal or neglect the work is materially affected , or

If he fails to comply with the provision of clauses above, then the Owner / Architect/Customers representative may give him a notice by registered post or recorded delivery specifying the default, if the Contractor either shall continue such a default for fourteen days after receipt of such a notice and shall at any time thereafter repeat such a default (whether previously repeated or not), then the Architect/Customers representative without prejudice to any other rights or remedies may within ten days after such continuance or repetition of notice by registered post or recorded delivery forthwith determine the employment of the Contractor under this contract, provided that such notice shall not be given unreasonably.

**Bankruptcy of Contractor:**

In the event of the Contractor becoming bankrupt or making a composition or arrangement with his creditors or being a company having a winding up order made or (except for purpose of reconstruction) a resolution for voluntary winding up passed or a receiver or manager of his business or undertaking duly appointed or secured by a floating charge, of any property comprised in or subject to the floating charge, the employment of the Contractor under this contract shall forthwith automatically be determined but the said employment may be reinstated and continued if the Architect/Customers representative and the Contractor, his Trustee in bankruptcy, liquidator, receiver or manager, as the case may be shall so agree.

The Owner shall be entitled to determine the employment of the Contractor under this contract, if the Contractor shall have offered or given or agreed to give to any person and gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any action in relation to the obtaining or execution of this contract with the Owner or, for showing or forbearing to show favor or disfavor to any person relating to this contract or any other contract with the Owner, or if the like acts shall have been done by any person employed by the Contractor or acting on his behalf (whether with or without the knowledge of the Contractor), or if in relation to this Contractor or any person employed by him or acting on his behalf shall have committed any offence under the Prevention of Corruption Act, or shall have given any fee or reward the receipt of which is an offence under the Local Government Act.

In the event of the employment of the Contractor, being determined as aforesaid and so long as it has been reinstated and continued, the following shall be the respective rights and duties of the Owner and Contractor:

The Owner may employ and pay other persons to carry out and complete the works and he or they may enter upon the works and use all temporary building plant, machinery, appliances, goods and materials intended for delivered to and placed on or adjacent to the works and may purchase all materials and goods necessary for the carrying out and completion of the works.

The Contractor shall if so required by the Owner or Architect/Customers representative within fourteen days of the date of determination assign to the Owner without payment the benefit of any agreement for the supply of materials or goods and / or for the execution of any works for the purposes of this contract but on the terms that a supplier or Sub-Contractor shall be entitled to make any reasonable objection to any further assignment thereof by the Owner. In case the Owner may pay any supplier or Sub-Contractor shall be entitled to make any reasonable objection to any further assignment thereof by the owner. In any case the Owner may pay any supplier of Sub-Contractor for any materials or goods delivered or works executed for the purpose of the contract (whether before or after the date of determination), in so far as the price thereof has not already been paid by the Contractor. The Owner's rights under this clause are in addition to his rights to pay nominated Sub-Contractors as provided in relevant clause above and payments made under this clause may be deducted from any sum due or to become due to the Contractor.

The Contractor shall as and when required in writing by the Owner / Architect/Customers representative so to do (but not before) remove from the works any temporary buildings, plant, tool equipments, goods and materials belonging to or hired by him. If within a reasonable time after any such requirements has been made the Contractor has not complied therewith, then the owner may (but without being responsible for any loss or damage) remove and sell any such property of the Contractor, holding the proceeds less all costs incurred to the credit of the Contractor.

The Contractor shall allow or pay to the Owner in the manner hereinafter appearing the amount of any direct loss and / or damage caused to the owner by the determination. Until after completion of the works under clause 36 above, the Architect/Customers representative shall not be bound by any provisions of this Contractor to make any further payment to the Contractor, but upon completion and the verification within a reasonable time of the accounts therefore the Owner / Architect/Customers representatives shall certify the amount of any direct loss and/ or damage caused to the Owner by the determination and if such amounts when added to the monies paid to the Contractor before the date of determination exceed the total amount which would have been payable on due completion in accordance with this contract, the difference shall be debt payable to the Architect/Customers representative by the Contractor and if the said amount when added to the said monies be less than the said total amount, the difference shall be a debt payable by the Owner to the Contractor.

#### **43. DETERMINATION BY THE CONTRACTOR**

Without prejudice to any other rights and remedies which the Contractor may possess, if:

The Owner does not pay to the Contractor the amount due on any certificate within the 'Period of Honoring Certificates', named in the appendix hereto and continues such default for seven days after receipt by registered post or recorded delivery of a notice from the Contractor stating that notice of determination under this condition will be served if payment is not made within seven days from receipt thereof; or

The Owner interferes with or obstructs the issue of any certificate due under this contract; or

The carrying out of the whole or substantially the whole of the uncompleted works (other than the execution of work required under clause above is suspended for a continuous period of the length by reason of:

Force Majeure, or

Loss or damage occasioned by any one or more of the contingencies referred to on clause above; or

Civil commotion; or

Architect/Customers representatives instructions issued under this contract

The Contractor not having received in due time necessary instructions, drawings, details or levels from the Architect/Customers representative for which he specifically applied in writing on a date which having regard to the "Date of Completion" stated in the appendix hereto or to any extension of time then fixed under clause above was neither unreasonably distant from nor unreasonably close to the date on which it was necessary for him to receive the same, or

Delay on the part of Artists, Tradesmen or others engaged by the Architect/Customers representative in executing work not forming part of this contract, or

The opening up for inspection of any work covered up or of the testing of any of the work, materials or goods in accordance with clause above (including making good in consequence of such opening up or testing.)

Then the Contractor may thereupon by notice by registered post or recorded delivery to the Owner or Architect/Customers representative forthwith determine his employment under this contract provided that such notice shall not be given unreasonably.

Upon determination, then without prejudice to the accrued rights or remedies of either party or to any liability of the classes mentioned in clause above which may accrue either before the Contractor or any Sub-Contractors shall have removed his or their temporary buildings, plant, machinery, appliances, goods or material or by reason of his or their so removing the same the respective rights and liabilities of the Contractor and the Owner shall be as follows that is to say:

The Contractor shall with all reasonable dispatch and in such manner and with such precautions, as will prevent injury, death or damage of the classes in respect for which before the date of determination he was liable to indemnify the Owner under relevant clause above, remove from site all his temporary buildings, plant, machinery, appliances, goods and materials and shall give facilities for his Sub-Contractors to do the same but subject always to the provisions of sub paragraph (c) of clause herein below.

After taking into account amounts previously paid under this contract the Contractor shall be paid by the Owner:

The total value of the works completed at the date of determination.

The total value of work begins and executed but not completed at the date of determination the value being ascertained mutually in accordance with clause above.

The cost of materials or goods properly ordered for the works for which the Contractor shall have paid or of which the Contractor is legally bound to pay and on such payment by the Owner materials or goods so paid for shall become the property of the Owner.

The reasonable cost of the removal under clause above.

Any direct loss and / or damage caused to the Contractor by the determination.

Provided that in addition to all other remedies the Contractor upon such determination may take possession which may have become the property of the Owner under clause above until payment of all monies due to the Contractor from the Owner.

#### **44. CO-ORDINATION OF WORK**

At the commencement of work, and from time to time, the Contractor shall confer with the Sub-Contractors, persons engaged on separate contracts in connection with the work and with the Architect/Customers representative for the purpose of the co-ordination and execution of the various phases of the work.

The Contractor shall ascertain the Sub-Contractors, persons engaged on separate contracts in connection with the works, the extend of all chasing, cutting and forming of all openings, holes, grooves etc as may be required to accommodate the various services, the routes of all services and the positions of all floor outlets, traps etc in connection with the installation of plant and services and arrange for the construction work accordingly. The breaking and cutting of completed work must be avoided.

#### **45. LABOUR**

The Contractor shall not employ child labour at site. No labour shall reside within the compound except authorized guards. All statutory clearance like labour licenses with all local statutory compliances will be obtained by the Contractor within fifteen days of LOI and submitted to the Owner / Architect/Customers representative failing which commercial implications against the same will be deducted from first RA bill.

#### **46. GUARANTEE**

Besides guarantees required elsewhere, the Contractor shall guarantee the work in general for one year as noted under respective clauses above.

All required guarantees shall be submitted to the Architect/Customers representative by the Contractor when requesting certification of accounts for payment by the Architect/Customers representative.

#### **47. ANTIQUITIES**

All fossils and other objects of interest or value which may be found on the site or in excavating the same during the progress of the work shall become the property of the Owner. The Contractor shall carefully take out and preserve all such objects and shall immediately or as soon as conveniently may be after the discovery of such articles deliver the same into the possession of the Architect/Customers representative or of the Clerk of Works un cleaned and as excavated.

#### **48. ARBITRATOR**

48.1 All dispute and differences of any kind whatever arising out of or in connection with the contract or the carrying out of the works (whether during the progress of the works or after their completion and whether before or after the determination, abandonment or breach of the contract) shall be referred to and settled by the Architect/Customers representative who shall state his decision in writing. Such decision may be in the form of a Final Certificate or otherwise. The decision of the Architect/Customers representative with respect of any of the excepted matters (referred to under clause hereinabove) shall be final and without appeal, but if either the Architect/Customers representative or the Contractor be dissatisfied with the decision of the Architect/Customers representative on any matter, question or dispute of any kind (except any of the Expected Matters) or as to the withholding by the Architect/Customers representative or any certificate to which the Contractor may claim to be entitled then and in any such case either party (the Owner) or the Contractor may within 28 (Twenty Eight) days after receiving notice of such decision give a written notice to the other party through the Architect/Customers representative requiring that such matters in dispute be arbitrated upon.

Such written notice shall specify the matters which are in dispute and such dispute or difference of which such written notice has been given and no other shall be and is hereby referred to the Arbitration and final decision of a single arbitrator being Fellow of the Indian institute of Architects. Contractor and the Architect/Customers representative / Owner should agree upon single Arbitrator to be appointed. In case of disagreement as to the appointment of a single arbitrator, Arbitration will be done by a panel of two arbitrators, both being fellows of the Indian institute of Architects one to be appointed by each party, which arbitrators shall before taking upon themselves the burden of reference to appoint an umpire.

48.2 The Arbitrator, the arbitrators or the Umpire as the case may be shall have power to open up, review and revise any certificate, opinion, decision, requisition or notice save in regard to the Excepted Matters (referred to in clause hereinabove) and to determine all matters in dispute which shall be submitted to him or them and of which notice shall have been given as aforesaid.

48.3 Upon every or any such reference the cost of and incidental to the reference and award respectively shall be to the direction of the arbitrator or arbitrators, or the umpire as the case may be shall be final and binding on the parties. Such reference except as to the withholding by the Architect/Customers representative of any certificate under clause hereinabove to which the Contractor claims to be entitled shall not be opened or entered upon until after the completion of alleged completion of the works or until after the practical cessation of the works arising from any cause unless with the written consent of the Owner and the Contractor. Provided always that the Owner shall not withhold the payment of an Interim Certificate nor the Contractor except with the consent in writing of the Architect/Customers representative in any delay the carrying out of the works by reason of any such matters, question or

dispute being referred to Arbitration but shall proceed with the work with all due diligence and shall until the decision of the Arbitrator or arbitrators or the Umpire as the case may be given abide by the decision of the Architect/Customers representative and no award of the arbitration or the arbitrators or the umpire as the case may be shall relieve the Contractor of his obligations to adhere strictly to the Architect/Customers representative's / Owner's instructions with regard to the actual carrying out of the works. The Owner and the Contractor hereby also agree that Arbitration under this clause shall be a condition precedent to any right of action under the contract.

#### **49. PROTECTION AND CLEANING**

49.1 The Contractor shall protect and preserve the work from all damage or accident providing any temporary cover or protection as required by the Architect/Customers representative. This protection shall be provided for all property adjacent to the site as well as on the site.

49.2 The Contractor shall properly clean the work as it progresses and shall remove all rubbish and debris from the site from time to time as is necessary and as directed. On completion, the Contractor shall ensure that the premises and / or site are cleaned, surplus materials debris, sheds etc removed, areas under floors cleared of rubbish, gutters and drains cleared, doors and sashes eased, locks and fastening oiled, keys clearly labeled and handed over to the Clerk of Works so that the whole is left fit for immediate occupation or use and to the satisfaction of the Owner / Architect/Customers representative.

49.3 All such debris & disposals shall be carried away and disposal off such that no complaints from Govt. authorities, general public are raised.

49.4 Contractor shall submit the identity to the client /Consultant, of a person from his staff to whom this housekeeping, final cleaning & handover duties are assigned.

#### **50. TOLERANCE**

The Contractor shall exercise every care to ensure that all structural matters are sufficiently plumb and true to dimensions called for on the Drawings to receive prefabricated finishing elements such as doors, windows, cabinet work, ceramic work, concrete, tiles etc. Any variations may require rectification in the structural members or may involve remaking or replacing the finishing elements, fabricated to fit into the openings or spaces, as called for on the Drawings.

In case of separate contract, the Contractor whose work does not conform to dimensions called for shall be liable for all the expenses which may have to be incurred for rectification or replacement as may be required by the Architect/Customers representative for the proper installation of the finishing elements. The Architect/Customers representatives' decision in this respect shall be final and binding on the parties concerned.

## **GENERAL AND SPECIAL CONDITIONS OF CONTRACT**

### **GENERAL CONDITIONS**

#### **1. ADDITIONAL WORK**

Any additional work if required/ ordered by the Director IITM PUNE/ Consultant shall be taken up immediately and completed within the agreed time schedule.

#### **2. WORKING DRAWINGS**

Electrical layout drawings furnished by Director IITM Pune/ consultant during order placement shall be referred for a general guideline purpose. Errors or inconsistencies discovered by the Contractor in the Drawings and Specifications shall be promptly brought to the attention of the Consultant through the Project Engineer for interpretation or correction. Local conditions, which may affect the work, shall likewise be brought to the Consultants attention. If at any time, it is discovered that work is being done which is not in accordance with the Contract Drawings / approved working drawings and Specifications, the Contractor shall correct the work immediately.

All Drawings, Bill of Quantities and Specifications, including copies thereof furnished to the Contractor are the property of the Consultant. They shall not be used on any other work and shall be returned to the Consultant and Director IITM Pune on request upon completion or termination of the contract.

**Contractor shall submit installation detail working drawings for Director IITM Pune/ Consultants approval within 1 week of the award of contract.**

The details shall comprise but not limited to the following.

- Earthing pits, Earth bus, equipment/ panel earthing, etc.
- Lighting
- Cable trays: - Details shall include pre-fabricated accessories such as risers, bends, tees, couplers, reducers, etc.
- Civil work like wall opening/ cut out/ inserts/ pockets sleeves/ Hume pipes/ RCC pipes for laying cables at road crossings required.
- Any other drawings as may be required by Director IITM PUNE/ Consultant for completing the project on time without cost over-run.
- 

#### **3. EQUIPMENT/ WORKMANSHIP**

The equipment to be supplied under this Contract shall be strictly as per specifications of the Contract and relevant IS specifications. In the event of any ambiguity/ dispute the Director IITM PUNE/ Consultants verdict shall be final and binding on the Contractor.

#### **4. MAKES OF THE STANDARD BOUGHT-OUT EQUIPMENT**

The makes of the bought-out/ standard products are specified in the Tender. In case some other equivalent makes are to be used, the Contractor shall specify makes of the equipment offered. These shall be reputed makes and shall be subject to the approval of Director IITM PUNE/ Consultant.

The Manufacturer's drawings and catalogues shall be submitted in 4 sets, within 4 weeks of date of award of the order or letter of intent. In any case this shall be before actual installation/ use of the equipment/ material at site. The operating instructions & maintenance manuals shall be handed over immediately on commissioning.

#### **5. DEFECTS / MODIFICATIONS**

If in the opinion of Director IITM PUNE/ Consultant/ Statutory authorities the work carried out is defective, the Contractor shall rectify such defects without any additional cost to Director IITM PUNE; or carry out modifications to make the work complete in all respects and acceptable to the Director IITM PUNE/ Consultant/ Statutory authorities. To get satisfactory test readings, the Contractor shall carry out required modifications (which may include even replacement of defective items) without any additional cost of whatsoever nature to Director IITM PUNE. The work shall be guaranteed to yield the specified rating(s), design conditions within tolerance as per relevant IS specs. Any equipment, which in the opinion of the Director IITM PUNE/ Consultant/ Statutory Authorities does not meet specified requirements for which it is installed, may be rejected and Contractor shall replace it free of cost and within such time as may be reasonably allowed to him. The delay in the execution of the project on this account is not acceptable.

#### **6. COMPLETION CERTIFICATE**

The Contractor shall inform the Consultant, completion of erection for inspection and witnessing the site tests. Required tools/ instruments for such tests shall be arranged by the Contractor. The equipment shall be commissioned only after obtaining written acceptance of pre-commissioning tests (as per requirement) by the Director IITM Pune/ Consultant. At this stage the Consultant shall issue completion certificate to the Contractor. The Director IITM Pune / Consultant reserve the right to issue the completion certificate in parts. If due to Contractor's inefficiency the Contractor's completion certificate is delayed, the Director IITM PUNE reserve their right to put the equipment to use. The maintenance period or defects liability period shall start from the date of completion to the satisfaction of the Director IITM PUNE as mentioned in the completion certificate. Before issue of completion certificate, Contractor shall supply AS-BUILT drawings and operation and maintenance manuals as per relevant clause.



## **7. COMPLETION CERTIFICATE UNDER DEVIATION**

The Director IITM Pune/ Consultant may consider issuing completion certificate for the Contract along with the list of deviations for which the Contractor shall give an undertaking that the deviations shall be attended and rectified within two months from the date of completion certificate. The right of issuing such a certificate lies exclusively with the Director IITM Pune depending on nature of deviations.

## **8. LIQUIDATED DAMAGES FOR DELAY IN DELIVERY**

Liquidated Damages shall be 1% of total contract value per week or part thereof subject to a maximum of 5% of the total contract value for the Delay beyond the agreed completion dates for various stages / phases. If during the course of the contract it is clear to the Purchaser / Consultant that the delivery is delayed by more than 5 weeks due to reasons totally attributable to the Supplier, the Purchaser shall have right to termination of the contract.

## **9. DEFECTS LIABILITY PERIOD & FINAL ACCEPTANCE CERTIFICATE**

Defects liability period shall commence on the date of completion mentioned in the completion certificate (with or without deviation list) and shall not finish for at least **one years**. On completion of the defects liability period, the Director IITM Pune/ Consultant shall carry out final inspection of work and issue a list of defects/ deviations, if any. The Contractor shall attend to and rectify these defects/ deviations immediately. During the defects liability period, if there is any defect observed in the work carried out by the Contractor; the contractor shall rectify such defects immediately. At the end of the defects liability period and after rectification of all deviations, the Consultant shall issue final acceptance certificate. The Director IITM PUNE will release the retention amount or bank guarantee within 15 days; of presentation of final acceptance certificate by the Contractor.

If after defect rectification, the item is not acceptable to Director IITM PUNE/ Consultant, the Contractor shall replace the item by right quality item, free of cost. "The nature and quantum of defect, it's reporting to the Contractor, Contractor's response" thereof shall be recorded in writing by the Director IITM Pune and acknowledged by the Contractor/ Consultant as the case may be.

The Contractors shall handover the running equipment to the Director IITM Pune, for use and routine maintenance. However the Contractor is responsible for quality of work for defect liability period and quality of supplied equipment. The erection shall be as per Contract specifications and relevant IS Specifications.

The Contractor shall obtain, well in time, before/ during and after completion of erection, approval from MSEB and electrical inspector, factory inspector, other statutory authorities as and when required. Charges for co-ordination/ liaison to are considered separately.

## **10. PERFORMANCE GUARANTEE**

If the performance of the equipment fail to prove the guarantee set forth in the specification, Supplier shall investigate the causes and provide free of cost to Purchaser / Consultant equipment within one month period to prove the guarantees.

If Supplier fails to prove the guarantee within the one month period, Purchaser shall have the option to take over the equipment and rectify, if possible, the equipment to fulfil the guarantees and or to make necessary additions to make up the deficiency at Supplier's risk and cost. All expenditure incurred by the Purchaser in this regard shall be to Supplier's Account.

The manufacturer's guarantee for all brought out equipment shall be made available to the Purchaser and shall be valid for the entire defects liability period. If the manufacturer does not issue such guarantees, the Supplier shall guarantee the brought out items for the entire defects liability period along with this guarantee for the equipment.

## **11. WARRANTY /GUARANTEE**

Equipment shall be guaranteed for trouble free operation for a period of 18 months from arrival at site or 12 months from the date of commissioning whichever is earlier. Any defects discovered during this period shall be rectified free of cost.

## **12. WORKMANSHIP**

Good workmanship and neat appearance are pre-requisites of the Contract. Work shall be carried out in accordance with statutory rules and regulations in force and confirm to MSEB standards, electrical inspector's requirements, IE rules and relevant IS specifications and to the satisfaction of Director IITM Pune/ Consultants.

## **13. EXTENSION**

Upon it becoming reasonably apparent that the progress of the work is delayed, the Contractor shall forthwith (within a maximum period of seven days) give written notice of the cause of the delay to the Director IITM Pune / Consultants and if, in the opinion of the Consultant, the completion of the work is likely to be or has been delayed beyond the "Date of completion" stated in the agreement hereto or beyond any extended time previously fixed under this clause.

- a) By force majeure,
- b) Reason of any exceptionally inclement weather,
- c) Reason of loss or damage occasioned by any one or more of the contingencies referred to in this document
- d) Reason of social commotion, local combination of workmen strike or lockout affecting any of the trades employed upon the works or any of the traders engaged in the preparation manufacture or transportation
- e) Any of the goods or materials required for the work,
- f) Reason of Consultant's / and or the Director IITM Pune instructions issued

g) Reason of the Contractor not having receiving in due time necessary instructions, drawings, details or levels from the Director IITM Pune / Consultant for which he specifically applied in writing on a date which having regard to the date of completion stated in the appendix hereto or

h) Any extension of time then fixed was neither unreasonably distant from nor unreasonably close to the date on which it was necessary for him to receive the same

l) Delay on the part of nominated Sub-Contractors or nominated suppliers which the Contractor has taken all practicable to avoid or reduce, or

j) Delay on the part of artists, tradesmen or others engaged by the Director IITM Pune in executing work not forming part of this contract, or

k) Reason of the opening up for inspection of any work covered up or of the testing of any of the works, materials or goods in accordance with clause 31.7 above (including making good in consequence of such opening up or testing) unless the inspection of test showed that the work materials or goods were not in accordance with this Contract, or

l) Reason of the Contractors' inability for reason beyond his control and which he could not reasonably have foreseen at the date of this Contract to secure such labour, goods or materials as are essential to the proper carrying out works, then the Consultant shall estimate the length of the delay beyond date or time aforesaid make in writing a fair and reasonable extension of time for completion of works, provided always that the contractor shall use constantly

his best endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Director IITM Pune / Consultant to proceed with the work.

The Contractor will forfeit his claim for extension if he does not report the cause of the delay in completion date within seven days of the date of occurrence.

#### **14. TOOLS & OTHER MATERIAL**

All special tools and tackles required for the proper erection and assembly of equipments covered by the Contract shall be obtained by the Contractor himself. All sundry materials such as foundation bolts, nuts etc. required for the erection of equipments/ switch boards including base channels (If required & mentioned) to raise the level of the switch boards shall be included in the erection costs of respective items. Necessary scaffolding shall be arranged by the Contractor. Scaffolding shall be so fastened that swaying/ swinging from structure or building shall be prevented.

#### **15. QUANTITIES**

Quantities mentioned in the Tender documents are approximate. Before placing order Bidder is advised to check the quantity with his working drawings and arrive at actual required quantities as per site conditions. In any case, the payment will be made on the basis of

finally supplied and erected quantities on completion of work. Director IITM PUNE keep option to pay for any additional quantities left balance and not erected, but do not bind themselves to do so. If the orders are split for supply and erection, it is the responsibility of erection Contractor to prepare working drawings and inform Director IITM Pune/Consultants so that supply Contractor can be informed to supply quantities required for satisfactory completion of project.

Bidder to note that no claims for loss/ compensation/ escalation on the grounds of increase/ decrease in the quantities indicated in the tender schedule of quantities, shall be entertained under any circumstances, nor will the Contractor shall be entitled to prefer any claims whatsoever on these grounds.

#### **16. AS BUILT DRAWINGS**

On completion of work the contractor shall submit a soft copy along with 4 sets of as-built drawings in hard copy. These shall include -

1. Detailed drawing showing layouts cables routing, earthing, lighting system, etc. as installed.
2. Manufacturers' operation and maintenance instructions manuals for supplied items.
3. Test results after Consultants acceptance.
4. Contractor's instructions for routine maintenance of the work.
5. Any other drawings/ details deemed necessary by the Director IITM PUNE/ consultant for satisfactory maintenance of the work.
6. List of recommended spares for 2 years operation.
7. Relay co-ordination details (if any)
8. Quality assurance plan
9. Catalogues of major equipments
10. Commissioning reports and settling parameters
11. Warranty certificates by OEM
12. Release orders by authorities
13. Commissioning documents with MSEB.
14. Acknowledgement/ Memos etc.
15. Approvals and NOCs in originals

#### **17. CARE OF WORKS**

From commencement to the completion of works the Contractor shall take full responsibility of all work related to this Contract and those of other agencies, including temporary works. In case of any damage, loss or injury to the works; either of Contractors or other agencies the Contractor shall repair/ make good and acceptable.

The Contractor is also liable for any damages to the works his or others, caused by him in the course of any operations carried out by him for the purpose of carrying out his obligations. Any delay occurring on account of any of the above shall be to the account of Contractor. Contractor may employ watchman for safe custody of materials. Security and safety of all works related to this Contract is Contractor's sole responsibility.

The Contractor shall make good all civil works damaged/ disturbed by him while carrying out electrical installation, immediately after installation work or in any case before end of the Contract.

**18. PENALTY**

The penalty shall be 1% of total Contract value per week or part thereof subject to a maximum of 10% of the total Contract value for the delay beyond the agreed completion dates for various stages / phases. If during the course of the Contract it is clear to the Director IITM Pune / Consultant that the project is delayed by more than 5 weeks due to reasons totally attributable to the Contractor, the Director IITM Pune shall have right to terminate the Contract or get part or whole of the remaining work executed by some other agency at the Contractor's risk and cost, besides applying the penalty for delay caused to the project.

**19. FORCE MAJEURE CLAUSE**

This includes delays due to any war, hostilities, act of public enemy, civil commotion, strikes, lockouts, rebellion, revolution, insurrection or military or unsurpassed power, sabotage, fire, floods, explosions, epidemics, quarantine restrictions, earthquakes, damage by air craft and acts of god or any case for which Director IITM PUNE are responsible for the delay in execution/ completion of work by contractor; neither party shall, by reasons of such eventuality, be entitled to terminate this contract nor shall have any claims for damages against the other in respect of such non performance and deliveries under this contract shall be refunded as soon as practicable after such eventuality has come to an end or exist. The above mentioned Force Majored events shall not include constraints which could prudently be foreseen like shortage of power, non availability of raw materials, difficulties in making transport arrangements etc.

**20. INSURANCE OF WORKS/ LABOURS**

The contractor must take comprehensive insurance policy to cover his works, labours against all risks and include the cost of his policy in the tender price.

The Contractor shall at his own expense, without limiting his liabilities and obligations under any provisions of the Contract, effect and maintain until the completion of the Contract such insurance policies as are required under the Employee's State Insurance Act (ESI), the Factories' Act and any other Labour Law as may be applicable.

The Contractor shall procure such insurance policies with an insurance company as approved by the Director IITM Pune, against all risks in respect of which the Contractor is required under this clause to indemnify the Director IITM Pune, in particular, the Contractor shall effect and maintain an insurance policy of at least Rs.5.00 lakhs for per person engaged for the execution and completion of Work, Rs.5.00 lakhs per accident for injury or death and at least Rs.5.00 lakhs per accident for any damage caused to any third party property and the Contractor shall adequately indemnify the Director IITM Pune

against all such third party accident/damage, losses or claims which may arise in respect of the Work or in consequence thereof.

The Contractor shall also maintain adequate insurance/medical policies against all claims which may be made upon the Director IITM Pune whether under the workmen's compensation act or any other statute in force during the currency of the Contract. All such insurance /medical policies shall be in the joint names of the Director IITM Pune and the Contractor and shall be deposited with the Director IITM Pune.

The Contractor shall be responsible for any such damage, loss of person or property or any other claim arising out and incidental to the negligence or failure of the Contractor or Contractor's personnel to execute the Work in accordance with the Contract, and for all such damages, losses or claims for which the insurance policies as stated above have not been procured by the Contractor.

## **21. FIRE INSURANCE**

Unless otherwise instructed by the Employer, the Contractor shall on signing the Contract, insure the Work(s) and the materials to be used for the execution and completion of the Work and keep them insured until the virtual completion of the Contract, against any loss or damage arising due to fire and/or earth-quake

Such insurance policy shall be with an insurance company as approved by the Employer and shall be in the joint names of the Employer and the Contractor and for such amount and the consultants fees and for any further sum if called upon to do so by the employer the premium of such further sum being allowed to the contractor as an authorized extra. Such policy shall be adequate to cover the property of the Employer lying on the Site and the Consultant's fees in connection with the Consultant's services generally in the reinstatement and shall not cover any property of the Contractor or of any Sub-contractor or employees. The Contractor shall deposit such policies and receipts for the premium with the Employer within twenty-one days from the date of signing the Contract unless otherwise instructed by the Employer. In the event of any default of the Contractor in insuring, as provided above, the Employer may so insure and may deduct the premiums paid from any money due or which may become due to the Contractor. The Contractor shall, as soon as the claim under the policy is settled, or the work is reinstated by the insurance office should they elect to do so, proceed with all due diligence of the completed Work(s) to ensure that the Work is fully replaced and restored in the same manner as though the fire or any other event which had caused such destruction had not occurred and the Work in all respects complies with conditions and specifications of the Contract. The Contractor, in case of rebuilding, replacing or reinstatement after fire, shall be entitled to such extension of time for completion as the Employer may deem fit.

## **22. RISK PURCHASE CLAUSE**

If in the opinion of the Director IITM Pune/ Consultant, the contractor fails to perform and discharge his obligations at any time during tenure of the contract including maintenance period, the Director IITM

PUNE shall give 7 days' notice in writing to the contractor to improve his performance. If the contractor fails the Director IITM PUNE reserve the right to cancel the whole or part of the order and get the same carried out by other agencies at the contractors' risk, cost and responsibilities and recover the costs from the contractors' outstanding bills or security deposit or retention amount.

### **23. LABOUR LAWS**

The contractor shall abide by the provisions of state/ central govt. / local labour laws and discharge his obligations towards any liability arising out of such laws in respect of his workers/ sub contractors workers. In case, the contractor fails to comply with the law requirements, the Director IITM PUNE will have to intervene and settle the demands/ disputes of the contractor or his sub contractors labour and debit the cost to the contractors' account. The contractor shall maintain all such records for the attendance of his labour/ other people as may be required. In no case, the same would be mixed up with records of the Director IITM Pune/ his other contractors.

### **24. SETTLEMENT OF DISPUTE / AMBIGUITIES**

In case of disputes/ ambiguities while interpreting any of tender/ contract conditions Director IITM Pune/ consultant decision in the matter shall be final and binding.

### **25. BENEFICIERY FOR INSURANCE POLICIES**

Insurance policies mentioned in the respective clauses shall be taken within 10 days of award of the order/ LOI. Director IITM PUNE shall be the sole beneficiaries for these policies. Copies of these policies shall be produced when asked. If contractor fails to take out these policies within the stipulated period, Director IITM PUNE reserve their right to take out these policies on contractor's behalf and debit the cost to contractors' account

### **26. COMPLIANCE TO STATUTORY RULES / REGULATIONS / ACTS**

The contractor will have to comply with all the rules/ regulations/ acts prescribed under the Factories Act, Provident Fund Act, ESI Act, Shops and Establishment Act, Workmen's Compensation Act and such other Acts and labour laws as may be applicable and any liability arising out of non observance of the regulations and Acts in respect of his employees, in respect of this contract work, will have to be fully assumed and met by the contractor. The contractor should ensure that he satisfies all the above regulations acts etc.

### **27. REGULATIONS**

The contractor and his employees shall observe all prevailing rules and regulations of working in **IITM, Pune** and modified/ upgraded/ amended from time to time.

### **26. SITE SUPERVISIONS AND SITE INSTRUCTION BOOK**

The contractor shall deploy qualified and responsible engineer at site for site supervision and this engineers shall be available at site during working hours to take instructions and answer queries.



### **29. MEETINGS**

Senior representative of the contractor along with the site engineer shall attend scheduled site meetings and make himself available for any other meetings with the consultants/ Director IITM PUNE as and when required at site. The contractor shall co-ordinate his work with those of other agencies and the consultants/ Director IITM PUNE shall decide the priorities.

### **30. MAINTENANCE OF RECORDS**

The contractor shall maintain at site proper record of the contracts agreement, drawings, site instructions or any other records as requested by consultants/ Director IITM PUNE and shall make these available to consultants/ Director IITM PUNE as and when required during site visits.

Safety instructions are discussed in detail in section 16.

### **31. HOUSE KEEPING**

The contractor shall provide proper housekeeping, keep working place neat and clean and store materials neatly and properly at the closure of each day's work. Protecting electrical equipment from other contractor's activities (e.g. Painting, etc.) shall be contractor's responsibility with intimation to safety officers.

### **32. ARBITRATION**

All disputes, claims, controversy and differences of any kind whatsoever arising out of or in connection with the Contract or the execution of the Work(s) (whether during the progress of the Work(s) or after their completion and whether before or after the determination, abandonment or breach of the Contract) shall be referred to and settled by the Consultant who shall state his decision in writing. Such decision may be in the form of a final certificate or otherwise and shall be issued by the Consultant within 30 days of the date of last hearing with respect to such dispute. The decision of the Consultant with respect to any of the excepted matters shall be final and without appeal. But if either the Employer or the Contractor is dissatisfied with the decision of the Consultant on any matter, question or dispute of any kind (except any of the

excepted matters) or as to the withholding by the Consultant of any certificate to which the Contractor may claim to be entitled under the Contract, then and in any such case either party (the Employer or the Contractor) may within twenty-eight days after receiving notice to such decision give a written notice to the other party requiring that such matters in dispute be arbitrated upon. Such written notice shall specify the matters which are in dispute and such dispute or difference of which such written notice has been given and no other shall be and is hereby referred to the arbitrator being a member of the Institution of Engineers to be agreed upon and appointed by both the parties or in case of disagreement as to the appointment of a single arbitrator, to the arbitration of two arbitrators being both member of Institution of Engineers one to be appointed by each party, which arbitrators shall before taking upon themselves the



burden of reference appoint an umpire. The arbitrator, the arbitrators or the umpire shall have power to open up, review and revise any certificate, opinion, decision, requisition or notice save in regard to the excepted matters and to determine all matters in dispute which shall be submitted to him or them and of which notice shall have been given as aforesaid. The failure to timely appoint an arbitrator by any party shall entitle the other party to request the Institution of Engineers to appoint such arbitrator and the non-appointing party shall not be entitled to raise any objections in this regard.

Upon every or any such reference the cost of incurred and incidental to the reference and award respectively be in the direction of the arbitration, or arbitrators or the umpire who may determine the amount thereof, or direct the same to be taxed as between Attorney and Client or as to between party and party, and shall direct by whom and to whom and in what manner the same shall be borne and paid. The submission shall be deemed to be a submission to arbitration within the meaning of the Arbitration and Conciliation Act, 1996 or any statutory amendments to the Act. The award of the arbitrator or arbitrators or umpire shall be final and binding on the parties. Such reference except as to the withholding by the consultants of any certificates to which the contractor claims to be entitled, shall not be opened or entered upon until after the completion or alleged completion of the works or until after the practical cessation of the works arising from any cause unless with the written consent of the employer and the contractor. Provided always that the employer shall not withhold the payment of the interim certificate nor the contractor in any way delay the carrying out of the works by reason of any such matter, question or dispute being referred to arbitration he shall proceed with the works with all due diligence and shall until the decision of the arbitrator or arbitrators or the umpire be given, abide by the decision of the consultants and no award of arbitrator or the arbitrators or the umpire shall relieve the contractor of his obligations to adhere strictly to the consultants' instructions with regard to the actual carrying out of the works.

The Employer and the Contractor hereby also agree that arbitration under this clause shall be a condition precedent to any other right of action under the Contract. All the disputes arising out of or in any way connected with the Agreement or Contract in respect of the above work shall be deemed to have arisen in Pune and only the courts in Pune shall have jurisdiction to determine the disputes.

### **33. TAC APPROVAL**

Installation shall be subject to approval of Tariff Advisory Committee (TAC) of Fire Insurance Association of India. Hence contractor shall use all materials approved by TAC and it would be contractor's sole responsibility to fill in insurance forms, prepare necessary drawings and submit the same to Fire Insurance Authorities and obtain their approval for the electrical installation. Materials under Director IITM

PUNE' scope of supply shall be procured from suppliers approved by TAC.

### **34. SAMPLE APPROVAL**

Even though the approved makes are mentioned in the tender, it is necessary to get approval for samples of supply items by project consultant as well as by Director IITM Pune. With such promptness as to cause no delay in his work or in that of any other sub-contractor. This shall be delivered free of cost. Work shall be carried out in accordance with approved samples. Sample prior to approval to Director IITM Pune / consultant needs to be approved by MSETCL/MSEDCL.

### **35. ACCESS FOR DIRECTOR IITM PUNE / CONSULTANT TO THE WORK**

The Director IITM Pune / Consultant and their representatives shall have access to the works and the workshops or other place of the Contractor where work is being carried out for the Contract and when work is to be so prepared in workshops or other places of a Sub-Contractor (whether or not a nominated Sub-Contractor.) at all reasonable times. The Contractor shall have a term in the Sub-Contract so as to secure a similar right of access to those workshops or placed for the Director IITM Pune / Consultant and his representatives and shall do all things reasonably necessary to make the right effective.

### **36. CONSULTANT'S STATUS AND DECISIONS**

The Consultant shall be the Director IITM PUNE representative during the construction period. The Consultant shall periodically visit the site to familiarize himself generally with the progress and the quality of the work and to determine in general if the work is proceeding in accordance with the Contract Document. He shall not be required to make exhaustive or continuous on site inspection to check the quality or quantity of the work and he shall not be responsible for the Contractors' failure to carry out the construction work in accordance with the Contract Document. During such visits and on the basis of his observations while at the site he shall keep the Director IITM Pune informed of the progress of the work, shall endeavor to guard the Director IITM Pune against defects and deficiencies in the work of the Contractor and he shall condemn work which fails to conform to the Contract Document. Consultant shall have authority to act on behalf of the Director IITM Pune only to the extent expressly provided in the Contract Document or otherwise in writing which shall be shown to the Contractor. He shall have authority to stop the work, whenever such stoppage may be necessary in his reasonable opinion, to ensure the proper execution of the Contract. The Consultant shall be in the first instance the interpreter of the conditions of this contract and the judge of its performance. He shall side neither with the Director IITM Pune nor with the Contractor but shall use his powers under the Contract to enforce its faithful performance by both. In case of the termination of

the appointment of the Consultant, the Director IITM Pune shall appoint a capable and reputable Consultant against whom the Contractor shall make no reasonable objection and whose status under the Contract shall be that of the former Consultant. Any dispute in connection with such appointment shall be subject to Arbitration.

### **Decision**

The Consultant shall within a reasonable time make decisions on all claims of the Director IITM Pune or the Contractor and all other matters relating to the execution and progress of the work of the interpretation of the Contract Document. The Consultant may in his absolute discretion and from time to time issue further drawings, details and / or written instructions, written directions and written explanations in regard to:

Variation or modifications of the design.

The quality or quantity of works or the additions or omissions or substitution of any work.

Any discrepancy in or divergence between the drawings and / or specifications.

The removal and / or re-examination of any works executed by the Contractor.

The dismissal from the works of any persons employed thereon.

The opening up for inspection of any work covered up.

The amending and making good of any defects under defects liability period.

The removal from the site of any material therefore.

Assignment and sub letting.

Delay and extension time.

The postponement of any work to be executed under the provision of this Contract.

### **Dismissal**

The Contractor shall on the request of the Director IITM Pune / Consultant immediately dismiss from the works any person employed thereof by him who may in the opinion of the Director IITM Pune / Consultants be incompetent or misconducts himself and such person shall not be again employed on the work without the permission of the Director IITM Pune / Consultant

### **SPECIAL CONDITIONS OF CONTRACT**

Temporary/ Construction Power Supply: - Contractor shall arrange **at his own cost** arrangement for temporary power and distribution of the power to his equipments. Contractor shall properly document inward of such equipments and shall take permission from client while taking out. Contractor shall remove all wires, sundry materials, etc. after completion of works and clear the site. However power supply for

lighting of site can be availed from Director IITM PUNE existing connection.

Drinking Water supply: - To be arranged by contractor.

Material storage on site: Contractor shall create a lockable facility on the site at his own cost & shall provided his security service round the clock for the materials under his custody. The client shall not remain responsible for any theft, misuse by other agencies or damage due to improper stacking, loading etc in any case.

Completion Period – Completion period shall not extend **Eight months** from the date of LOI.

Validity of bid – Bids shall be valid up to end of the project or for a period of twelve months maximum from the date of submission of bids. Other escalations shall not be entertained during the execution.

Declaration: Contractor shall have to submit declaration to the client that **“There is no Legal Case pending against Bidder, the process of which may affect Progress/ execution of contractual work to them”**.

**Bidders shall note that the quantities mentioned in the BOQ are tentative; contractor shall not directly buy the material without the actual measurement on site. Wastages or surplus material claims thereafter shall not be entertained in any case & only erected quantities shall be paid after certifications.**

**SPECIAL CONDITIONS  
OF  
CONTRACT**

**PART 4 A**

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## SPECIAL CONDITIONS OF CONTRACT (SCC)

Unless otherwise agreed, these conditions shall be reading in conjunction with relevant clauses of General Conditions of Contract works involving General construction and Erection (GCC, hereinafter). In case of variance / discrepancies between SCC and GCC, the conditions laid down in SCC shall take precedence. Further in case of variance / discrepancies between SCC and Contract Documents, the latter shall prevail.

### 1. TERMS OF PAYMENT

#### 1. Performance Security:

Within 7 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security for an amount equivalent to 5% of the Contract price in the form of Demand draft/Bank Guarantee, from nationalized / scheduled bank located in India in favour of **DIRECTOR, INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008**. Which will be released on completion of work and handing over the site to the Institute.

#### 2. Mobilization advance: No mobilization advance.

**3. Material at Site:** 70% Payment will be made of invoice value for the material at site after due certification by the Architect, Project Management Consultant and Institute Authorities.

#### 4. Running Account Bills (RA Bills):

The Contractor shall submit one running account bill per month, value of the same should not be less than 20% of work order value. Payments against running bills shall be considered as running account payment and shall be considered as an advance towards final settlement of accounts with the Contractor and not as payment for the work completed and certified. The payment shall be made after deducting other recoveries, taxes etc. The payment shall be made within 3 weeks to the Contractor after due certification of the work by Architect/Consultant.

#### 5. Retention Money:

Retention money @ 5% (Five percent) will be deducted from each running account bill of contractor. After completion of work 95% payment of total work done will be made to contractor and remaining 5% will be released after defect liability period i.e 12 month from the date of handing over of completed site for possession to the Institute or on submission of Bank Guarantee of remaining 5% amount valid up to the defect liability period.

#### Final Bill:

The final measurements of all structures shall be submitted to the Architect/Customers representative within seven days from the completion of each structure. The final bill along with the measurements duly certified by the Architect/Customers representative shall be produced within thirty days from the completion of all works within the scope of work and its' handing over. No claims shall be entertained after receipt of final bill.

The final bill shall be paid within sixty days from the date of submission of final bill subject to the following:

- i) Reconciliation of free issue of material approved by site in charge.
- ii) Clearance of all temporary structure erected during construction.
- iii) Five sets of as built Drawings (Hard and Soft Copy), Completion Certificate, Site Clearance Certificate and Handing/Taking over Certificate, Site records, Test reports duly certified by the Architect and Project Management Consultant.

## **2. VARIATION IN QUANTITIES**

The contract rates shall remain valid and firm for variation to any extent in individual quantities of items of work. However, variation will be allowed if the final total contract value varies by (+ or -) 10% with respect to total initial L.O.I. / work order value.

## **3. Penalty Clause:**

If the work is not completed within the aforesaid period, the contractor shall pay liquidated damage of 1% per week subject to a maximum 10% of value of work order in case of delays beyond the accepted completion period for reasons solely attributed to him.

## **4. SITE FACILITIES**

4.1 Water required for construction, drinking as well as for labour hutment and miscellaneous purpose shall be arranged by contractor at his own cost.

4.2 Electricity required for Construction work and for labour hutment shall be arranged by the Contractor at construction site at his own cost. No compensation of any sorts for non availability related to water and electrical supply in terms of extension of time as well as in terms of cost will be paid to contractor.

4.3 No space for temporary labour colony shall be allowed within the premises of the plot. Unless specifically agreed by the Owner upon written request to that effect given by the contractor. Contractor shall make his own arrangement for accommodation of their workers and staff elsewhere at no extra cost to Owner.

## **5. COMMENCEMENT TIME**

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The contractor shall be given possession of the site for work when the engineer notifies him that the owner is ready to do so. Such possession shall not be exclusive to the contractor and the contractor shall in accordance with the requirement of the engineer / owner afford all reasonable opportunities to any other agencies employed by the owner and their workmen for carrying out their work and to the workmen of the owner and of any other duly constituted agencies who may be employed in the execution on or near the site of any work not included in the contract or of any contract which the owner may enter into in connection with or ancillary to the works.

The Contractor shall commence the works on site within 10 (ten) days on receipt of letter of intent from the Owner and shall proceed with the same with due expedition and without delay except as may be expressly sanctioned or ordered by the Architect/Customers representative / Owner or be wholly beyond the Contractors' control. In case where the complete site is not possible to be handed over the Contractor, the Architect/Customers representative / Owner will ensure that enough portion of the area is handed over for the Contractor to carry out the work as stipulated in the agreement program.

## **6. TIME SCHEDULE AND TENTATIVE CONSTRUCTION PROGRAMME**

The Contractor shall mobilize adequate number of plant and machinery to complete the work as shown in construction program. It will be deemed that Contractor has allowed for mobilization of this plant and machinery including spares to replace in case of break down in his quoted rates and any extra resource mobilization required to achieve the program, quantity remaining same, will not be paid for.

The Contractor shall work on three shifts (Round the Clock) if required, to complete the work as per construction programme and shall make necessary lighting arrangements to facilitate working during night. Contractors' quoted rates shall cover working on three shifts basis as mentioned herein. No extra claim shall be entertained on this account.

**A total of eight months** shall be allowed to complete the job from LOI and agreed timeline during the tender finalization. The timeline shall be divided on job to job basis also. Contractor shall draw out a tentative schedule and submit along with their offer.

## **7. ALTERATIONS IN SPECIFICATIONS AND DESIGNS**

During the execution of the work, the Architect/Customers representative / Owner may desire to make some alterations in specifications and design, for example, use of deformed (Tor steel) reinforcement in place of mild steel reinforcement in particular RCC work. The Contractor shall carry out such changes as per written instruction of Architect/Customers representative. There should not be extra cost to the Owner.

Cost implication for specification changes for supply items should be negotiated as per clause "Extra items".

No extra claims whatsoever shall be entertained on any account.



The Owner will inform to the Contractor, after Contractor starts site mobilization, the name and designation of the person who is authorized to accept and approve alterations / changes / modifications if they shall affect any of the terms and conditions including unit item rates, completion period stipulated in the contract, increase in quantity of contract works indicated in the contract, finalization of rates of extra items and such other issues. The Contractor shall implement any such change / alteration / modification only after the Contractor has received approval in writing from Owners' such authorized person.

## **9. COMPLETION**

9.1 Virtual Completion Certificate: Architect/Customers representative shall issue a Virtual Completion Certificate to the Contractor after he complies following:

9.1.1 Having obtained a written request from Contractor for issuing virtual completion certificate with an undertaking to finish any outstanding work within next one month or lesser period.

9.1.2 Completed work have passed final tests as prescribed in the contract, if any.

## **10. COMPLETION CERTIFICATE**

Architect/Customers representative shall issue to the Contractor a Completion Certificate of works after following conditions have been complied with:

10.1 Having obtained a written request from contractor for issuing completion certificate after fulfilling his obligations stated in below.

1) Contractor has completed all the balance contract works in all respects including rectification of any defects etc. within fifteen days or less as stipulated by the Owner from the date of issue of virtual completion certificate.

2) All tools and tackles, surplus mud, bentonite mix, waste material and rubbish debris is cleared from the site completely.

3) The executed contract works have been measured jointly by the Architect /Customers representative and Contractor assuming that these measurements shall be binding and conclusive.

4) All the temporary works, labour and staff colony etc constructed by the Contractor are removed and the work site cleaned to the satisfaction of Architect/Customers representative / Owner.

5) Material reconciliation if any for materials issued by Owner has been completed including return of surplus / scrap material to the Owner by the Contractor.

6) Preparation of as built sketches for areas where revisions have been made completed by the Contractor. The sketches shall be clear so as to enable the Architect/Customers representative for preparation of "As Built" drawings.

7) Accounts with other Contractors have been settled by the Contractor and Owner has been indemnified by the Contractor against all claims for any cause whatsoever.

8) Performance Bank guarantee for the defects liability period has been submitted by the Contractor.

**Defects liability period / maintenance period shall commence from the date of issue of this certificate.**

**Warranty and defect liability:** In addition to terms mentioned in tender documents following terms will be applicable for manufacturing/hidden defects and supply of defective or wrong material:

\* Roofing: 10 years from the date of Hand over and Acceptance Phase.

\* Waterproofing: 10 years from the date of Hand over and Acceptance Phase.

\* Civil Construction workmanship: 1 years from the date of Hand over and Acceptance Phase.

**Final Completion Certificate:**

The final completion certificate shall be given by the Architect/Customers representative/Owner two weeks after the expiry of the defect liability period / maintenance period considering the following:

The contract works have been duly maintained by the Contractor during monsoon or such period.  
Any defects observed have been rectified to the satisfaction of the Owner.

Obligations if any to be performed as per the contract.

Notwithstanding the issue of the final completion certificate, the Contractor and the owner shall remain liable for the fulfillment of any obligation incurred under provisions of the contract prior to the issue of the final completion certificate which remains unperformed at the time such certificate is issued and the purpose of determining the nature and extent of any such obligations, the contract shall be deemed to remain in force between the parties hereto.

**11. SUBSTANDARD WORK**

In case when quality of work / performance is not in accordance with Contract and which Owner / Architect/Customers representative deem it inexpedient to correct and accepts it under special circumstances, Owner reserve the right to make an equitable deduction from contract price based on unit - item rates.

**12. WORK DURING MONSOON**

12.1 Contractor shall provide suitable covered shed to carry out structural fabrication work as per agreed schedule during monsoon at no extra cost to Owner.

12.2 During monsoon and other periods, it shall be the responsibility of the Contractor to keep the construction work free from water at his own cost.

### **13. FORCE MAJEURE**

13.1 The terms and conditions mutually agreed in respect of this contract shall be subject to “Force Majeure”. Neither party shall be considered in default in the performance of its obligations hereunder, if such performance is prevented or delayed because of war, hostilities, revolution, civil commotion, epidemic, accident, fire, wind, flood or because of any law and order proclamation regulation, ordinance of any government or any other case whether of a similar or dissimilar nature beyond the reasonable control of the party affected.

13.2 Exclusion from Force Majeure condition – labour strike of Contractors’ workers.

13.3 Should one or both the parties be prevented from fulfilling their obligations by a state of Force Majeure continuously for a period of two months, the two parties should consult with each other regarding the future implementation of the contract.

### **14. ARBITRATION**

Provisions as stipulated in General Conditions of Contract will be applicable.

If Owner and Contractor have exhausted all reasonable means to settle a claim or dispute the matter shall be referred to arbitration under the rules of the Indian Council of Arbitration, New Delhi.

Arbitration proceedings shall be held at the offices of the Indian Council of Arbitration, New Delhi.

**Courts in Pune alone shall have jurisdiction in incidental matters.**

The prevailing party in any arbitration proceedings shall be reimbursed by the other party for all costs, expenses and charges, including, without limit, reasonable attorneys' fees, incurred by said prevailing party; provided, however, the fees paid to the arbitrators shall be shared equally by the Owner and Contractor.

**ADDITIONAL  
SPECIAL CONDITIONS  
OF  
CONTRACT**

## **PART 4 B**

### **ADDITIONAL SPECIAL CONDITIONS OF CONTRACT (SCC)**

#### **1. TEST FOR MATERIALS AND WORKMANSHIP**

All materials and workmanship shall be subject to such tests as stipulated in the contract or as suggested by the Architect/Customers representative / Owner's representative. Contractor shall on advice of Owner / Architect/Customers representative shall conduct such tests at his own expense and establish quality strength and specifications of the material / workmanship.

#### **2. UNCOVERING OF WORK**

The Contractor shall uncover any part of the works or make openings in or through them as per the instructions of Architect/Customers representative / Owner in case of doubt about the quality of material or workmanship, and shall afterwards reinstate and make them good. The Contractor shall bear all such expenses unless the need for this was on account of Owners' default. In case later case, the Owner shall bear the expenses.

#### **3. CONTRACTOR'S ARRANGEMENT FOR WORK**

3.1 The Contractor shall arrange for fabrication, cutting, drilling, welding, assembling, bolting, filling, fixing, aligning etc as required for the contract work of construction, erection, testing or any other site work.

The contractor shall supply / arrange all the materials necessary for carrying out contract works, such a tools, tackles, equipment, plants, welding machines, compressors, drilling machines, cranes, hoists, lifting tackles, ropes, pulleys, packing shim hydraulic pumps, jacks etc, and also other consumables such as welding rods, brazing rods, fluxes, solders, gases, coal, fuel oils, kerosene, cotton waste, etc complete. **All lifting tools, tackles must be in good conditions and identified by sign and identification mark with rates test certificates from competent authorities.**

The Contractor shall co-ordinate and arrange for the inspection / approval by statutory authorities of the contract works carried out by him for the purpose of compliance with the necessary regulations issued by the statutory authorities.

The Contractor shall arrange for protecting properly all site work carried out by him from damage, pilferage and becoming dangerous to life and property.

The Contractor shall comply with all the work rules and safety regulations issued by the owner and the statutory authorities, which may be necessary during execution of the contract work.

All plant, equipment and materials used by the Contractor shall be safe and comply with statutory regulations, work rules and safety rules and the contractor shall be liable for any loss or damage arising from their use.

#### **4. TRANSFER OF PROPERTY**

The contract works shall become the property of the Owner upon acceptance of delivery. The Contractor shall mark all such materials as the property of the owner but it shall be at the Contractors' risk until delivered and finally accepted by the owner on virtual completion of the work.

Wherever earthwork / excavation to be undertaken, original ground levels at 5m grid shall be taken and jointly signed by the Contractor, and representative of the owner. The payment on the item earthwork or filling will be worked out with reference to these original levels.

The execution of the work shall be in strict adherence to the planned sequence of work and time schedule or instructions by the representative of Owner.

#### **5. REQUEST BY OWNER FOR SLOWING DOWN THE WORK**

If for any reason, the progress of the contract works is slowed down due to Owners' explicit requirement, the Contractor shall be entitled to proportionate extension of the completion time.

#### **6. ORDER BOOK**

The Contractor shall maintain an Order Book at site of the work. Any special orders and instructions to be issued to the Contractor at site will be recorded in this book which will be numbered and initialed by the representative of the Owner. The Contractor will however sign all orders as a token of his having seen and noted.

**7. PAYMENT:** All payments shall be made in Indian currency.

#### **8. COST VARIATION**

8.1 The Bill of Quantities included in the contract documents is provisional and approximate and liable to variation without entitling the Contractor to any compensation.

#### **9. SPECIFICATIONS**

Those items for which detailed specifications have not been included in the contract document shall be executed as per relevant IS / BS/ CPWD specifications or as per the standard construction practices and / or as per the instructions / suggestions of the Architect/Customers representative.

#### **10. LABOUR LAWS AND RULES**

The Contractor shall maintain relevant codes and fulfill all conditions and requirements in accordance with:

The Payment of Wages Act.

Contractor's Liability Act.

Workmen's Compensation Act.

Contract Labour (Regulation & Abolition) Act, 1970 and Central Rules, 1971.

Apprentice Act 1961.

Any other Act or enactment relating thereto and rules framed from time to time.

All statutory clearances like labour licenses will be obtained by Contractor within seven days to Architect/Customers representative / Owner. Form V will be provided by Owner.

#### **11. APPROVED BRAND NAMES**

Wherever brand names / model number are specified in this contract, they shall be followed strictly and a approved equivalent will be permitted only if the Contractor provides adequate proof to satisfy the Architect/Customers representative / Owner that the particular item is no longer manufactured by the said company.

#### **12. DISCREPANCIES AND ADJUSTMENT OF ERRORS**

In case of discrepancy between Schedule of Quantities, the specifications and / or the drawings the following order of preference shall hold good. Architect/Customers representative shall give necessary instructions in writing.

- 1) Description in Schedule of Quantities.
- 2) Particular specification and special quantities, if any.
- 3) The drawings.
- 4) General Specifications.

If there are any provisions varying or conflicting with one another, the Architect/Customers representative shall be the deciding authority with regard to the intension of the document.

#### **13. INCOME TAX DEDUCTION AT SOURCE**

The owner shall deduct T.D.S per provisions of Income Tax Act from the bill amount of executed works. A certificate of deduction will be issued to the Contractor to the effect as per standard formats.

#### **14. AS BUILT DRAWINGS**

Two copies of drawings released for "Issued for Construction" shall be given to Contractor. The Contractor shall put the As Built mark ups in full detail and submit the drawings to Architect/Customers representative before handing over the work, failing which final certificate shall not be issued by the Architect / Customers representative.

#### **15. QUOTED RATE ITEMS**

Items where R.O. (Rate Only) is mentioned are not envisaged at this stage. However, the same will be executed if the need arises or those do become as substituted items and it will be treated same as other items of the contract.

**16. FIRM PRICE**

The Rates and Prices as per the Schedule of Quantities shall remain firm for the entire period of completion.

However, for any extended period of contract due to reasons beyond the control of the Contractor, the contract price for the balance portion of the remaining works shall be adjusted for increase or decrease in accordance with Standard Escalation Clause which will be mutually agreed upon (Basic indices prevailing on the date of letter of intent.)

**17. SAFETY REGULATIONS OF OWNER'S PREMISES**

Contractor should obey Safety Regulations as per Owners' requirement. Use of Rope for lifting purpose shall be strictly prohibited.

**Read, Understood in the language Known to Me/Us and Accepted.**

**Signature of Contractor**

**Date & company seal**



## **SPECIAL CONDITIONS OF CONTRACT**

This document describes the Special Conditions of Contract as applicable to this contract.

### **QUALIFYING REQUIREMENT OF THE BIDDER**

The bidder desirous to quote for the afore said work should have carried out the works of similar nature out of which one contract value shall not be less than one crores single work.

The minimum turnover of the bidder during last 5 years should not be less than three Crores.

The bidder shall submit along with the offer the following pre-qualifying documents giving details about his company, works completed etc. as per the formats given below:

### **PARTICULARS OF THE BIDDERS**

- 1) Name of the Company :
- 2) Nature of the Company :  
(I.e. Proprietorship/Partnership/  
Pvt. Ltd./Limited.)
- 3) Registered Address :
- 4) Contact Numbers :
- 5) Telegraphic Address :
- 6) Name of the Directors/  
Partners/Owner: :
- 7) Turn over during last 5 years :
- 8) Name of the Bankers :
- 9) Sales Tax registration No. :
- PAN of Income Tax :

1. DETAILS OF THE WORKS COMPLETED DURING LAST 5 YEARS

(To be submitted)

2. DETAILS OF THE WORKS IN HAND

(To be submitted)

3. INCOME TAX & SALES TAX CLEARANCE CERTIFICATES

The bidder shall furnish photo copy of income tax/sales tax clearance certificate from the competent authority along with his offer.

4. LIST OF MACHINERIES & OTHER ASSETS AVAILABLE

(To be submitted)

5. LIST OF PERSONNEL (TECHNICAL) WITH QUALIFICATION AND EXPERIENCE

(To be submitted)

FACILITIES BY THE OWNER

The owner shall provide the following facilities at project site, free of charge to the contractor:

Reference points: Owner/Architect/Customers representative shall provide two points at reasonable distance to form the base line and to facilitate layout and survey work by the contractor and the reference Bench mark for levels.

If available, space shall be provided for labour camps free of cost by the client. The contractor shall clean/vacate make good the space as and when instructed by the Engineer in Charge. It shall be contractor's responsibility to maintain clean and hygienic condition in and around labour camps/site premises. The contractor shall also provide temporary toilet facility for labours and demolish the same as and when instructed by the Engineer in Charge.

DEVIATIONS

No deviations are permitted from the tender specifications. Any conditional offers shall be summarily rejected.

**RESOURCE PLAN  
AND  
TIME SCHEDULE**

**(To be submitted By Contractor)**

**SITE  
MANAGEMENT  
PLAN**

## **PART - 6 A**

### **SITE MANAGEMENT**

#### **1. SITE PRELIMINARIES**

The section shall be read in conjunction with General Terms and Conditions of Contract, Works Involving Construction and Erection (GCC) as applicable. On commencement of the work apart from other stipulations mentioned elsewhere in the Contract, the Contractor shall undertake the following free of cost:

The Contractor shall accept the existing levels and dimensions of grounds, roads, ditches, culverts, nallas, buildings, etc jointly recorded and agree in writing, as the same would be taken as the basis for all subsequent measurements.

The Contractor shall set out the work properly in the field from base lines and datum levels.

The Contractor shall establish adequate number of benchmarks at key locations in such manner as the Architect/Customers representative may determine. Whenever required, Contractor shall also mark elevations and co-ordinates of foundations, pedestals, walls, columns and at cross sections of roads as required by the Architect/Customers representative. All existing utilities such as water lines, drains, transmission lines etc which contractor may encounter during the operations shall be properly maintained and protected by means of shoring, strutting, planking etc from damage as directed by the Architect/Customers representative.

The contractor shall take care to protect Owner's property during the construction. In case any property is damaged, the same shall be made good by Contractor at his own cost to the satisfaction of Owner and he shall face all consequences arising there from (e.g. accidental death of his workman after falling on underground live cable).

The Contractor shall co-operate fully in executing the work and work in harmony with other agencies working simultaneously at site.

#### **2. SITE ORGANIZATION AND EQUIPMENT**

Before the commencement of works, the Contractor shall submit to the Architect/Customers representative / Owner for his approval a complete site organization chart describing the activity of each individual and also a complete list of equipment to be used by Contractor at site. The Architect/Customers representative reserves his right to ask the Contractor for augmenting the personnel and equipment for proper and speedy execution of the works. The Contractor shall be particularly required to maintain quality control, planning department and good industrial relations.

#### **3. CO-ORDINATION PROCEDURE**

3.1 The Contractor shall liaise closely with the Architect/Customers representative, at all times in day-to-day work. Contractor shall be responsible for coordinating between the Architect/Customers representative and the Owner's site staff.

3.2 The Contractor shall program, co-ordinate and phase all works including delivery of Sub-Contractor's and suppliers' materials and execution of Sub-Contractors' work in all respects.

3.3 Contractor shall be responsible for working out quantities of bulk materials such as pipes, pipe fittings, valves, structural steel etc as per drawings and documents submitted to Contractor to ensure availability of material and manpower as per planned schedule of work.

As soon as a drawing is released, Contractor shall submit the above to the Architect/Customers representative, in prescribed format.

3.4 All works which are carried out and which do not come under preview of the drawings, shall be supported by the joint measurements and sketches, without which no bill shall be entertained.

#### **4. PROGRESS REPORTS**

**Within Fifteen days** of the receipt of Letter of Intent (LOI), the Contractor shall submit to the Architect/Customers representative a detailed programme of work showing various activities in the form of bar-chart that the Contractor will follow for the completion of work. He shall also submit minimum resources such as manpower, equipment, machines and shuttering to carry out the job as per schedule with a guarantee of reinforcement if required to cater over lapses and re-adjustments in schedule. The details shall be given in prescribed format. Contractor shall also submit in quadruplicate the weekly progress reports (on every Monday) outlining.

- Progress achieved during the previous week.
- Program for the following week covering status drawings, material procurement, construction, fabrication and erection.
- Manpower and supervisory personnel employment on the job.
- Number and type of construction aids / tools / tackles available at site in working order.
- Shortfalls, if any and reasons thereof.
- Types and areas for which various permits are required.
- Accident Report.
- Test Reports.

#### **5. SITE MEETINGS**

During the course of the work, the Contractor shall hold progress meetings on site at regular intervals as determined by the Owner / Architect/Customers representative for the purpose of coordinating the Contractors' and Sub-Contractors' works and delivery of Sub-Contractors' materials to ensure full compliance with the above. Minutes of such site meetings will be recorded, copies will be distributed to all persons concerned and full effect shall be given to all instructions mentioned herein.

#### **6. MEASUREMENTS**

Mode of Measurement shall be as per relevant provisions of standard IS Codes are applicable unless otherwise noted specifically. The Contractor shall maintain up-to-date areas / structure wise record of measurements of all the works carried out by him, jointly measured with the Architect/Customers representative / Owner. No bill will be entertained unless accompanied by measurement sheets and material reconciliation statement duly signed by Architect/Customers representative / Owner. Contractor shall give due notice to the Architect/Customers representative and Owner whenever any works or materials are intended to be covered up in order that they may be inspected or that correct measurements may be taken before being so covered up. Architect/Customers representative's decision on mode of measurement shall be final.

## **7. PRE-FINAL BILL**

Contractor shall submit a pre-final bill minimum one month in advance of final completion date, comprising of cumulative measurements based on the drawings and as certified (along with the reconciliation of material) up to the period. The final bill shall be submitted by the Contractor within one month of pre-final bill (along with material reconciliation.)

## **8. NOTES AND OBSERVATION**

During the entire construction period, the Contractor shall maintain a duplicate book. Observations and remarks pertaining to the construction will be entered into this book by the Owner / Architect/Customers representative. All notifications made directly by the Owner / Architect/Customers representative to the Contractors' address by means of registered mail shall be deemed to be sufficient and legal.

## **9. RETURN OF SURPLUS**

Notwithstanding anything contained to the contrary anywhere in this contract, wherever any materials for the execution of the contract are procured with the assistance of the Owner either by issue from Owner's stocks or purchase made under orders or permits or licenses issued by the Owner, the Contractor shall use the said materials economically and solely for the purpose of the contract and shall not dispose them off without the permission of the owner and shall return to the Owner all surplus or unserviceable materials that may be left with the contractor after completion of the contract or its termination for any reasons whatsoever on being paid or credited such price as the Owner shall determine having due regard to the initial cost and present condition of the materials at the time of such return thereof.

The price to be allowed to the Contractor however, shall not exceed the amount charged to him excluding the storage charges, if any.

## **10. MATERIAL RECONCILIATION**

It shall be Contractor's responsibility to prepare material reconciliation statements for every month and submit the same along with Running Account (R.A.) Bills and final material reconciliation statement along with final bill for any material that may be issued by Owner as free issue or at issue rate.

## **11. DOCUMENTATION**

11.1 Final Bill: At the end of the job, the Contractor shall submit three copies of final certified quantities of each item of work including any extra / additional items.

11.2 As Built Sketches : At the end of the job, the Contractor shall submit three copies of as built sketches for portion / areas not constructed as per drawings but as per instruction of Owner / Architect/Customers representative for all mechanical, piping, tanks and structural works.

## **12. CLEANLINESS**

The Contractor at all times shall keep the site reasonable free from all rubbish, offensive and harmful matter. On completion of the works, he shall remove all plant, tools, materials sheds etc. Apart from normal safety regulations as referred in General Terms and Conditions for contract involving construction and erection (GCC) , it shall be clearly understood by the Contractor that for the type of industrial structures covered by the contract, these are bound to be cut outs in floors for equipment, ducts, lifts, pipes etc. Till the time they are erected in positions, the cut outs from potential hazards and hence the same shall be properly barricaded at no extra cost, as directed by the Architect/Customers representative. Storage areas for materials like pipes, pipe fittings, and valves structural steel etc shall be as per the direction of the Architect/Customers representative. The Contractor shall be required to confine himself to these areas only for good housekeeping and for clear access.

## **13. SAFETY REGULATIONS**

In respect of all labour, directly or indirectly employed for the performance of the work by Contractor, the Contractor shall at his own expenses arrange for all the safety provisions as per the safety codes of C.P.W.D., Indian Standard Institution, The Electricity Act, The Mines Act and such other Acts as applicable. The Contractor shall also observe and abide by all Fire and Safety regulations of the Owner. Contractor shall at his own cost employ at least one safety officer at site.

**For the purpose of safety management and practices at site, Contractor shall follow the Architect/Customers representative's / Owner's safety regulations as stipulated in their Safety Manual.**



# **SAFETY RULES AND REGULATIONS**

## **PART 6**

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## **SAFETY CONDITIONS FOR UNDERTAKING SITE WORKS BY CONTRACTORS**

These Safety Conditions shall not be regarded as exhaustive. These have been issued for the guidance of the Contractor and will not in any way absolve the Contractor from any such obligations or liabilities he might incur or transfer such obligations or liabilities to the company.

### **1. GENERAL**

The Contractor shall obtain a "Work Permit" from owner before starting any work on site. The "Work Permits" are issued to prevent Contractors working in unauthorized areas and will be valid for specific area for a limited period.

The Contractor shall ensure that at no time during the erection and commissioning, his workmen operate any of the existing plant and Equipment in and around the site allocated to them.

The Contractor is to remove all waste material and rubbish from and around the work site and leave the job thoroughly cleaned up, ready for use.

With a view to the safety of its own Employees, Owner reserves the right to inspect at any time, any items of machinery or equipment brought into Owners' site by the Contractor, his servants and agents and to prohibit the use on the site of any items, which in owners opinion is or may be dangerous, but the exercise of such right for the omission to exercise it any particular case shall not detract from the Contractor, his agents and servants responsibilities in respect of his machinery, equipment and system of working nor give the Contractor any right against Owner in respect thereof. The Contractor shall execute the work in a manner causing the least possible interference with the business of owner, or with the work of any other Contractor who may be engaged on the premises and shall at all times coming with the reasonable requirements of Owners' senior project engineer at site.

All precautions necessary not only for the safe working of the Contractors' workmen at site shall be taken by the Contractor, but shall also deploy all precautions to safeguard existing structures, equipment and workmen of other agencies in and around the job site.

### **2. SECURITY**

For carrying out work at heights exceeding 6 (Six) feet or over and near openings in floors, roofs etc, the following precautions are to be taken:

Safety Belts to be worn and hook properly fastened.

Written permission of Owner is to be obtained before carrying out any work on roof. Adequate safety precautions like use of safety belts, crawling ladders, safety net etc., are to be taken.

All workmen engaged on overhead work shall be experienced in such work.

Whenever possible, steel staging or platform shall be erected with planks of minimum thickness 2" and minimum width 12". When the nature of the work demands staging of a greater width than one plank, additional planks shall be added and latched securely together.

Staging shall be provided with simple safety rails or ropes, throughout its length, at waist height and on each open side.

Staging supports shall be steel scaffolding safely secured and supported on firm level footings or slung from overhead beams. The supports shall be situated at maximum distance of 8 ft. apart and the staging shall be secured to each support.

Wherever it is not possible to put up staging and / or use safety belts / safety nets or sheets shall be slung beneath the place of work.

When working over open process, vessels or tanks, safety belts and safety nets shall always be used whether or not staging and scaffolding is provided.

Safe access to all points of works shall be provided in the form of suitable ladders, stairways etc.

Area below is to be suitable fenced off to avoid injuries to passerby. Warning boards and signs should also be put up.

### **3. EXCAVATIONS**

In the event of an excavation being made or a man hole being lifted etc, the Contractor shall be responsible for seeing that any opening, sump or pit caused by him or his Sub-Contractors is securely fenced as required by the Factory Act.

### **4. LIFTING GEAR**

The Contractor shall produce Test Certificate to Owner from approved certifying authorities for all of his lifting gear and hoists (slings, chains, hooks, chain pulley blocks, winches, hoists, cranes etc.) before being allowed to start work.

These certificates shall be retained at site with Contractor's supervisor for subsequent spot checks also

### **5. PRESSURE AND LEAK TESTING**

Pressure and leak testing of all equipment is normally to be done hydraulically. However, in special cases where pneumatic testing is essential, written approval is to be obtained from Architect/Customers representative before starting work. Under no circumstances gases other than Nitrogen, Carbon-dioxide, Air or steam are to be used.

### **6. ELECTRICAL**

Portable power tools rated for above 50 Volts, supply and hand lamps rated for above 24 volts supply are not permitted at site.

The transformer shall be fed through an armoured cable with a 3 pin Rey role plug, properly earthed.

All power supply / distribution boards will have canopy for protection.

All supply points shall have proper plug and socket.

Contractor shall provided insulated flexible cables, distribution board including individual sockets with ELCB.

## **7. WELDING**

As far as possible, DC Generator sets are to be used instead of AC Transformer sets. AC transformer sets are banned for welding jobs inside vessels (both open and closed top type.)

Contractor shall get his welding sets certified by Electrical Section before starting work. These certificates shall have to be renewed every two months.

A copy of the certificates shall be displayed on respective welding sets.

Only cables in good condition and insulated holders are to be used. The length of supply cable to welding shall not exceed 25 ft and the welding set body shall be properly earthed.

The welder is to wear good quality insulated welding gloves, shoes and overalls while at work.

A charged fire extinguisher of CO2 type is to be carried with each welding set.

The welder should not use a building structure, pipeline, railway track, etc as a return path of the current.

ELCB shall be provided for human protection, on all power supply points.

## **8. FIRE REGULATIONS**

Fire Prevention: Before out any hot work (gas cutting, welding etc.) the Contractor is to obtain hot work permit from Owners' manager after ascertaining that the area is safe for working.

Smoking is strictly prohibited in site premises. This has been indicated by putting up sign boards as shown below:-

### **“SMOKING IS NOT PERMITTED IN SIDE THE SITE PREMISES”**

Even at permitted locations, cigarette ash or butts are to be disposed off in ash trays provided.

No combustible material is to be stored on or near any source of heat (i.e. hot pipes, welding or gas cutting operations, boilers, furnaces, etc.) and before leaving the place of work or Contractor's sheds the Contractors' employees are to ensure that nothing is left which could start a fire.

Special attention is to be paid to collection and disposal of oil soaked cotton waste or rags. On no account are these to be dropped into corners, pushed below equipment or left hanging on pipes.

Gas cylinder should be used in a safe manner. They should not be dropped from heights. Acetylene cylinders should be kept in upright position. Oxygen cylinders should not be kept near inflammable materials like oil etc.

Tarpaulins are not to be used in the vicinity of welding / gas cutting jobs.

Contractors' employees of at least status of a foreman shall examine all arrangement before such work is commenced and shall satisfy them that all reasonable safety precautions have been taken.

The Contractor shall remove all waste material and rubbish from and about the work site and leave the job thoroughly cleaned up, ready for use.

Contractor shall duly return the permit after job completion

**Fire Instructions:**

- Instructions for the event 'If you discover a fire': Shout "Fire, Fire" loudly, run for nearest fire alarm switch and press it.
- If possible, also dispatch someone else immediately to the Main Gate / Gate Lodge.
- Where possible, switch off any electrical and gas apparatus near the fire.
- Check the nature of fire, pick up appropriate fire extinguisher and try to put out fire.
- For paper, cloth wood fires, - Use Soda Acid type extinguisher.
- For petrol, oil and fat fires, - Use foam or carbon dioxide fire extinguisher.
- For electrical fires,- Use only Carbon dioxide fire extinguisher.

On Hearing Fire Alarm: The alarm will be given by the continuous sounding of the siren.

Make sure that your place of work is safe and wait there for further instructions.

## **9. PERSONAL PROTECTIVE EQUIPMENT**

Protective clothing, head and eye protection safety equipment are to be worn, at all times as per the job requirements.

## **10. ACCIDENTS**

In case of injury or serious illness, notify concerned department on Owner's premises. All injuries are to be reported by filling in the injury report form, which should be made available with Architect/Customers representative's representative at site.

All the Contractor's workmen shall be covered under the Employees' State Insurance Scheme/ Janata policy and other scheme which may be specified by the Statutory Authorities from time to time.

## **11. SAFETY ENGINEER**

There would be full time Safety Engineer of the Contractor at site to ensure safety in all operations. He shall be a graduate engineer with training on safety in construction.

Owners' own safety engineer would inspect the operations and instruct from time to time. He would be also authorized to stop work in case he is of opinion that such activity or condition may lead to any accident.

## **12. SAFETY REVIEW MEETING**

Periodic safety review meetings will be conducted by Owner / Owner's representative to review safety and for better co-ordination with other agencies. The Contractor's Senior Representative shall personally attend the meeting and ensure compliance.

## **13. DAILY SAFETY MEETING**

Every day morning safety review will be held with Owner's Representative and issues will be discussed and action points shall be monitored, in a separate safety register / file.

## **14. WORK AFTER NORMAL WORKING HOURS**

Extra care need to be taken for jobs being carried out after normal working hours with due re-validated work permit.

## **15. CONVEYANCE FOR EMERGENCY**

Conveyance and person with driving license should be available at site at all times of work execution so that in case of an accident, the victim can be rushed to nearest medical center. Full time standby vehicle should be provided.

First Aid Box to be kept in 'Ready to Use' condition at all times at the site office.

The Site In-charge and key supervisors to be trained on first aid, for electrical shock, fall from heights, burns etc.

## **16. PROCEDURE FOR CONTRACTOR'S ENTRY AND EXIT INTO / FROM THE SITE**

If contractor brings his property into the Site premises with the intension of taking it back at a later date, he shall:

- Present such items to the security department at the gate.
- Provide the security with two copies of list of these items neatly written (typed) on the Contractors' letterhead

The security Department shall then:

- Examine the goods and stamp both copies.
- The duplicate copy shall be returned to the contractor.

- The original shall be retained at the gate lodge and passed on to the Engineering stores the next morning.

Engineering stores shall:

- Compare his request against the valid challan indicating entry of the same material.
- Prepare a gate pass for the same (writing work of the gate pass shall be done by the Contractor and authorization by the senior departmental supervisor in engineering stores. Only one gate pass book shall be reserved for such duty and the stamp Contractors' Property' shall be stamped across the Gate Pass.
- Cancel out the original and duplicate challan or the pertinent items therein.

The security dept. shall permit exit of Contractors' property only on receipt of such gate passes as mentioned above.

#### 17. SITE RULES:

- SMOKING IS STRICTLY PROHIBITED DURING FUEL SUPPLY AND AT THE IMMEDIATE AREA.
- Use life line at high elevations if there is falling hazard. Don't work at risky areas if guardrails are not provided.
- Keep tidy your working area at all times, remove your hand tools and unused materials before leaving and leave your working area tidy after completion of work, housekeeping is part of your job, BAD HOUSEKEEPING CREATES UNSAFE SITUATIONS
- DO NOT EAT AT OTHER THAN DESIGNATED PLACES LIKE IMPROPER AND ANTI HYGIENIC AREAS
- DO NOT APPROACH WITH FLAME TO THE EXPLOSIVE AND FLAMMABLE MATERIAL DON'T SMOKE AT PROHIBITED AREAS
- Do not tamper the electrical panels and switches.
- Don't enter the any place other than your responsible area without permission.
- Follow up the site traffic rules.
- Designated transportation roads will be used for the jobsite and shortcuts will not be used.
- Don't accept your guests during the working hours.
- Don't take out any materials or hand tools from jobsite without permission.
- Inform all accidents/incidents to your chief.
- Nobody will climb the electrical towers without permission.

- Collect the scrap materials at designated place.
- Carry the hazardous liquids in special containers.
- Don't keep sharp edge tools in your working clothes.
- Avoid unsafe acts at risky areas for fire safety.
- Use all necessary proper personal protective equipment and ensure the providing of necessary warning signs while working with machinery and equipments
- Obey the warning tags on the panels, switches, valves and control systems such as 'DANGER', 'DO NOT OPERATE', 'DO NOT TOUCH' and ensure the availability of these tags in case of necessity.
- Be careful in order not to damage the cables during the transportation of construction vehicles and equipments on the route.
- Welding is prohibited without mask and no one will look the welding arc with naked eyes.
- No flammable material will be kept in the working area.
- Take all necessary precautions for fire safety.
- Don't use any vehicles if you are not driver or operator. Operators will obey the all traffic rules on the jobsite.
- SPEED LIMIT IS 10 KM/H OBEY THE SPEED LIMIT AND WARN THE PEOPLE WHO DOESN'T OBEY
- Be careful at the intensive vehicle traffic area on the jobsite and keep these roads open at all times.
- Use designated roads for transportation to the jobsite and always walk at the left side of road.
- Don't keep, eat or drink any food or drink when working at closed area.

### **SAFETY REGULATIONS ELECTRICAL**

The contractor shall at his own expense, arrange for the safety provisions as per the codes of Indian Standard Institution, Indian Electricity Act / Rule and such other Rules, Regulations and Laws as may be applicable in respect of all labour, directly or indirectly employed in the work for performance of the Contractor's part of this agreement.



While the Indian Electricity Rules 1956, as amended up to date, are to be followed in entirety, any installation or portion of the installation that does not comply with these Rules, should be rectified immediately.

The contractor shall be responsible for and indemnify the buyer against all injury to persons – both his own workmen and others and for all damage to structural and / or decorative part of the buyer's property during erection and commissioning of the equipment. The contractor shall repair / reinstate all such damage at his own cost.

It shall be ensured that the control switches and distribution boards are duly marked, the distribution diagrams of substations are prominently displayed, and the substation premises, main switch rooms and D.B. enclosures are kept clean. Particular care should be taken to prevent the substation being used as store for inflammable materials, broken furniture, waste materials etc.

No inflammable materials shall be stored in places other than the rooms specially constructed for this purpose in accordance with the provisions of the Indian Explosives Act. If such storage is unavoidable, it should be allowed only for short period and in addition, special precautions such as cutting off supply such places at normal times, storing materials away from wiring and switch boards, giving electric supply for a temporary period with due permission of engineer- in charge shall be taken.

Protective and safety equipment such as rubber gloves, earthing rods, line men's belt, portable respiration apparatus, necessary number of caution boards such as "Man on Line", "Don't switch on" etc should be provided in easily identifiable locations. Where electric welding or such other nature of work is undertaken, goggles shall be provided.

Rubber or insulating mats should be available in front of the main switchboards or any other control equipments of medium voltage or above.

Standard first Aid boxes containing materials as prescribed by the St John Ambulance or Indian red cross should be provided in easily identifiable locations and should be easily available.

Periodical examination of the first aid facilities and protective and safety equipment provided should be undertaken and proper records shall be maintained for their adequacy and effectiveness.

Charts (one in English and one in regional language – Marathi) displaying methods of giving artificial respiration to a recipient of electrical shock shall be prominently displayed at appropriate places.

A chart containing the names, addresses and telephone numbers of nearest authorized medical practitioners, hospitals, fire brigade and also officers in charge shall be displayed prominently along with the first Aid box.

Steps to train supervisory staff and authorized persons of the engineering staff in the first Aid practices, including various methods of artificial respiration with the help of local authorities such as fire brigade, St. John's Ambulance Brigade, Indian Red Cross or other recognized institutions equipped to impart such training shall be taken, as prompt rendering of artificial respiration can save life at the time of electric

shock. Electrical wiring and control switches should be periodically inspected and any defective wiring switches which will expose live parts should be replaced immediately to make installation safe. No work on live L.T. bus bars or pedestal switch boards should be handled by a person below the rank of a wire man and such a work should preferably be done in the presence of the Engineer in charge of the work. When working on or near live installation, suitable insulated tools should be used, and special care should be taken to see that these tools accidentally do not drop on live terminals causing shock or dead short. The electrical switchgear and distribution boards should be clearly marked to indicate the area being controlled by them. Before starting any work on the existing installation, it should be ensured that the electric supply to that portion in which the work is undertaken is preferably cut off. Precautions like displaying "Men at Work" caution boards on the controlling switches, removing fuse carrier from these switches and these fuse carriers being kept with the person working on the installation, etc, should be taken against accidental energization. "Permit to Work" should be obtained from the Engineer-in-charge. No work on H.T. main should be undertaken unless it is made dead and discharged to earth with an earthing lead of appropriate size. The discharge operation shall be repeated several times and the installation connected to earth positively before any work is taken up. Before energizing any installation after the work is completed, it should be ensured that all the tools have been removed and accounted and no person is present inside any enclosure of the switchboard. Any earthing connection made for carrying out the work should be removed. "Permit to work" should be received back duly signed by the person to whom it was issued in token of having completed the work and the installation being ready for energisation and "Men at Work" caution Boards removed. In case of electrical accidents and shock, the electrical installation on which the accident occurred should be switched off immediately and the affected person should be immediately removed from live installation by pulling him with the help of coat, shirt, and wooden material or with any other dry cloth. He should be removed from the place of accident to a nearby safe place and artificial respiration continuously given as contained in BIS code and standard prescribed by St John Ambulance Brigade or Fire Brigade. While artificial respiration on the affected person is started immediately, help of Fire Brigade and Medical Practitioner should be called for an artificial respiration should be continued uninterrupted until such help arrived. These instructions should be explained in Hindi / local language to those staff who does not understand English. The contractor shall ensure that all portable power tools used by the workman are rated 230 volts, double insulated and have to taken through 100 mA Earth Leakage Circuit Breaker (ELCB). Also all temporary lighting shall be supplied through 30 mA ELCB. Inserting wire into the sockets without the plug tops is not allowed. The length of the extension cord for portable tools should not be more than 5 feet. Temporary cables and flexible wires of short length should be bunched up and supported at inaccessible height. Temporary lamps should be mounted at inaccessible height. If lamps are incandescent, they should be protected by wire-mesh.

All power supply / Distribution Boards shall have canopy for protection against weather if located outdoors.

While carrying out work in Vessels / AC ducts or any other confined place, hand lamps with metallic guard suitable for 24 Volts AC supply shall be used. All non-current carrying metallic parts of electrical system and equipment shall be earthed with two separate earthing wires of adequate capacity.

### **GENERAL RESPONSIBILITY**

The contractor shall obtain a "Work Permit" from the Site Engineer / Client before starting any work at site. The work permits are issued to prevent any one working in unauthorized areas and they are valid for specific period.

The contractor shall produce test certificates from Government approved certifying authorities for all the lifting gear & hoists (slings, chains, hooks, chain pulley blocks, winches, cranes etc) before starting the work. The contractor's supervisor for subsequent spot checks shall retain the certificates.

The gas cylinders should be used in safe manner. They should not be dropped from heights. Acetylene cylinder should be kept upright position. Oxygen cylinders should not be kept near inflammable materials like oil etc.

The contractor is to remove all waste materials from and around the work site and leave the work spot spick and span.

### **HOT WORK**

Before carrying out any hot work (gas cutting, welding etc) the contractor shall contact the site-in -charge to ascertain about the safety of the area for welding work.

For welding work DC Generator sets are to be used instead of AC transformer sets.

The contractor shall produce certificates for his welding sets checked by the site in charge of consultant before starting the work. The certificates shall have to be renewed every two months. A copy of the current certificate shall be displayed on the welding sets.

Only cables in good condition and insulated holders are to be used. The length of the supply cable shall not exceed 25 feet and the welding set body shall be properly earthed. Under no circumstance building structure pipeline should be used as a return path of the current.

A charged fire extinguisher of CO2 type is to be carried with each welding set.

The welder is to wear good quality insulated welding gloves, shoes & goggles while at work.

Tarpaulins are not be used in the vicinity of welding / gas cutting jobs.

### **EXCAVATION**

In the event of an excavation being made, it is the responsibility of the contractor to see that any opening, sump or pit caused by them is securely fenced as required by the Factory Act.

### **WORKING AT HEIGHT**

For carrying out work at heights exceeding 6 feet or over and near the opening in floors, roofs, etc the following precaution to be taken.

The written permission of the Departmental Manager is to be taken before carrying out any work. Adequate safety precautions like use of safety belts, crawling ladders etc are to be taken.

All personnel engaged on overhead work shall be men experienced in such work.

Whenever possible timber staging or platform shall be erected with planks of minimum thickness 2 inches and minimum width 12 inches when the nature of work

demands staging of a greater width than plank provided then additional planks shall be added and lashed securely.

Staging shall be provided with simple safety rails or ropes throughout its length, at waist height and on each open side.

Staging supports shall be of standard steel scaffolding safely secured and supported on firm level footings or slung from overhead beams. The supports shall be situated at a maximum distance of 8 feet apart and staging shall be secured to each support.

In case the site or nature of work is unsuitable for erection of proper staging all workers shall wear safety belts around their waists and secure their lifelines to strong scaffolding or structural members.

Wherever it is not possible to put up staging and / or use safety belts, safety nets or sheets shall be slung beneath the place of work.

When working in open process vessels or tanks, safety belts or safety nets shall always be used whether or not staging and scaffolding is provided.

Safe access to all points of work should be provided in the form of suitable ladders, stairways etc.

Contractor's employee of at least status of a foreman shall examine all arrangements before starting such work is commenced and shall satisfy himself that all reasonable safety precautions have been taken.

### **FIRE INSTRUCTIONS**

Before carrying out any hot work (gas cutting, welding etc) the contractor shall contact the site-in -charge to ascertain about the safety of the area for welding work.

Smoking is strictly prohibited in factory premises. Severe action will be taken if any of the contractor's workmen is found smoking at the work site area.

In case fire is discovered, dispatch additional force & site Engineer. Wherever possible switch off any electrical and gas apparatus near the fire.

Check the nature of fire, pick up appropriate fire extinguisher and try to put out fire. For Electrical fire use carbon dioxide fire extinguisher.

### **PERSONAL PROTECTIVE EQUIPMENT**

The personal protective equipment should be worn wherever necessary.

### **REVIEW MEETINGS**

Periodic safety review meeting shall be conducted to review safety and for better coordination with other agencies.

Periodically safety review will be held with Site Engineer and issues will be discussed and action points shall be monitored and recorded in a separate safety Register / File.

### **SAFETY AUDITS**

Periodic safety audit shall be carried out by CONSULTANT. The interval between the safety audits shall be discussed with Site Engineer / safety Officer.

### **WORK AFTER NORMAL WORKING HOURS**

Extra care need to be taken for jobs being carried out after normal working hours with due revalidated work permit.

**ACCIDENTS**

In case of injury or serious illness, the department should be informed immediately. All injuries are to be reported by filling in the "injury report" form, which will be available with the respective department / site engineer.

These safety conditions should not be regarded as exhaustive. These have been issued for the guidance of the contractor and will not in any way absolve the contractor from any obligations or liabilities that might incur or transfer such obligations on liabilities to the company.

# TECHNICAL CONDITION OF CONTRACT

## TECHNICAL CONDITIONS OF CONTRACT (CIVIL)

INTENT

The intent of this document is to define the technical requirement and the quality standards of the materials to be incorporated in the works and the workmanship during the execution of the works.

#### GENERAL

All works shall be as per the relevant IS / CPWD specifications unless otherwise mentioned below:

Wherever in the specifications mention is made of any produce by name, make or catalogue number, it shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The contractor, in such cases, may use any product, which is equal to that name, provided prior written approval from the Architect / Customers representative is obtained.

Unless substitution is requested no deviation from the specification will be permitted. Failure to propose the substitution of any article within 30 days after signing of the contract or after specific details given by the Architect/Customers representative will be deemed sufficient cause for the denial of the request for substitution.

If any particular structural steel sections mentioned in the drawing and design are not available, and the employer and the Architect/Customers representative are convinced accordingly, the alternative sections are to be decided by the Architect/Customers representative at his discretion. If no extra charges have been specified for items involving work below or above ground level or above roof level for additional lifts, it should be presumed that rates for such items as shown in drawings and bill of quantities are inclusive of work at additional depths or lifts.

The contractor shall, without any extra charge, at all stages furnish any data required by the Architect/Customers representative such as levels, falls, slopes etc. to enable him to take suitable decisions required for proper execution of the work.

The Architect/Customers representatives' decision in these respects shall be final and binding on the contractor.

#### SECURITY

Contractor shall not disclose any information furnished by the owner/Architect/Customers representatives nor any drawings, reports and any other information prepared by the contractor for the project, without the prior written approval of the owner, except in so far as disclosure is necessary for the performance of contractors work and services under this contract.

## TECHNICAL SPECIFICATIONS

The various items indicated in BOQ shall be read in conjunction with the technical specifications of the tender, and IS/CPWD specifications as applicable to such items. In the event of variance and /or ambiguity or incompleteness between Technical specifications, IS specifications, CPWD stipulations, and BOQ description, the following order shall prevail .

- a) BOQ Description
- b) Technical Specifications
- c) IS specifications
- d) CPWD specifications



## **TECHNICAL SPECIFICATIONS FOR CIVIL AND STRUCTURAL WORKS**

### **A. EARTHWORK AND LEVELLING –**

#### **A-1. SETTING OUT AND LEVELLING**

The contractor shall set out and level the works and shall provide all instruments and attendance required by the Architect/Representative of Architect/Customers representative/Engineer-In-Charge for checking the work.

The contractor shall all time maintain in good working condition a Dumpy Level, Theodolite at site to enable the site Engineers to check the line & levels of work.

#### **A-2. EARTH WORK**

Before starting actual excavation work, contractor shall notify the Engineer-in-charge for taking the necessary measurements of cross sectional levels along the alignment for measurement purposes. The levels recorded in the field book shall be signed by the Engineer-in-charge and authorized representative of the contractor in token of acceptance. The contractor shall remove all the material from the marked area of excavation by using labour, tools and equipments most suitable for excavation of soft material as enumerated in the item in wet or dry conditions. The excavation shall be true to line, curve, and shape, level grade as per the drawings or as directed. The widths of excavations shall be as minimum to the widths required at the bottom and the vertical faces shall be as far as possible in plumb. Unless provided in the contract, no extra payment shall be made for the excavation on side slopes for stability of slopes. Contractor shall be fully responsible for the correctness of the excavation. Whenever the strata of different grade of soil not covered in this item is met, the excavation shall be stopped and the Engineer-in-charge shall be notified to take the cross-sectional levels for taking the measurements and the same shall be recorded and practice as mentioned above shall be adhered to. The extra excavation in depth or on sides shall not be paid and the contractor will have to fill the extra excavated depths in layers to bring the correct level by watering and ramming at his own cost.

#### **A-3. CLEARING**

Before commencement of excavation work the area shall be cleared off small trees (the trees not exceeding 15 cm girth at 1.2 m height from ground level), roots, heavy grass, logs, stumps, rubbish, slush etc. and other objectionable matter. The material so removed shall be burnt or disposed off as directed by the engineer. Where earth fill is intended the area shall be stripped off all loose and soft patches, and top soil containing objectionable matter before the earth fill commences. The trees other than the small trees (as defined above) shall not be cut and shall be brought to the notice of Owner/Architect/Customers representative if fouling within the construction area.

#### **A-4. EARTHWORK IN EXCAVATION**

Classification:

The earthwork will be classified under any of the following categories:

**A-4.1 Soft or Loose Soil:**

Generally any soil which yields to ordinary application of pick and shovels or to phawara, or other ordinary digging implements, such as organic soils, turf-gravel, sand, silt, loam, clay, peat, soft shale, loose murum.

**A-4.2 Hard or Dense Soil:**

Generally any soil which requires the close application of picks or jumpers or scarifies to loosen such as silt clay, gravel, cobble stones and boulders up to .03 cum in volume, hard shale, compact and hard murum, soft conglomerate etc. This will also include hard core soling, macadam surfaces, tarmac, stone and brick masonry works.

**A-4.3 Soft Rock:**

Rocks or boulders which may be quarried or split with crow bars. This will also include laterite and hard conglomerate and PCC works.

**A-4.4 Hard Rock:**

Any rock excluding the soft rock, or boulders for the excavation of which the blasting is required. This also includes RCC works.

**A-4.5 Hard rock (Blasting prohibited)** Hard rock which requires blasting as described in (d) above, but where the blasting is prohibited for any reason and excavation has to be carried out by chiseling or by pneumatic implements.

**A-5. EXCAVATION TO THE CORRECT PROFILE –**

When the excavation work is carried out for road works, open drainage works or any other works like foundation works, basement etc the profile shall be maintained as per the approved drawings.

**A-6. EARTHWORK IN EMBANKMENT**

All the fill material will be subject for Architects/Customer Representatives approval. If any material is rejected by Engineer-In-Charge/Architect/Customers representative the contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill materials shall be deposited or disposed off as directed by the Engineer-In-Charge/Architect/Customers representative after the fill work is completed. No earthfill shall commence until surface water discharges and the streams have been properly intercepted or otherwise dealt with as directed by Engineer-in-charge/Architect/Customers representative.

**A-7. ALLOWANCE FOR SETTLEMENT –**

Work before being finally paid, shall be brought to the correct level. Final measurements will be made on allowing the filling works for settlement, for one complete monsoon. In the event the measurements are to be finalized before and hand allowance shall have to be made by extra earthwork for which no payment will be made. Until the certified completion of the contract, all banks and cuttings are to be maintained by the contractor.

#### A-8. PRESERVATION OF BANKS –

The contractor shall make good all losses due to subsidence, wastage or guttering due to rain, wind, wear, or from any cause whatsoever and shall have no claims for extra works on this account.

##### Protective Measures:

All the excavated pits, trenches etc. shall be properly protected from any accidents by providing strong fencing around. At night red lantern and watchman shall be kept in proper position to indicate the danger zone. It is the responsibility of the contractor to take the adequate protective measures and safety of the excavation, people and workmen and surrounding properties and will have to bear the damages if caused. All the cost of protective measures shall be included in the item rate.

#### A-9. FILLING IN LAYERS –

All the banks shall be made up in successive layers of not more than 30 cms in depth over the whole width between the toes of the slopes. Side slopes shall be carried out simultaneously with the rest of the work and not filled in afterwards. In setting up profiles due allowances for subsidence must be made and must be added to all the heights of the actual height of formation level.

#### A-10 FILLING IN PITS AND TRENCHES AROUND FOUNDATIONS OF STRUCTURES, WALLS ETC. IN EXCAVATED MATERIALS–

##### A-10.1 General –

After the structural foundation and plinth construction is over, the space between ground level and sub level below top of plinth depending upon the depth of flooring, its bedding and foundation is to be filled in with approved excavated materials watered and compacted.

##### A-10.2 Construction-

Firstly the ground over which the filling has to be done shall be cleared of all grass, loose stones , rubbish of all kinds, as well as trees , bushes , roots of trees, etc. If there is water in the area, it shall be pumped out or haled out. The sides of concrete and masonry in the foundation trenches shall be filled with suitable excavated materials and compacted.

Next, the approved excavated material , which has been stacked as per the direction of the Engineer in charge shall be cleaned of all rubbish, large size stones etc. clods broken down to a size of 50mm or less , conveyed to the site of filling and laid in 30cm layers. Each layer shall be watered and compacted with heavy rammers/roller of 8 -10 tons before the upper layer is laid till the required level is reached so as to form a thoroughly compact base. The process of filling in plinth , watering and compaction shall be carried out by the contract or in such a way as not to endanger the foundation columns, plinth walls etc. already built up. Under no case black cotton soil shall be allowed for filling in plinth and foundations.

#### A-11. PLINTH FILLING IN CONTRACTORS SOIL–

##### A-11.1. General:

After the structural foundation and plinth construction is over, and the sides of foundation trenches are filled up to ground level, the space between ground level and such level below top of plinth depending

upon the depth of flooring, its bedding and foundation shall be filled in with contractors soil, sand or murum, as specified and approved by the Engineer in charge.

**A-11.2 Construction:**

The filling shall be carried out firstly by clearing of grass, loose stones, rubbish of all kinds, as well as trees, bushes, roots of trees, etc. If there is any water in the area, it shall be pumped out or hauled out. The material to be filled shall be brought from outside instead of from the foundation excavation.

The material to be brought from outside shall be either sand, murum and shall be got approved by the Engineer in charge. In no case, black cotton or similar greatly expansive and shrinkable soil shall be used.

The approved material to be filled in shall be broken to a size of 50mm or less. The stacking of material should be done in such a way as not to interfere with any general traffic, or any constructional process or activities. The contractor shall be responsible for any mishap or inconvenience of any kind due to his default in this respect.

**A-11.3 Item to include—**

1. Clearing the ground on which filling is to be done and dewatering if necessary.
2. Providing the approved material for filling in.
3. Cleaning up the material to be used for filling if necessary.
4. Filling contractors soil in plinth in layers, watering and compaction.
5. All labour, equipment and other arrangement necessary for satisfactory completion of the item.

**A-12. RUBBLE SOLING –**

**A-12.1 General –**

After the structural foundation, plinth construction and filling are completed, rubble soling of specified thickness shall be laid over the consolidated plinth filling, hand packed and compacted.

**A-12.2 Materials-**

The stones to be used shall be broken rubble with fairly regular shape and free from weathered, soft and decayed portion. The rubble shall be sound stones of the type mentioned in the item and selected for their larger size. Stones shall be of the full height of the soling and the length and width shall not generally exceed 2 times the height. The stones to be used for wedging in the joints between larger stones shall be chips of the largest size possible to fit in the interstices. All sound and suitable rubble obtained from the foundations excavated and approved by the Engineer in charge shall be necessarily made use of first unless otherwise directed.

**A-12.3 Construction –**

The bed on which rubble soling is to be laid shall be cleared of all loose materials, leveled, watered and compacted and got approved by the Engineer before laying rubble soling.

Rubble soling shall be laid to the specified thickness closely packed by hand and firmly set with their broadest face downwards. The interstices between adjacent stones shall be wedged in with stones of the proper size and shape and well driven in with wooden mallets to ensure a tightly packed layer. Such wedging shall closely follow the placing of the larger stones. After hand packing and wedging, compaction of the soling shall be done thoroughly with log rammers/rollers. Adequate care shall be taken by the

contractor while laying and compacting the rubble soling to see that the masonry or any part of the structure is not damaged. Rubble soling shall be started only after the masonry is fully cured.

A-12.4 Item to include –

1. Supplying broken rubble of approved quality and size at site.
2. All labour, material, tools and equipment for handling, laying hand packing and compacting the rubble.
3. Any other incidental charges to complete the work as per the drawings.

**A-13 Conveying of surplus excavated earth to outside:**

A-13.1. General –

This item covers the payment for the additional lead over the initial free lead involved in conveyance of surplus excavated materials required to be stacked or spread at a distance of more than 1000 meters' from the building shall be disposed off in the locality fixed by Engineer.

The material shall be conveyed by means of suitable devices, and / or conveyance without any loss or damage to the materials being removed. The conveyance shall not also cause obstruction or nuisance to the traffic by scattering the material being conveyed, on to the road or cause any sort of nuisance to the nearby property owners. The material conveyed to the place of disposal shall either be either stacked or spread as directed.

The opening up and maintenance of the route, payment of the royalties, compensation to land owners and for damages if any, etc. during the process of conveyance etc. shall be the entire responsibility of the contractor.

**A-14 Pre - constructional anti-termite treatment:**

Providing pre-constructional anti-termite treatment to building at different stages of construction by applying chemical emulsion Aldrin 0.5% E.C. or chlordane 1% E.C. doses as specified in IS:6313 (Part III) 1981 list for different stages, including pre-constructional soil

treatment in foundation and plinth including drilling the holes of requisite size with inserting GI pipes and plugs as well along the exterior periphery of building below apron so as to form chemical barrier including giving treatment to wooden members including all labour, material, tools & plants etc. complete with 5 years guarantee.

A-14.1 General:

The item pertains to providing pre-constructional anti-termite treatment to building at different stages of construction by applying different appropriate chemicals as per provision in IS: 6313 (Part I-II) 1981. The item also covers the treatment to soil.

A-14.2 Material:

A-14.2.1. Chemicals: Any one of the following chemicals preparing water emulsion to achieve the percentage concentration specified against each chemical shall be used for anti-termite treatment.

Chemical Relevant Indian Standard Concentration by Volume

A-14.2.1a. Aldrin emulsifiable concentrate IS: 1307-1982 0.5%

A-14.2.1b. Heptachlor emulsifiable concentrate. IS: 6439-1972 0.5%

A-14.2.1c. Chlordane emulsifiable concentrate. IS: 2682-1966 1.0%

Chemicals are available in concentrated form in the market and concentration is indicated on the sealed containers. To achieve the specified percentage of concentration, chemical should be diluted with water in required quantity before it is used.

Graduated containers shall be used for dilution of chemicals with water in the required proportion to achieve the desired percentage of concentration. For example, to dilute chemical of 30% concentration, 69 parts of water shall be added to one part of chemical for achieving 0.5% concentration. Contractor shall procure the chemical of required concentration in sealed original containers directly from the reputed authorized dealers. The chemical shall be kept in the custody of the contractor or his authorized representatives and issued for use to meet the day's requirements. Empty containers shall be property of contractor.

A-14.3. Safety Precautions: All chemicals used for anti-termite treatment are POISONS. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mists or swallowed. The containers having emulsifiable concentrates shall be clearly labeled and kept secured in closed stores so that children or pet cannot get at them. Storage and mixing of concentrates shall not be done near any fire source or flame. Persons using these chemicals shall be warned that absorption through skin is the most likely source of accidental poisoning. Particular care shall be taken to prevent skin contact with concentrates and prolonged exposure to dilute emulsion shall also be avoided for which safety gloves shall be provided to the work man. After handling the concentrates or dilute emulsion, workers shall wash themselves with soap and water and wear clean clothing, especially before eating and smoking. In the event of severe contamination, clothing shall be removed at once and the skin washed with soap and water. If chemical has splashed into the eyes they shall be flushed with plenty of soap and water and immediate medical attention shall be sought. The use of plain pair of spectacles or goggles should provide to the workman. Care should be taken in the application of chemicals to see that they are not allowed to contaminate wells or springs, which serve as source of drinking water.

The work shall be carried through Sub Agency registered with appropriate authority.

The person executing this job should be provided with apron, pair of hand gloves, mask, safety specs etc.

#### A-14.3.1 Pre-Construction Chemical Treatments:

A-14.3.1 a. Chemical treatment of soils for the protection of buildings from attack of subterranean termites shall be done as per IS: 6313 (Part II)-1981. Treatment shall be got done only from the approved specialized agencies using the chemicals procured from reputed and authorized dealers. Graduated containers shall be used for dilution and spraying of the chemical shall be done using hand operated pressure pumps. Proper check should be kept to ensure that the specified quantity of chemical is used for the required area during the operation.

A-14.3.1 b. Time of Application: Soil treatment should start when foundation trenches and pits are ready to take bed concrete/leveling course in foundations. Laying of bed concrete/leveling course should start when the chemical emulsion has been absorbed by the soil and the surface is quite dry. Treatment should

not be carried out when it is raining or soil is wet with rain or sub soil water. Treatment to the surface of earth filling within the plinth shall also be done in the same manner laying the sub-grade for flooring.

A-14.3.1 c. Disturbance: The treated soil barrier shall not be disturbed. If for some reasons the treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

**A-14.3.2. Treatment of Masonry Foundations and Basements:**

A-14.3.2 a. The bottom surface and the sides (up to a height of 300 mm) of the excavations made for masonry foundations and basements shall be treated with the chemical at the rate of 5 liters per square meter surface area.

A-14.3.2 b. After the masonry foundations and the retaining wall of the basements come up, the backfill in the immediate contact with the foundation structure shall be treated at the rate of 7.5 liters per m<sup>2</sup> of the vertical surface of the substructure for each side. If water is used for ramming, the air fill, the chemical treatment shall be carried out after the ramming iteration is done by Roding the earth at 150mm centers close to the wall surface and spraying the chemical with the above dosage. The earth is usually returned in layers and the treatment shall be carried out in similar stages of back filling. The chemical emulsion shall be directed towards the concrete or masonry surfaces of the columns and walls so that the earth in contact with these surfaces is well treated with the chemical.

A-14.3.3. Treatment for RCC Foundation and Basements: In case of RCC foundations, the concrete mix is dense (being M25 or richer). It is, therefore, unnecessary to start the treatment from the bottom of excavations. The treatment shall start at the depth of 500 mm below ground level except when such ground level is raised or lowered by filling or cutting after the foundations have been cast. In such cases, the depth of 500 mm shall be determined from the new soil level resulting from the filling or cutting mentioned above, and soil in immediate contact with the vertical surfaces of RCC foundations shall be treated at the rate of 7.5 liters per square meter.

A-14.3.4. Treatment of Top Surface of Plinth Filling: The top surface of the filled earth within the plinth walls shall be treated with chemical emulsion at the rate of 5 liters per m<sup>2</sup> of the surface before the sand/sub-grade is laid. Holes up to 50 to 75 mm deep at 150 mm centers both ways shall be made with crow bars on the surface to facilitate saturation of the soil with chemical emulsion.

A-14.3.5. Treatment at Junction of the Walls and the Floor : To achieve continuity of the vertical chemical barrier on inner wall surfaces from the ground level, a small channel 30 x 30 mm shall be made at all the junctions of walls and columns with the floor (before laying the sub-grade) and rod holes made in the channel up to ground level 150 mm apart and the chemical emulsion poured along the channel @ 7.5 liters per m<sup>2</sup> of the vertical wall or column surface so as to soak the soil right to bottom. The soil shall be tamped back into place after this operation.

A-14.3.6. Treatment of Soil along External Perimeter of Building: After the building is complete, 300 mm deep holes shall be provided in the soil with iron rods along the external perimeter of the building at intervals of about 150 mm and these holes shall be filled with chemical emulsion at the rate of 7.5 liters per m<sup>2</sup> of vertical surfaces. If the depth of filling is more than 300 m, the external perimeter treatment

shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier. In case the earth outside the building is graded on completion of building, this treatment shall be carried out on completion of such grading.

A-14.3.7. Treatment of Soil under Apron (Plinth Protection) along External Perimeter of Building: Top surface of the consolidated earth over which the apron is to be laid shall be treated with chemical emulsion at the rate of 5 liters per square meter of the surface before the apron is laid. If consolidated earth does not allow emulsion to seep through, holes up to 50 to 75 mm deep at 150 mm centers both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion.

A-14.3.8. Treatment for Expansion Joints: Anti-termite treatment shall be supplemented by treating with chemical emulsion through the expansion joint after the sub-grade has been laid @ 2 liters Per linear meter of expansion joint.

A-14.3.9. Treatment of Walls Retaining Soil above Floor Level: Retaining walls like the basement walls above the floor level retaining soil need to be protected by providing chemical barrier by treatment of retained soil in the immediate vicinity of the walls, so as to prevent entry of termites through the voids in masonry, cracks and crevices, etc. above the floor level. The soil retained by the walls shall be treated at the rate of 7.5 liters per m<sup>2</sup> of the vertical surface so as to affect a continuous outer chemical barrier, in continuation of the one formed under 3.4.

A-14.3.10. Treatment of Soil Surrounding Pipes, Waster and Conduits: When pipes, wastes and conduits enter the soil inside the area of the foundations, the soil surrounding the points of entry shall be loosened around each such pipe water or conduit for a distance of 150 mm and to a depth of 75 mm before treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated for a distance of over 300 mm unless they stand clear of the walls of the buildings by about 75 mm.

A-14.3.11. Item to Include:

The item includes providing all labour, material, tools & equipments etc. at different stages of construction of a building, ant termite treatment. Item also includes all precautions while dealing with the poisonous chemicals. The item and the rate also includes guarantee of the treatment for 5 years.

A-14.3.12. Mode of Measurement and Payment:

All measurements shall be in m<sup>2</sup> and shall be for plinth area of the building and the soil treatment area outside the building shall be measured separately. The contract rate shall be per sqm of plinth area of treatment.

## **A-15. APPLICABLE CODES**

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable.  
In all cases, the latest revision of the codes shall be referred to.

- a) IS - 783      Code of Practice for Laying of Concrete Pipes.



- b) IS - 1200      Method of Measurement of Building Works
- c) IS - 3764      Safety Code for Excavation Work
- d) IS - 3385      Code of Practice for Measurement of Civil Engineering Works.
- e) IS - 2720      Part-II Determination of Moisture Content.  
  
Part-VII Determination of Moisture Content- Dry Density Relation Using Light Compaction.  
  
Part-VIII Determination of Moisture Content - Dry Density Relation Using Heavy Compaction.  
  
Part-XXVIII Determination of Dry Density of Soils, in-place, by the Sand Replacement Method.  
  
Part-XXIX Determination of Dry Density of Soils, in-place, by the Core Cutter Method.

#### **A-16. MODE OF MEASUREMENT**

**All the items shall be measured as per IS 1200 measurement code.**

- 1) The excavation works shall be measured as under:

For measuring the excavation works for mass excavation, foundations, basement, footings & trenches the plan size with PCC shall be considered, or the actual space left by the contractor whichever is less. The quantity of excavation shall be calculated by multiplying the plan area, as derived above, by actual depth of excavation or as stiputed. If extra depth is excavated contractor has to refill the area with M15 grade concrete with his own cost. The tenderer shall built in their rate the extra excavation required for allowing the ramps, slopes, working space etc and no extra on this account shall be allowed. The excavation for piping works shall be measured as per relevant IS, if it is not included in the item itself.

- 2) The filling works shall be measured as under:

The actual measurement of the fill shall be calculated by taking levels of the original ground before start of the work after site clearance and after compaction of the fill at suitable intervals and the quantity of fill computed from these levels.

The deductions shall be made from actual measurement in all cases of fill except for floors to arrive at net measurement of filling based on pre-accepted or specified deduction (stated as percentage) for voids.

If the filling is obtained from the borrow pits it shall be measured from the borrow pits as excavation.

## **B REINFORCED CONCRETE AND ALLIED WORKS**

All the concrete in the works shall be controlled concrete as defined in IS: 456 unless otherwise specified.

### **ALL CONCRETE WORKS SHALL BE FORM FINISH .**

The quality of material and method and contract of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall confirm to the applicable portion of this specification.

The Engineer-in-charge/Architect/Customers representative shall have the right to inspect the sources of material/s, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment and the quality control system such as inspection shall be arranged and the Engineer-in-charge/Architect/Customers representative 's approval shall be obtained prior to starting of the work.

#### **B-1. CEMENT**

Unless otherwise specified or called for by the Engineer-in-charge /Architect/ Customers representatives/Owner cement shall be ordinary and/or pozolana Portland cement in 50 kg bags. Changing of brands or type of cement within the same structure or portions thereof shall be permitted only with the approval of Engineer-in-charge/ Architect/Customers representative.

A certified report altering to the conformity of the cement to IS specs by the cement manufacturer shall be furnished to Engineer-in-charge /Architect/Customers representative.

The cement shall be stored in watertight shed and in the manner that the rotation of fresh and old is taken care. The bags should be kept on a wooden pallet or runner and the stacking to be done properly to avoid collapse. It should be stored away from the sides of shed for access and precautionary measure to avoid rain water.

#### **B-2. AGGREGATES**

B-2.1) Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete.

B-2.2) Fine aggregate is aggregate most of which passes through 4.75 mm IS Sieve.

B-2.3) Coarse aggregate is aggregate most of which is retained on 4.75 mm IS Sieve.

B-2.4) All fine and coarse aggregate proposed for use in the work shall be subject to Engineer-in-charge/Architect/Customers representative's approval.

B-2.5) Machine made/crushed sand shall be used, provided the constituent rock composition shall be sound, hard, dense, non organic, durable etc.

#### **B-3. WATER:**

B-3.1 Water used for both mixing and curing shall be free from injurious amount and deleterious materials.

B-3.2 The suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS 456.

B-3.3 The PH value of water shall generally be not less than 6.0

**B-4. REINFORCEMENT:**

B-4.1. M.S/Tor steel shall confirm to the relevant latest IS code of practice. The steel brought on site shall be got tested (at approved laboratory at the contractors cost before using on site).

**B-4.2 Storage:**

The reinforcement shall not be kept in direct contact with the ground but stacked on top of an arrangement of timber sleepers or the like. Bars of different classification size and length should be stored separately.

If the reinforcing rods have to be stored for a long duration, they shall be coated with cement was before stacking and/or be kept under cover or stored as directed by the Architect/Customers representative. Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion and deterioration.

**B-5. CONCRETE GRADE**

Concrete grade shall be as designated on drawings. In concrete grade M15, M20, M25 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq. mm as per IS:456.

**B-6. DESIGN MIX CONCRETE:**

It shall be contractor's sole responsibility to carry out the mix designs at his own cost. He shall furnish to Architect/Customers representatives at least 10 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. Trial mixes shall be designed in accordance with IS 10262" Recommended guidelines for concrete mix design". The compliance of a designed mix for structural concrete shall be judged by the strength of the hardened concrete in comparison with the specified characteristic strengths. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS: 516 shall comply with the requirements of IS: 456. Minimum compressive strength for the various grades of concrete are as specified under:

Grade of Concrete	Min. compressive strength	Min. compressive strength
	after 7 days in N/sq. m	after 28 days in N/sq. mm
M20	13.5	20.0
M25	17.0	25.0
M30	20.0	30.0
M35	24.0	35.0

Conversion to volumetric proportion

Contractor should use weigh batcher for site mixing or concrete from batch type RMC is only allowed. No volume batching is allowed.

#### B-7. BATCHING OF CONCRETE:

In proportioning concrete, the concrete of both cement and aggregate shall be determined by weight. in case uniformity of aggregate has been established over a period of time, and where weigh batching is not practicable , the quality of fine and coarse aggregate (not cement) may be determined by volume if permitted by the Engineer. if fine aggregate is moist and volume batching is adopted, allowance shall be made for bulking in accordance with IS 2386( part 111).

The water cement ratio shall be maintained constant at its correct value. to this end , determination of moisture content in both fine and coarse aggregate shall be made by the contractor at no extra cost. The frequency of tests shall be determined by the Engineer-in-charge according to weather conditions. The Customers representative may request test whenever he feel the correct moment. The contractor has to fulfill the request immediately at his own costs.

#### B-8. TESTING

##### B-8.1. Slump Test.

Slump tests shall be carried out as often as demanded by the Engineer-in-charge/Architect/Customers representative and invariably from the same batch of concrete from which the test cubes are made. Slump tests shall be done immediately after sampling.

##### B-8.2. Concrete Cube and other Ingredient Testing.

All testing shall be done as per approved field quality plan. The field quality plan shall be prepared in line with IS: 456. Contractor shall produce the test results of the cubes in time and shall maintain proper record of it.

#### B-9. NOMINAL MIX CONCRETE:

No mix design or preliminary tests are necessary for Nominal Mix Concrete. Nominal Mix Design shall be restricted to works of minor nature in which the strength of concrete is not critical as decided by the Engineer-in-charge/Architect/Customers representative. Proportions for Nominal Mix Concrete shall be in accordance with IS 456.

#### B-10. MIXING OF CONCRETE:

Concrete shall be mixed in a mechanical mixer. The mixer shall comply with IS 1791. The mixing shall be continued until there is uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete shall be remixed. For guidance, the mixing time may be 1 ½ to 2 minutes.

Workability of the concrete shall be controlled by direct measurement of water content. Workability shall be checked at frequent intervals (See IS 1199).

#### B-11. CONSTRUCTION JOINTS

Construction joints shall be properly planned and shall be as per the Engineer-in-charge / Architect / Customers representative's instructions. They shall be made at right angles to the member, and shall be made against firm stop boards. The stop boards shall be removed as soon as possible after placing the concrete. The concrete shall be well brushed off with steel brush and be provided with a key for next lift. Before the next lift is over the joint shall be well scrubbed to remove all loose materials.

#### B-12. FORM WORK

All form work for RCC water retaining structures shall be either new waterproof plywood or new steel plates only. After each use form work should be thoroughly cleaned, checked for accuracy and approved by Customers representative for further repetition for work. Damaged formwork shall not be used. All the concrete of grade M20 and above shall be fair face concrete. Extra care shall be taken to ensure proper cover to the reinforcement. Readymade plastic cover moulds or mortar cubes shall be used for all concrete work. A smooth finish shall be obtained with the use of lined or plywood forms having smoothed and even surfaces. In case after removal of the forms, joint marks, blemishes, projections etc. are visible, it is Customers representative's decision to request the removal of concrete elements at contractors cost or to take further decision like, e.g. joint marks shall be smoothed off, and all blemishes, projections etc. shall be removed properly leaving the surface smooth.

#### B-13. DESIGN OF FORMWORK

The design and engineering of form work as well as its construction shall be the responsibility of contractor. If so instructed, the drawings and/or calculations for the design of form work shall be submitted to the Architect /Customers representatives for their approval at no extra cost. Architect / Customers representative's approval however, shall not relieve the contractor of the full responsibility of the design and construction of form work. The formwork shall be designed and constructed to the shapes, lines and dimensions shown on the drawings within tolerances given below:

B-13.1 Deviation from specified dimensions of cross section of column and beams.  $-6\text{mm} +12\text{mm}$ .

B-13.2 Deviation from dimensions of footings:

Dimension in plan:  $-6\text{mm} +12\text{mm}$

Eccentricity: 0.02 times the width of the footing in the Direction of deviation but not more than 50mm.

Thickness:  $\pm 0.05$  times the specified thickness.

Note: the above tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel or dowels.

The formwork shall be capable of being dismantled and removed from the cast concrete without shock, disturbance or damage. The arrangement shall be such that the soffit forms properly supported on props can be retained in position for such period as may be required by maturing conditions or specifications.

#### B-14. RCC WORKS

Rates for all R.C.C. work are deemed to be inclusive of drip moulds at soffit as per design given by the Architect, wherever necessary, even if they are not expressly specified or shown on drawings. The rates of R.C.C. chajjas, canopies, parapets, retaining walls etc. include rainwater disposal arrangement by 25mm G.I. pipe spouts as directed by the Architect. Any extra concrete, laid to adjust slopes for drainage, is to be paid in cubic meter basis as the rate for plain concrete work for templates etc. In case, tenders are invited involving R.C.C. work with rates for R.C.C. work inclusive of steel and only typical R.C.C. details are given, it should be noted that proportion of steel may vary for individual members. The tendered rates for R.C.C. work will hold good, even if the proportion of steel to concrete work varies for individual members, provided that over-all percentage of steel does not vary more than  $\pm 5\%$  of steel content.

#### B-15. TOLERANCES IN CONCRETE WORK

Tolerance is a specified permissible variation from lines, grade or dimensions given in drawings. No tolerances specified for horizontal or vertical building lines or footings shall be constructed to permit encroachment beyond the legal boundaries. Unless otherwise specified, the following tolerances shall be permitted:

##### B-15.1. Variation from plumb

B-15.1.1. 5 mm per 2.5 m or 25mm whichever is less.

B-15.1.2. For exposed corner columns and other conspicuous lines in any bay or

5 m maximum length/height	5 mm
in 10 m or more length/height	10 mm

B-15.2) Variation from the level or from the grades indicated on the drawings.

B-15.2.1) In slab soffits, ceilings, beam soffit, and in arises

In 2.5 m	5 mm
In any bay or 5 m maximum	8 mm
In 10 m or more	15 mm

15.2.2) For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

in any bay or 5 m maximum	5 mm
in 10 m or more	10 mm

15.3) Variation from the linear building lines from established position in plan and related position of columns, wall and partitions:

in any bay or 5 m maximum	10 mm
in 10 m or more	20 mm

15.4) Variation in the sizes and locations of sleeves, openings in walls and floors: 5 mm except in the case of and for anchor bolts.

15.5) Variation in cross-sectional dimensions of columns and beams and in the thickness of walls:

Minus	5 mm
Plus	10 mm

15.6) Footings

15.6.1) Variation in dimension in plan	
Minus	5 mm
Plus	50 mm

15.6.2) Misplacement or eccentricity: 2% of footing width in the direction of misplacement but not more than 50 mm

15.6.3) Reduction in thickness: Minus - 5% of specified thickness subject to a maximum of 50 mm

15.7) Variations in steps

15.7.1) In the flight of stairs	
Rise	3 mm
Tread	5 mm
15.7.2) In consecutive steps	
Rise	1.5 mm
Tread	3 mm

Tolerances in other types of structures shall generally conform to those given in Clause 2.4 of Recommended Practice for Concrete Form work (ACI 347).

15.8. Tolerances in fixing anchor bolts shall be as follows:

15.8.1 Anchor bolts without sleeves plan	(+/-) 1.5 mm in all directions.
15.8.2) Anchor bolts with sleeves Elev.	(+/-) 5.0 mm in all directions.
15.8.3) For bolts upto & including 28mm dia.	(+/-) 5 mm in all directions.

15.8.4) For bolts 32 mm and above	(+/-) 3 mm in all directions.
15.8.5) Embedded parts	(+/-) 5 mm in all directions.

**B-16. RCC Precast Slab/Covers:** The frame of trench cover shall be firmly embedded to correct alignment and levels in R.C.C. slab of 100 mm thick in concrete M30 with reinforcement as per approved drawing.

**B16.1 Precast Concrete Trench Covers & Frames:** Precast reinforced cement concrete covers intended for use in trenches and water works shall generally conform to IS : 12592 (Part 1 & 2) 1991.

Detailed specifications are as under:

1. Grades : Types & Uses  
Covers and frames shall be of the following four grades and types:

- Designation Type/ shape of cover
- Light Duty LD-2.5 Rectangular, Square, Circular
- Medium Duty MD-10 Rectangular, Circular
- Heavy Duty HD-20 Circular-Square, Rectangular,
- Extra Heavy Duty EHD – 35 Circular, Square, Rectangular,

2. The different grades and types of covers may be used as follows and as directed by Architect/Customer Representative/Engineer-in-Charge:

- a) LD-2.5 Rectangular, Square or Circular Types: These are suitable for use within residential and institutional complexes/area with pedestrian but occasional LMV traffic. These covers may also be used for Inspection chambers.
- b) MD-10: These are suitable for use in service lanes/roads, car parking areas etc.
- c) HD-20: Suitable for use in institutional/commercial areas/carriage ways with heavy-duty vehicular traffic like buses, trucks, etc.
- d) EHD-35: Circular, square, or rectangular (scraper ) types: These are suitable for use on carriage way in commercial/ industrial/port areas/near warehouses/ godowns where frequent loading and unloading of trucks/trailers are common, with slow to fast moving vehicular traffic of the types having wheel loads upto 11.5 tones, irrespective of the location of the chambers.

3. Materials:

**Cement:** Cement used for manufacture of pre-cast concrete trench covers shall be 43 grade Ordinary Portland cement conforming IS: 8112-1989.

**Aggregates:** The aggregates used shall be clean and free from deleterious and organic matter and shall conform to the requirements of IS: 383- 1970. The aggregates shall be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm.

**Concrete:** The contractor shall determine the mix proportions such that it will produce dense concrete without voids, honey combing etc. The minimum cement content in the concrete shall be 460 kg/m<sup>3</sup> with



a maximum water cement ratio of 0.45. Concrete weaker than grade M-30 (design mix) shall not be used. Compaction of concrete shall be done by machine vibration only.

**Reinforcement:** The reinforcement steel shall conform to IS: 1786-1985 as specified. Reinforcement shall be clean and free from loose mills scale, loose rust, and mud, oil, grease or any other coating, which may reduce or destroy the bond between the concrete and steel. A light film or rust may not be regarded as harmful but steel shall not be visibly pitted by rust. In addition, wire pieces shall be used as on additional reinforcement.

#### 4. Shapes and Dimensions:

**Shapes:** The shapes of precast concrete covers shall be square, rectangular or circular as specified.

**Dimensions:** Dimensions of Precast concrete trench covers shall be as given in Table, the minimum clearance at top between the frame and cover shall be 5 mm.

Precast covers are designed and provided with MS rims of 2.5 mm thickness welded around with provision of two lifting books welded at appropriate locations.

5. Chequered pattern on operative surface. The MS Rims along with the edges of precast covers and their operative surface are suitably coated/finished using corrosion resistant paint.

#### 6. Performance requirements

##### Test Load

When tested for ULTIMATE breaking load using 300 mm diameter block as per the method described in IS:1292 (part-I) covers shall be within the following range:

Light-duty (LD) - 2.5 tones, Medium duty (MD) – 10 tones, Heavy Duty (HD) – 20 tones, Extra Heavy Duty (EHD) – 35 tones

7. Lifting Device: The minimum diameter of mild steel rod used as lifting device shall be 10 mm for light and 12 mm for medium duty covers and 16 mm for heavy and extra heavy-duty covers. The lifting device shall be protected from corrosion by galvanizing or epoxy coating or any other suitable method as directed by Architect/Customer Representative/Engineer-in-Charge.

8. Finishing & Coating: To prevent any possible damage from corrosion of steel the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish. In order to protect the edges of the covers from possible damage at the time of lifting and handing it is necessary that the covers shall be cast with a protective mild steel sheet of minimum 2.5 mm thickness around the periphery of the covers. Exposed surface of mild steel sheet shall be given suitable treatment with anticorrosive paint or coating.

#### 9. Physical Requirements:

a) General: All units shall be sound and free from cracks and other defects, which interface with the proper placing of the unit or impair the strength or performance of the units. Minor chipping at the edge/surface resulting from the customary methods of handling during delivery shall be deemed for rejection.

b) Load Test: The breaking load of individual units when tested in accordance with the method described in IS: 12595-1991 shall not be less than the values specified in Table:

Grade of cover	Type Load (tones)	Diameter of Block (mm)
EHD	35 Circular, Square or Rectangular	300
HD	20 Circular, Square or Rectangular	300
MD	10 Circular or Rectangular	300
LD	2.5 Circular, Square or Rectangular	300

10. Fixing:

The frames of trenches shall be firmly embedded to correct alignment and level in RCC slab on the top of masonry which shall not be paid as extra unless specified otherwise.

11. Item to Include:

The item includes all labour, material, tools and equipment, to construct the cover as per the approved drawing and the above specifications, including curing, making, etc. complete. All incidental works are included in the item.

12. Mode of Measurement and Payment:

The measurement shall be recorded in number of covers of specified dimensions, constructed as per above specifications. The contract rate shall be per number of specified dimensions and include the cost of materials and labour involved in all the operations.

**C. BRICKWORK:**

**C-1** Brick works using common burnt clay conventional building bricks or fly ash bricks from approved supplier, having crushing strength not less than 50 Kg/cm<sup>2</sup> in **foundation and plinth**, in CM 1:4 (1 cement :4 find sand), including curing, scaffolding, etc. complete, as directed.

**C-1.1** Workmanship:

C-1.1.1 Proportion:

The proportion of the CM shall be 1:4 (1 cement: 4 fine sand), by volume.

C-1.1.2 Soaking of bricks:

The bricks required for masonry shall be thoroughly wetted with clean water for about 4 hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is an indication of thorough wetting of bricks.

C-1.1.3 Laying:

C-1.1.3 a. Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete the bond; closer and in such case it shall be cut to required size and used near the ends of walls.

C-1.1.3 b. A layer of mortar shall be spread on full width for suitable length of the lower course. Each brick shall first be properly bedded and set home by gently tapping with the handle of the trowel or wooden mallet. Its inside face shall be flushed with mortar before the next brick is laid and pressed against it. On completion of the course, the vertical joints shall be fully filled from the top, with mortar.

C-1.1.3 c. The walls shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate courses shall generally be in one vertical plane. The thickness of brick course shall be kept uniform.

C-1.1.3 d. The bricks shall be laid with the frog facing upwards. A set of tools comprising of wooden straight edges, mason's spirit level, square half meter rub, pins, string and plumb shall be kept on the site of work for frequent checking during the progress of work.

C-1.1.3 e. Both the faces of walls, having thickness greater than 23 cm. shall be kept in proper plumb. All the connected brick work shall be kept not more than 1 m. over the rest of the work. Where this is not possible, the work shall be raked back according to bond (and not left toothed) at an angle not steeper than  $45^{\circ}$ .

C-1.1.3 f. All the fixtures, pipe outlets of water, holdfasts of doors and windows, etc. which are required to be built in the wall shall be embedded in CM, as per the drawings or as directed.

#### C- 1.2 Joints:

C-1.2.1 Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exceed 12 mm. The face joints shall be raked out as directed by taking tools daily, during the progress of work, when the mortar is still green so as to provide key for plaster or pointing to be done, subsequently.

C-1.2.2 The face of bricks shall be cleaned every day on which the brick work is laid and all mortar dropping shall be removed.

1.2.3 At the end of day's work or on holidays the top of unfinished masonry shall be kept wet. If the mortar becomes dry, white or powdery, for want of curing, work shall be pulled down and re-built at Contractor's expense.

#### C-1.3 Curing :

Fresh work shall be protected from rain suitably. Masonry work shall be kept moist on all the faces for minimum period of 7 days. The top of masonry work shall be kept well wetted at the end of the day's work.

#### C-1.4 Preparation of foundation bed:

If the foundation is to be laid directly on the excavated bed, the bed shall be leveled, cleared off of all loose materials, cleaned and wetted before starting masonry work. If masonry is to be laid on concrete footing, the top of concrete shall be roughened, cleaned and moistened. The Contractor shall obtain approval of the Architect/Customers representative/Engineer-in-charge for the foundation bed, before foundation masonry is started. When pucca flooring is to be provided flush with the top of the plinth, the inside of the plinth wall shall be lowered down having an offset of the same thickness of the flooring with respect to the outside plinth wall top or as directed.

#### C-1.5 Mode of Measurements and Payment:

C-1.5.1 The measurement of this item shall be taken for the brick masonry fully completed in foundation upto plinth. The limiting dimensions not exceeding those shown on the drawings or as directed shall be final. Battered, tapered and curved portions shall be measured net.

No deduction shall be made from the quantity of brick work, nor shall any extra payment be made for embedding in masonry or making holes in respect of following items:

C-1.5.1.a. End of joists beams, posts, girders, rafters, purlins, trusses, corbel, steps etc. where cross sectional area does not exceed  $500 \text{ cm}^2$ .

C-1.5.1.b. Architectural openings in walls, parapet and compound walls, not exceeding  $1.0 \text{ m}^2$  area.

C-1.5.1.c. Wall plates and bed plates, bearing of slabs, chajjas and the like whose thickness does not exceed 10 cm. and the bearing does not extend to the full thickness of wall.

C-1.5.1.d. Drainage holes, recesses for cement concrete blocks to embed hold fasts for doors, windows etc., forming tooth's, grooves etc. and providing cramps for holding stone lining.

C-1.5.1.e. Iron fixtures, pipes upto 300 mm. dia.; holdfasts and doors and windows built into masonry and sanitary and water supply pipes, etc., for concealed electrical wiring and any other fixtures or inserts.

C-1.5.1.f. Forming chases of section not exceeding  $350 \text{ cm}^2$ . in masonry.

C-1.5.2 The rate shall be for a unit of one  $\text{m}^3$ .

**C-2** Brick work using common burnt clay conventional building bricks, having crushing strength not less than  $50 \text{ Kg/cm}^2$ , in **super structure** above plinth, for all floor levels, at any height and level, in any position, in CM 1:4, including curing, scaffolding, etc. complete, as directed.

C-2.1 Workmanship:

C-2.2 The relevant specifications of item no. C-1 shall be followed except that the masonry work shall be carried out above plinth level upto floor two level i.e. for height as specified in the special conditions.

C-2.3 The frames of doors, windows, cupboards, etc. shall be housed into the brick work at the correct location and level, as directed. The heavy steel doors, windows frames, etc. shall be built in with brick work, but for ordinary steel doors and windows, required opening for frames, hold-fasts, etc. shall be left in the wall and frames shall be embedded later on in order to avoid damage to the frames.

C-2.4 Necessary scaffolding shall be provided by the Contractor. The supports of the scaffolding shall be sound and strong, tied together with horizontal pieces over which the scaffolding planks shall be fixed. Normally simple scaffolding only shall be allowed. In this case horizontal pieces of the scaffolding shall rest in the holes, made in the header course only. Minimum number of holes shall be left in brick work for supporting horizontal member of the scaffolding.

C-2.5 The Contractor is responsible for providing and maintaining sufficiently strong scaffolding so as to withstand all loads likely to come upon it.

C-2.6 For the face of brick work, where plastering is to be done, joints shall be racked out to a depth not less than the thickness of the joints. The face of brick work shall be cleaned off of mortar dropping and other foreign matters at the end of day's work.

### 3.2 Mode of Measurements and Payment:

C-3.2.1 The masonry work above plinth level to floor two levels shall be measured and paid under this item.

C-3.2.2 Brick work in parapet shall be measured in the corresponding masonry item of storey immediately below the floor above which the parapet is built.

C-3.2.3 No deduction shall be made from quantity of brick work, nor extra payment shall be made for embedding in masonry or making holes in respect of following items:

(1) Ends of joists, beams, posts, rafters, purlins trusses corbel, step etc. where cross sectional area does not exceed 500 cm<sup>2</sup>.

(2) Architectural openings in walls, parapet and compound walls, not exceeding 1000 cm<sup>2</sup> area.

(3) Wall plate, sand bed plates, bearing of slab, chajjas and like whose thickness does not exceed 10 cm. and the bearing does not extend the full thickness of wall.

(4) Drainage holes, recesses for cement concrete blocks to embed hold fasts for doors, windows, etc., forming tooth's, grooves etc. and providing cramps for holding stone lining.

(5) Iron fixture, pipes upto 300 mm. dia. hold fasts of doors, and windows built into masonry and sanitary and water supply pipes etc., for concealed electrical wiring and any other fixtures or inserts.

(6) Forming chases of section not exceeding 350 cm<sup>2</sup> in masonry.

(7) Apertures for fire places shall not be deducted nor shall extra labour required to make spraying of Jambs, throating and making trenches over the aperture be paid for separately. The rate shall include for work of any shape e.g. pillars, curved or tapered walls, drip courses, projections, parapets, load walls, sills, ottas, steps, tank walls, platform and counter walls, ducts, channels and architectural moldings like corbelling, pattas, etc.

3.2.4 The rate shall be for a unit of one m<sup>3</sup>.

**C-3** Half brick, 4-1/2" thick masonry in common burnt clay conventional building bricks, having crushing strength not less than 50 Kg/cm<sup>2</sup>., for all floors, at any height and level, in any position, in CM 1:4 (1 cement: 4 coarse sand), with 2 nos. of 6 mm. dia. MS round bars after every 3 courses, embedded in CM, including curing, scaffolding, etc. complete, as directed.

#### C-3.1 Workmanship:

C-3.1.1 Relevant specifications of bricks, wetting and laying of brick, joints, curing, etc. shall conform to item no. 4.01 except that the brick work of half bricks, 90 mm. thick shall be carried out, in foundation and plinth.

C-3.1.2 Cement mortar used in masonry work shall be in proportion of 1 part of cement and 4 parts of sand, by volume.

C-3.1.3 All bricks shall be laid stretcher wise, breaking joints with those in the upper and lower courses. The wall shall be taken truly plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. The bricks shall be laid with frogs upwards. A set of mason's tools shall be maintained on work site as required for frequent checking.

C-3.1.4 MS bars, 6 mm. dia., 2 nos. shall be provided at every 3rd course. The end of reinforcement shall be fully embedded in the main wall on both sides as directed. Reinforcement shall be placed on top of the bottom most course and then on every 3rd course. Lap shall be of 15 cm.

C-3.1.5 The joints in course where reinforcement is placed shall allow sufficient mortar cover to the reinforcement.

**C-3.2 Mode of Measurements and Payment:**

C-3.2.1 The half brick masonry work in foundation and plinth shall be measured under this item, the limiting dimensions shall not exceed those shown in the plan or as directed. Any work done extra over the specified dimensions shall not be measured and paid for.

C-3.2.2 The relevant specifications of item no. shall be followed. The length shall be measured nearest to one cm.

C-3.2.3 The rate shall be for a unit of m<sup>2</sup>.

**D. STRUCTURAL STEEL WORKS –**

**D-1. INDIAN STANDARD CODES**

Unless otherwise specified herein, materials and workmanship or the work shall conform to the latest editions of the following standards or their approved equivalents.

D-1.1 Indian Code of Practice for General Construction in steel, Indian Standard Institute IS: 800.

D-1.2 Code of Practice Use of Metal Arc Welding for General Construction in Mild Steel, Indian Standard Institute IS 816.

D-1.3 Specification for Structural Steel IS: 226 and when specified IS 2062.

D-1.4 Specification for Black Hexagonal Bolts and Nuts IS 1363.

D-1.5 Specification for Precision and Semi-precision Hexagonal Bolts and Nuts IS 1364.

D-1.6 Specification for covered Electrodes for Metal and Welding of Mild Steel IS : 8114.

**D-2. FABRICATION:-**

All structural steel work shall be in accordance with IS : 800 All materials shall be finished straight and shall be machined true and square where so specified material at the fabrication shop shall be kept clean and protected from weather. All holes and edges shall be free from burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished.

**D-3. STRAIGHTENING:-**

All steel materials, before being worked shall be straight and free from bends or twists. If the sections are distorted or twisted they shall be straightened and flattened by methods that will not injure the material. (Heating and forging is not allowed). Contractor's lumps price shall be inclusive of the cost of all these operations involved in straightening as stated above.

**D-4. CUTTING AND EDGE PLANEING: -**

Cutting may be done by shearing, cropping, sawing, or mechanically controlled gas cutting torch as permitted by the Architect/Customers Representative/Engineer-in-charge. All re-entrant corners shall be shaped notch free to a radius of at least 12mm. Sheared or cropped edges shall be dressed to a neat finish and shall be free from distortion and burrs. Hand frame cutting shall be undertaken only if so permitted by the Engineer-in-charge and shall only be carried out by an expert in such work. Hand frame cut edges shall be ground smooth and straight Edge planning of sheared edge is not intended unless the sheared edges are such as to warrant it or specifically called for, by Engineer-in-charge whose decision shall be final and binding. Edges of cropped or gas cut edges shall be planned as directed by Engineer-in-charge.

**D-5. Grinding:-**

All the edges cut by flames shall be grounded before these are welded. Ends of all bearing stiffeners shall be ground to fit tightly at both top and bottom. In case of gantry girders, the bottom of the knife-edge support shall be accurately ground to provide effective bearing on the column bracket with a clearance not exceeding 0.1 mm locally at any place. The top surface of column bracket, struts and compression members shall be accurately ground and closely butted over the whole section with tolerance not exceeding 0.1 mm locally at any place. Notwithstanding the above full loads shall be transferred through welds. Column ends resting on bases shall be ground smooth and true to ensure minimum 85 % contact area with local gap not exceeding 0.1 mm.

The base plate shall be similarly ground over the bearing surfaces and shall have effective contact with the end of the shaft. The bearing face which is to be grouted direct to a foundation need not be ground if such face is true and parallel to the upper face. To facilitate grouting and escape of air holes shall be provided wherever necessary in column bases.

**D-6. Bending:-**

The bending of plates and sections to specially required shapes shall be done either on appropriate machine or by angles smithy and black smithy process.

**D-7. Rolling and framing:-**

Plates for chutes, hoppers etc shall be accurately laid off and rolled or formed to required profile shape as called for on the drawings. Adjacent sections shall be matched for facilitating accurate assembly, welding and erection in the field.

**D-8. Drilling and Punching:-**

Holes through more than one thickness of material for members such as compound stanchion and girders flanges shall, where possible, be drilled after the members are assembled and tightly clamped or bolted together sub punching may be permitted, by assembly provided the holes are punched 3 mm less in

diameter than the required size and reamed after assembly to the full size. Punching shall not be adopted where the thickness of the materials to be punched together exceeds 16 mm.

Matching holes for black bolts shall register with each other so that a gauge of 1.0 mm lesser in diameter than the diameter of the hole will pass freely through the assembled members in a direction right angle to such members. Finished holes shall not be more than 1.5 mm or 2.0 mm (as the case may be depending upon the diameter of the bolt is less than or more than 25mm) larger in diameter than the diameter on the black bolt passing through them. Unless otherwise specified by the Engineer-in-charge.

Holes for bolts shall not be formed by gas cutting process.

Where reamed members are taken apart for shipping or handling the respective pieces reamed together shall also be marked that they may be re-assembled in the final setting up. No interchange of reamed parts will be permitted. Poor matching, over drilling and ovality in holes shall be a cause for rejection.

Burrs shall be removed after drilling holes, there ever horizontal member is likely to collect water, and suitable holes for drainage shall be provided.

#### D-9. Notches:-

The ends of all joints, beams and girders shall be cut truly square unless required otherwise and joint flanges shall be neatly cut away or notched away wherever necessary, the notches being kept as small as possible. Corners of such notches in flanges shall be shaped to a radius of 50 mm.

#### D-10. Assembly:-

The component parts shall assembled in such a manner that they are neither twisted nor otherwise damaged and shall be so prepared that the specified chamfer, if any is provided. In order to minimize distortion in a member, the component parts shall be positioned by clamps, jigs and other suitable means and fasteners. If the individual components are to be bolted, parallels and tapered drifts shall be used to align the parts so that the bolts can be accurately positioned. Items like roof trusses etc. shall be assembled keeping in view the actual site conditions, prior to dispatch to site of erection, so that they can conveniently pre-assembled during erection. Necessary match marks shall be made on these components before disassembling in the shop and dispatching.

#### D-11. Connections:-

The contractor shall plan out the work right from the preparation of fabrication drawings stage to have shop connections as well as field connections effected either by welding, or by black bolts as shown on the design / fabrication drawings or as specified.

#### D-12. Bolted Connections:-

Bolts, nuts and washers and other fastening material shall be stored in racks off the ground with coating of suitable protective oil.



Bolts shall be inserted in such a way that they may remain in position under gravity even before fixing the nut.

The length of the bolt shall be such that at least one thread of the bolt projects beyond nut. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled, all joint surfaces including those adjacent to the washers shall be free of scales except tight mill scales. They shall be free of dirt, loose scales, burrs and other defects that would prevent solid seating of the parts. Contact surface shall be free of oil, paint, lacquer or galvanizing. Wherever necessary tapered washers or flat washers or spring washers shall be used under the nut so that no part of the treaded portion of the bolt is within the thickness of the parts bolted together.

Flat washers shall be circular of a diameter two and a half (2-1/2) times that of bolt and of suitable thickness. Where bolts head/nuts bear upon the be-leveled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the belt. Flat washers shall be circular. All the bolts and nuts shall be of steel with well-formed hexagonal heads unless specified otherwise, forged from the solid and shall be dipped in hot linseed oil as soon as they are made.

Notwithstanding anything to the contrary contained in IS: 1363, IS: 1364, and IS: 1367, the unthreaded length of the bolt shall be equal to total thickness of metal being bolted together plus 2 mm. The threaded length shall be equal to at least the diameter of the bolt plus 6mm. Not more than one shop splice shall be provided to make up the full length of member. This splice shall be within full strength butt weld.

#### D-13. Welded Connections:-

Manual arc welding shall be used, except in case of continuous welds, use of automatic welding machine shall be necessary for ensuring satisfactory quality of fabrication. Welding must be done by experienced and tested welders in proper sequence using necessary jigs and fixtures.

Welding shall be done by experts in the field who have been qualified by tests as specified in this specification. Surfaces to be welded shall be free from loose scales, slag, rust, grease, paint and any other foreign materials.

The members to be joined by fillet welding shall be brought and held as close together as possible and in no event shall be separated by more than 3mm. If the separation is 1.5 mm or greater, the fillet weld size shall be increased by the amount of separation. This shall only apply if the surfaces are completely sealed by welds.

Before commencing fabrication of members in which welding is likely to result in distortion or locked up stresses a complete program of fabrication, assembly and welding shall be made and submitted to the Engineer for approval.

Web to flange connections shall be welded by continuous double fillet welds by automatic or semi-automatic electric arc welding process. All welds shall be free from defects like blow-holes, lack of penetration, slag and inclusions etc. All fillet welds shall be inspected for flaws. Butt welding in flange plates or web plates shall be complete before the flanges and webs are welded together. All main butt welds shall have complete penetration unless noted otherwise.

The contractor shall give timely notice to the engineer-in-charge before welding is taken up at the site. Approval of engineer-in-charge shall be undertaken in written before welding field connections.

#### D-14. Electrodes:-

The electrodes used for welding shall be of suitable type and size depending upon the specifications of the parent material, the method of welding, the position of the welding and the quality of welds, desired e.g. normal penetration welds or deep penetration welds and shall conform to IS : 814, IS : 1395 or IS: 1442 ( latest edition ) as per requirements.

Only those electrode which give radiographic quality welds shall be used. Suitable electrodes of Advani Oerlikon, Indian Oxygen or Philips or any approved make shall be used for the work. Specific approval of the Architect/Customers representative/Engineer-in-charge shall be taken by the contractor for the various electrodes proposed to be used on the work before any welding is started.

Where bare electrodes are used these shall correspond in specification to the parent material. The flux used for submerged arc welding should be specifically manufactured for the purposes and should have such a composition which does not evolve any appreciable quantity of gases. The electrodes shall be stored in an oven strictly in accordance with the manufacturer's requirements as stipulated.

#### D-15. Welding:-

No welding shall be done when the surface of the member is wet, galvanized or painted, nor during high winds unless the welding operator and the work are properly protected.

All welds shall be free from defects like blow holes slag inclusion, lack of penetration, under cutting, cracks etc. All welds shall be cleaned of slag or flux and show uniform sections, smoothness of weld metal, feather edges without overlap, freedom from porosity. The ends of the welds shall have full throat thickness. This shall be obtained on all main welds by the use of extension pieces adequately secured on either side of the main plates. Additional metal remaining after the removal of extension pieces shall be removed by matching or by other approved means and the ends and surface of the welds shall be smoothly finished.

The sequence of welding shall be carefully chosen to ensure that the components assembled by welding are free from distortion and large residual stresses are not developed. The distortion should be effectively controlled either by a counter effect or by counter distortion. The direction of welding should be away from the point of restraint and towards the point of maximum freedom

Each case shall be carefully studied before finally following a particular sequence of the welding.

Butt welds in flange plates and or web plates shall be completed before the flange and webs are welded together.

The beams and columns stiffeners shall preferably be welded to the webs before the webs and flanges are assembled, unless the web and flanges of the beam or column are assembled by automatic welding process.

Approval of welding sequence and the procedure shall not relieve the contractor of the responsibility for the correct welding and for minimizing the distortion in the finished structure which in no case shall exceed that laid down in Indian Standard.

All the welds shall be furnished full and made with correct number of runs, the welds being kept free from slag and other inclusion, all adhering slag being removed from exposed faces immediately after such run welding procedure, current voltage etc. shall be as per electrodes manufacturer's instructions.

All main butt welds shall have complete penetration and except where it is impracticable they shall be welded from both side. Back surface of the weld should be gauged and cleaned before first run of the weld is given from back to back.

Butt welds shall be terminated at the end of joint in a manner that will ensure soundness. Where abutting parts 20mm or more in thickness run on and run off plates with similar edge preparation and having a width not less than the thickness of the thicker part jointed shall be used. These extension pieces shall be removed upon completion of the weld and the ends of the welds made smooth and flush with the abutting parts by machining or by other approved means. Where the abutting parts are thinner than 20mm the extension pieces may be omitted but the ends of the butt welds shall then be chipped or gouged out to sound metal and side welded to fill up the ends to the required reinforcement.

**D-16. Inspection and Testing:**

The contractor provides at his cost all testing and inspection services and facilities to the engineer-in-charge. The cost of these tests shall be borne by the contractor. The contractor shall also give sufficient advance notice to the engineer-in-charge for inspection of materials or workmanship. The material rejected on inspection shall be promptly removed and replaced by materials approved by the engineer-in-charge.

The acceptance of test certificates or shop inspection by engineer does not relieve the contractor from the responsibility of providing materials conforming to specification requirements nor does it invalidate final rejection at the site by the engineer-in-charge unless otherwise stated. At all stages of fabrication and assembly, the structural steel members shall be inspected to check whether the dimensions, tolerances, alignment, painting and surface finish are within areas specified. The same standard of supervision and quality control as for shop work shall be maintained for field fabrication work inspection and tests on structural steel members shall be carried out as follows:-

**D-17. Inspection of Welds:-**

The contractor shall in routine check execution of established technological processes or general technological instructions. All welds shall be visually examined and measured for external dimensions by appropriate gauges. Profile of the weld shall be informed. In case of butt and corner welds the profile shall be convex and in case of submerge are fillet weld it shall be slightly concave. He shall also conduct selective examination of welds by ultrasonic and radiographic method.

The numbers of these tests are specified in Clause 6.03. However, welded joints in doubt examined by ultrasonic method would be re-examined by x-ray although this may be beyond the number of such tests specified. The contractor shall arrange for examination by ultrasonic, radiographic for welded joints for high quality control and in areas of doubtful welding as directed by engineer-in-charge.

**D-18. Quantum of Tests:-**

Visual examination	Hundred percent (100 %) of welded joints.
Dye penetration test	As and when directed by the
Ultrasonic	Hundred percent for butt welds.

**D-19. Rectification of Defective Welding Work:-**

Whenever defects like improper penetration, presence of blow holes, under cuts, cracking, and slag inclusion are noticed, the welds in such location shall be removed by gauging process. The joints shall be prepared again by cleaning the burrs and residual matters with the wire brushes and grinding, if necessary and re welded. The gauging shall be done using gouging electrodes. All defects shall be rectified, at no extra cost as per direction of the engineer-in-charge and tests shall be conducted again for such cases.

**D-20. Acceptance of Welded Structures:-**

The acceptance of the welded work shall depend upon correct dimensions and alignment, absence of distortion in structure, satisfactory results from the examination and testing of the joints and the test specimens as per IS soundness of weld and upon general workmanship being good. Decision of engineer-in-charge shall be final and binding.

**D-21. Tolerance:-**

The dimensional and weight tolerance for rolled shapes supplied by the contractor shall be in accordance with IS: 1852 and / or ASTM A6.

No rolled or fabricated members shall deviate from straightness by more than  $1 / 1000$  of the axial length or 10mm whichever is smaller. The length of members with both ends finished for contact shall have a tolerance of (+) or 9-0 mm.

Members without ends finished for contact bearing shall have a tolerance of (+) or (-) 1.5 mm for members length and a tolerance of (+) or (-) 3mm for members over 10 meters in length.

Lateral deviation between centre line of web plate and centre line of flange plate at contact surface in the case of built up sections shall not exceed 3mm. The combined warping and tilt of flanges in welded built up section shall not exceed  $1/200$ th of the flange width or 3mm whichever is smaller.

The deviation from flatness of welded plate girder web in the length between stiffeners or a length equal to the depth of the girder shall not exceed  $1/50$ th of such length.

Deviations from the specified depth of welded girders measured at the centre line of the web shall not exceed (+) or (-) 3mm upto a depth of 1000mm, (+) or (-) 5mm for depths above 1000mm and upto 2000 mm and (+) 18 mm and (-) 5mm for depths over 2000 mm.

**D-22. Shop Matching:-**

Some steel work , particularly columns, along with the tie beams / bracings, roof trusses etc. may have to be shop assembled to ensure satisfactory fabrication, obtaining of adequate bearing, areas etc., if so desired by the engineer at no extra cost to the purchaser.

**D-23. Marking of Members:-**

23.1. Before any steel work leaves the contractor's fabrication it shall be suitably marked in accordance with the approved drawings.

23.2. The erection marks assigned to various components of the structural steel work excepting cross-beams shall also contain an erection sequence number indicating the sequence in which the various components are to be erected.

23.3. Erection marks shall be clearly painted on the work, each piece being marked in at least two places. Each piece shall also have its weight marked thereon.

23.4. The centre line of all column bases and girder hearings and important levels shall be marked on the sections with the utmost care to ensure proper alignment and assembly of the pieces at the site.

23.5. A separate column code should be adopted for parts (if any ) fabricated out steel supplied by the contractor . Weight of these parts shall also be marked.

**D-24. Drilling holes for other works:-**

Holes in members (included in this scope) required for installing equipment or structures fabricated by other contractor shall be drilled by the contractor. Effort shall be made to supply information for these holes by Architect/Customers representatives / engineer-in-charge before fabrication. However these may be required to be drilled even after erection.

**D-25. Shop painting:-**

After all inspections and tests have been conducted to the satisfaction of the Architect/ Customers representatives/Engineer-in-charge, the steel surface to be painted or otherwise treated, shall be dried and thoroughly cleaned as per IS : 1477 part I. All steel work shall be given one (1) coat of approved metal protection except where encased in concrete. The metal protection of approved shade and of Asian/ICI/Jenson Nicholson or Shalimar Paints shall be used for the work.

Surfaces not in contact but in accessible after shop assembly shall receive two (2) different coats of shop paint. Surfaces to be welded shall not be painted or metal coated, within 50mm of the edge where welding is to be done since this may impair the quality of weld. Machined edges and contact surfaces shall be cleaned effectively but not painted Machine finished edges shall be protected against corrosion by a suitable coating.

Red oxide shall be used for shop painting with primer applied by brushing. The instructions of the manufacturers shall be followed in applying the paint.

**D-26. Erection:-**

The contractor shall complete all preliminary works at site like transporting fabricated materials, derricks, unloading gantry etc. so as to start erection work as per schedule. The contractor shall furnish at its' own cost necessary inflammable staging and hoisting materials or equipment for erection work. The

contractor shall also provide necessary passage ways, fences, safety belts, helmets, lights and other fittings to the engineer's satisfaction.

All assembling shall be carried out on a level platform. No dragging of steel shall be permitted.

The contractor shall ascertain the correctness of the foundations and carry in cleaning of foundation at his own cost. Welding shall be done in accordance with IS: 816. Code of practice for use of metal are welding for general construction on mild steel and IS : 823 code of procedure for manual arc welding of mild steel. The contractor shall work in co-ordination with the other agencies at site. The engineer shall have free access to inspect any part of the work, during erection and all erection shall be subject to his approval. In case of faulty erection all such dismantling and re-erection required will be at contractor's cost.

No paint shall be applied to field welds or bolts until these have been approved by the engineer-in-charge.

No welding or final bolting shall be done until the structures have been properly aligned and has the approval of the engineer-in-charge.

The contractor shall examine the site conditions and transportation clearances before deciding whether the building columns are to be fabricated in one piece or more than one piece. Maximum number of erection joints permitted in column shall be two i.e., no column shall be fabricated and erected in more than 3 pieces. Proper splice material shall be provided at the erection joints and as indicated in fabrication drawings. When erection joints are provided in column, their location shall invariably be above floor level and will be as per approval of the engineer-in-charge.

Nothing extra shall be payable for fabrication / erecting columns in one piece or more than one piece. The splice material shall however, be detailed in the fabrication drawings and shall be part of supply, fabrication and erection of structural steel.

D-27. Tolerance for erection:-

The tolerance limits during erection shall be as follows:-

- The shift of column base from the marked axis shall not exceed 5mm.
- All column tiers shall be plumb within a tolerance of 1 in 500 and the structure as a whole plumb within a tolerance or 1 in 1000.
- The displacement from plumb of a note that the deviations given elsewhere other than in the format as mentioned above shall be Null & Void (not acceptable) and all the conditions of the tender except for which the deviation column tiers shall not exceed 10mm and the total displacement of the structure as a whole should not exceed 25 mm for structures upto 50m an additional displacement of 1 mm for every 2.5 m additional height shall be permitted subject to maximum displacement of 50mm.

The actual levels of supports of trusses roller beams, roofing beams, purlins etc. shall not vary by more than 20mm from their marked levels.

The sweep of trusses, beams etc. in the horizontal plane shall not exceed 1 / 1500 of their span subject to a maximum of 10 mm.

The deviation of the upper chord of trusses from vertical plane through centers of supports shall be within 1 / 250th of the truss height. Deviation in spacing of purlins shall be within 5 mm.

**D-28. Stability:-**

- 28.1. The contractor shall be responsible for the stability at all stages of its erection at site and shall take all, necessary measures by the additions of temporary bracings and guying to ensure adequate resistance to wind and also to loads due to erection equipment and their operation. Guying and bracing shall be done in such a way that it does not interfere with the movement of working of other agencies working in the area. For the purpose of guying the contractor
- 28.2. Shall not use the structures which are likely to be damaged by the guy. Any damage caused by the contractor shall be rectified by him entirely at his own cost to the satisfaction of the purchaser / engineer-in-charge.
- 28.3. The lump sum supply, fabrication and erection of structural steel work shall include provision of such temporary bracings and their removal. Such temporary bracings used shall be the property or the contractor and may be removed by him at the end of the job from the site of work.
- 28.4. If work has to be carried out adjacent to switchyards or electrical installations which are live. Contractor must ensure suitable safety precautions in consultations with the engineer-in-charge.
- 28.5. If a portion of the work or project area cannot be made available to contractor for his activities due to operations being carried out by other contractors, he shall suitably modify his sequence of operations as to continue work without interruption.

**29. Defective work:-**

Any error in work which prevents proper assembling and fitting of parts in the field by moderate use of drift pins or moderate amount of remaining shall be classified by engineer-in-charge as defective work. No gas cutting or punching of holes shall be permitted for erection.

All defective work shall be replaced / rectified as the case may be by the contractor at his own cost. Any charges incurred by purchaser either directly or indirectly because of defective workmanship will be deducted from the amount due to contractor before payment is made.

**D-30. Grouting:-**

Fresh Conbextra- GP 2 or equivalent make shall be used for grouting of column bases and foundation bolts in pockets and block outs provided in foundation by other contractor. Contractor shall be responsible for bringing the top of concrete foundation to the desired level by chipping. In case the foundation is cast at lower than the desired level, the contractor make up the difference by providing additional height without extra payment for any such work or material. Top surface of foundation shall be chipped with a chisel to ensure proper bond between grout and the foundation concrete and shall be thoroughly cleaned.

**D-31. Painting:-**

After all inspection and tests have been conducted to the satisfaction of the engineer-in-charge, the steel surface to be painted or otherwise treated, shall be dried and thoroughly cleaned as per IS : 1477 part - 1.

All steel work shall be given one protective coat of red oxide except where encased in concrete. The metal protection of approved shed and of ICI or British Paints or Jenson Nicholson or Shalimar paints shall be used for the work. The instructions of the manufacturers shall be followed in applying the paint.

#### **E. PLASTERING AND WATERPROOFING**

E-1. Providing and laying minimum **12 mm. thick cement plaster** in single coat for walls and ceiling, in CM 1:4 with Neeru finish (finished with steel trowel) to concrete or brick surfaces, in all positions including scaffolding, curing, etc. complete.

##### **1.1 Materials:**

Water used shall be free from injurious amounts and deleterious materials. PH value of water shall generally be not less than 6.0.

##### **1.2 Workmanship:**

1.3 Scaffolding: Wooden ballies, bamboo, planks, trestles and other Steel scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster, which shall be independent of the walls.

##### **1.4 Preparation of back ground:**

1.4.1 The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be roughened by wire brushing if it is not hard and by dense hacking if it is concrete. In case of concrete surface, if a chemical retarder or shuttering oil has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles shall be cleaned off and care shall be taken that none of the retarder is left on the surface. Trimming of projections on brick/concrete surface wherever necessary shall be carried out to get an even surface.

1.4.2 Raking of joints in case of masonry wherever necessary shall be allowed to dry out for sufficient period before carrying out the plasterwork.

1.4.3 Scaffolding for carrying out plastering work shall be double scaffolding having two sets of vertical supports so that the scaffolding is independent of the walls.

##### **1.5 Preparation of Surface:**

1.5.1 All putlog holes in brickwork and junction between concrete and brickwork shall be properly filled in advance. Joints in brickwork shall be raked about 10 mm. and concrete surface shall be hacked to provide grip to the plaster. Projecting burrs of mortars formed due to gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brush/coir brush to remove dirt, dust etc., and the surface thoroughly washed with clean water to remove efflorescence, grease and oil etc., and shall be kept wet for a minimum of two hours before application of plaster.



1.5.2 For external plaster, the plastering operation shall be started from the top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supporting ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

#### 1.6 Applications of Plaster:

1.6.1 Plaster of cement mortar shall be laid in with somewhat more than 12mm thickness and pressed and leveled with wooden /aluminium roller to a finished thickness of 12mm. long straight edge shall be freely used to ensure a perfectly even surface. All corners and angles shall be perfectly plumb and soffits of arches true to the specified curve. All junctions of doors and windows and windows and other frames shall be neatly finished. All architectural paneling, grooves etc. to be shown in the thickness of the plaster shall be so worked. For Neeru finish the surface shall be finished with proper mixture of cement and neeru which is applied to the finished coat of cement plaster. Watering for curing shall be started soon after the initial set of the surface material to avoid damage.

1.6.2 Cement mortar shall be used within half an hour after addition of water. Any mortar or plaster which is partially set shall be rejected and removed from the site.

1.6.3 In suspending the work at the end of the day, the plaster shall be left out, clean to line both horizontally and vertically. While recommencing the plaster, the edges of the old work shall be scrapped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and shall not be nearer than 15 cm. to any corners or arises. Horizontal joints in plasterwork shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be patched up later on.

#### 1.7 Mode of Measurements & Payment:

1.7.1 The rates shall include for work at any height, position, and floor and for all necessary scaffolding, etc. as may be required. The rates shall also include for hacking and/or bush hammering to form key for plaster and for spatter dash treatment, as specified, as and where necessary.

The rates shall also include for all work in narrow width, arises, rounded angles, chamfered external angles, drip moulds, grooves and for making good after all trades.

The rate shall also include for Chicken Mesh to be formed in plaster at junction of slab and beam and slab and brick without any extra charge. The rate shall also include for similar grooves in plaster at the junction of masonry and wood or steel door/window/ventilator frame or at bottom of beam/lintels as drip moulds without extra charge.

1.7.2 All plastering shall be measured in m<sup>2</sup>. Unless otherwise specified. Length, breadth or height shall be measured correct to a centimeter.

1.7.3 Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooved or open joints in brick work, stone work, etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm, at any point on the surface.

1.7.4 The measurement of wall plastering shall be taken between the walls or partitions (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.

1.7.5 Soffits of stairs shall be measured as plastering on ceilings. Flowing/folding soffits shall be measured separately.

1.7.6 For jambs, soffits, sills, etc., openings exceeding 0.5 sqm and not exceeding 3.0 sqm, area deductions and additions shall be made in the following manner: -

(a) No deductions shall be made for end joints, beams, posts, etc. for openings not exceeding 0.5 sqm. Each and no addition shall be made for reveals, jambs, soffits, sills, etc. of these opening for finish to plaster around ends of joints, beams, posts, etc.

(b) Deduction for openings exceeds 0.5 sqm. But not exceeding 3.0 sqm. Each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings.

i) When both faces of any wall are plastered with same plaster, deduction shall be made for one face only.

(ii) When two faces of any wall are plastered with different types of plasters or if one faces is plastered and the other pointed, deductions shall be made from the plaster or pointing on the side of frame for door, windows, etc. on which width of reveals is less than that on the other side but no deductions shall be made on the other side. Where width of reveals on both faces of all is equal, deductions of 50% of area of opening on each face shall be made from area of plaster and/or pointing as the case may be.

1.7.7 For openings having door frames equal to projection beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.

1.7.8 In case of openings having area above 3.0 m<sup>2</sup>. Each, deduction shall be made for the opening but jambs, soffits, and sills shall be measured additionally.

1.7.9 The rate shall be for unit of one m<sup>2</sup>.

**E-2.** Providing and laying **20 mm. thick Double coat Sand faced cement** plaster on walls up to any height above ground level consisting of 12 mm. thick backing coat of CM 1:4 (1 cement: 4 sand) and 8 mm. thick finishing coat using sand, in CM 1:2 (1 cement: 2 sand), etc. complete. Including scaffolding, curing, making grooves, forming pattas and drip mould, etc. complete as directed.

2.1 Materials: Water used shall be free from injurious amounts and deleterious materials. PH value of water shall generally be not less than 6.0.

2.2 Workmanship:

2.2.1 The work shall be carried out in two coats. The backing coat (base coat) shall be in CM 1:4 and the relevant specifications of item no. 1. shall be followed except that the thickness of the back coat shall be 12 mm. average. Before the first coat hardens its surface shall be beaten up by edges of wooden tapers and close dents shall be made on the surface. The subsequent coat shall be applied after this coat has

been allowed to set for 3 to 5 days depending upon the weather conditions. The surface shall not be allowed to dry during this period.

2.2.2 The second coat shall be completed to average 8 mm. thickness in CM 1:2 as described above. The surface shall then be tapered to uniform grained texture by using sand only, as specified. The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per the sample approved.

2.2.3 Curing: The curing shall be started overnight after finishing of the plaster work. The plaster shall be kept wet for a period of 7 days. During this period, it shall be protected from all damages.

### 2.3 Mode of Measurements and Payment:

2.3.1 The relevant specifications of item No.1. Shall be followed.

2.3.2 The rate shall be for a unit of one m<sup>2</sup>.

**E-3.** Providing **cement vata**, 10 cm. x 10 cm. size, quarter round in cement mortar including neat cement finishing, watering, etc. complete.

3.1 Workmanship: The work of cement vata of 10 cm x 10 cm. size shall be carried out at junctions of parapets and terraces as directed. The vata shall be finished in quarter round shape. The work shall be carried out in the best workman-like manner. The internal portion of rain water pipe shall be rounded off properly during constructing the vata. The work shall be cured for 7 days.

### 3.2 Mode of Measurement and Payment:

3.2.1 The work shall be measured for finished item in Rmt.

3.2.2 The rate shall be for a unit of one Rmt.

### **E-4. WATERPROOFING WORK BY APPROVED AGENCY**

#### **4.1 Specification for waterproofing of basement structure**

(For Higher water pressure situation with PVC membrane system )

#### Scope

This specification covers waterproofing of basement structure by open cut excavation method with plasticized PVC membrane Sika plan 9.6 or equivalent by installation method of loosely laid and mechanically fastened.

#### General

The surface where waterproofing system needs to be installed shall be made free from all other activities that could disrupt the installation of the waterproofing system.

The specified waterproofing system shall be applied by a specialist applicator certified by the manufacturer of the system strictly se per the written method statement submitted by the manufacturer.

All products in the system shall preferably be manufactured by an ISO 9001 certified company, meeting the minimum key performance properties listed below against each; should the applicator choose to use

alternative equivalent products he shall provide proof of compliance with specified key performance properties.

The applicator shall ensure that the products in the system are received in good condition without damage, stored as per manufacturer's instructions.

All products in the specified system shall be produced by a single manufacturer or if the contractor or the applicator chooses to use some products from different sources they shall submit proof of compatibility.

Sikaplan 14.6 or equivalent and geo textile rolls etc. should be stored in horizontal positions in dry areas and protected against weathering on site as shown below.

Waterproofing applicators' staff should only wear suitable shoes with rubber soles (e.g. sports shoes and jogging shoes) when walking over during and after installation

Smoking and open fires must not be permitted at the site.

Waterproofing system:

Highly flexible membrane can protect an underground / basement structure against moisture, penetrating water and ground water under hydrostatic pressure.

Application: Horizontal Slab

- Over the base P.C.C, provide a 25 mm smooth plaster screed with cement – sand mortar reinforced with poly propylene fibres to control shrinkage cracking. However, if the P.C.C layer is finished smooth without any sharp projections of aggregate, the covering plaster layer may be omitted.
- Over the smooth screed, apply geo textile with weight / unit area as 300 gm / sq. mt with a minimum of 100 mm overlap by loosely lay out method.
- Loosely lay out the material with a minimum of 80 mm overlap and a 30 mm seam which should be welded by hot air welding gun of approved make (Leister guns).
- Loosely lay out the geo textile (300 gm / sq. mt) with a minimum of 100 mm overlapping. Use provisional ballast for geo textile with sand bags.
- Loosely lay out the polyethylene (HDPE) sheet (0.300 mm) as separation / gliding layer on geo textile. Overlap the HDPE sheet for 100 mm with adhesive tape for fixing at overlaps.
- Provide a protection screed plaster layer with minimum 300 kg / cu. mt cement content and minimum of 25 mm thickness with poly propylene fibre as reinforcement.
- At the junctions of the base slab and vertical wall (kicker joint), water bar (Type AR) to be used as per the guidelines from manufacturer.

Application: Vertical Walls

- Recommendation would be to cast the vertical wall fully and apply the membrane with bottom down approach with strategic fastening with metal strip and fasteners.
- In case, the wall is cast in stages and the membrane is applied simultaneously, the membrane should be provisionally tucked with the exposed reinforcement or the form work depending on the site conditions and should be heat welded with the surface water bar ( Type AR ) at the joints of pours.

- PVC discs of 100 mm diameter of approved round shape such as PVC DISC D 100 should be fixed mechanically onto the vertical wall and above material should be welded onto the discs to hold the membrane in vertical position against sagging due to self weight.
- Provide protection with a geo textile membrane with weight / unit area as 300 gm / sq. mt ). To secure geo textile with the membrane, use stitching method with PVC small strips of the same membrane which shall be welded with the main membrane.
- Erect brick work / protection layer firmly on the waterproofing.

Please refer to the method statement for details on installation guidelines.

Accessories:

1. Fast curing single component polyurethane sealant cum adhesive
2. Thinner DS
3. Stainless Steel plates and anchors. (Refer annexure 2 for specification of anchors and fasteners)
4. PVC disc (PVC DISC D 100)

Equipment for hot air welding:

1. Leister Triac S (manual for detailing)
2. Leister Electron (manual for seam welding)
3. Leister Varimat (Semi automatic for long seam welding)
3. Tool Box with roller, nozzles etc.

Application

***Applicator shall apply product in the specified system strictly as per the written method statement by the manufacturer.***

Testing:

Testing of welded seams: All welded seams should be tested for water tightness.

Testing methods:

Visual test with screw driver (heat welding only) - Heat welded seams should show continuous welding "rope" at seam edge. Irregular or interrupted seam (wrinkled seam) could be the signs of voids and capillaries in the seam. Glide the head of screw driver (approx. size 2) with slight pressure by hand along seam edge and check visually. Any voids or capillaries observed should immediately be rectified with hand held welding gun (Leister Triac S type) and 20mm silicone rubber.

4.2 Box Type Water proofing:

The underground structures shall be treated by Box method 15 cms thick layer of 1:3:6 cement concrete using No.2 metal shall be laid with smooth surface finished with trowel on well compacted soil or rubble soling or plum concrete in accordance with the soil strata. On this set proof, waterproof layer on cement base and about 7.5 cm thick shall be laid, using 1 layer of Shahabad stone placed diagonally with cut joints. After the RCC raft is laid this treatment shall be carried along the outer surface of the wall and up to a height of 30 cm above ground level. The thickness of the treatment to vertical sides is about 4 cms.

4.3. Waterproofing of water storage tank, after the plumbing work is complete the outer surface of the walls is plastered by the surface methods to floor and walls including partition walls which includes the internal plaster finished smooth with trowel. The thickness of treatment of the floor shall be 6.5 cms and on the walls 2.5 cms and finished smooth with the help of trowel. The tank shall be filled immediately after the treatment is completed.

#### 4.4 Lawn Terrace

The terrace shall be treated with surface method which after the slab shall be very through cleaned and brickbat coba with necessary gradient shall be laid for the easy flow of rain water. The coba shall be finally covered with set roof pointless waterproof plaster, finished smooth with trowel in cement colour with false marketing of 30 cms in the shape of a round wata. The average thickness of the treatment shall be 11.5 cms thickness and at the rain water outlet it shall be 7.5 cms

The treatment on the walls in this case will be for a height of 300mm above the final level.

#### 4.5 Waterproofing to toilet blocks.

All toilet blocks shall be treated with waterproofing on floors including 12 cm brickbat coba, in lime mortar 1:2 mixed with approved quality water proofing compound mixed as per manufacturers instruction, laid to slope and upto 1m height of wall dado and shall be made properly watertight around all plumbing work.

#### 4.6 Terrace waterproofing.

The terrace shall be first treated with waterproofed brick bat coba in cement mortar 1:3 laid to slope and of thickness as per the detailed drawings. The slopes properly graded for even flow of water towards the down take pipes. The junction of the slab and the parapet wall shall be treated with waterproofing flashings or fillet. The treatment of waterproofing shall be carried over the parapet wall.

#### 4.7 Thermo Cole insulation on terrace

The terrace to be treated with Thermo Cole shall be free of dust and dirt and shall be in a reasonably level condition and free of lumps and similar exerscesance. Brush one coat priming coat of bitumen emulsion no.1 (Shali kote 30 made by Shalimar Tar Products Ltd or equivalent diluted with an equal volume of clean soft water and allow it to dry until tacky, ensure that the entire surface is fully covered up.

Apply later hot 2 (Industrial Bitumen 85 /40 or 85/25 confirming to IS 702) latest editions at 20 kg / 10 sqm on the face and edge of the Thermo Cole slab with a mason's trowel. Set off thermo Cole on the roof and press it fairly into position, adjacent slabs must also be pressed together. All the joints to be then sealed with bitumen and then spread waterproof paper over the entire area.

Chicken mesh is then spread over it, which is covered with 2.5 cm thick cement mortar 1:4 metal no.1 and sand in the ratio of 1:3 . A fillet of 18cm x 12 cm is provided all along the junction of the slab and parapet wall.

**Guarantee for all waterproofing work.**

The item of waterproofing shall be carried out by M/s. India Waterproofing Company or equivalent to be approved by the Architect/Customers representatives and to their specifications.

A written guarantee in approved form shall be furnished to certify that the waterproofing shall be free from defects of materials and workmanship for period of 10 years. The leakage, failure to stay in place, splitting, pulling loose, illegating, tearing, undue expansion and contraction shall be judged as defective work.

**FORM OF GUARANTEE FOR WATERPROOFING**

Name of the project :

FREE MAINTAINANCE: WATERPROOFING WORK GUARANTEE

Name & Address of the  
Waterproofing Agency

We hereby guarantee that the surface treated by us for waterproofing in the above work for general Civil contractors M/s.....shall remain entirely water tight. Should, however, due to any unforeseen defects left out in the work carried out by us at the time of execution of the work, thereby any leakage from any surface treated by us during the period of **10 (TEN) YEARS from the date of completion of the work** i.e. from .....the same shall be rectified by us without any extra cost.

However, we shall not be responsible in any way if our work is tempered with or if the body of the structure is damaged due to sinking, cracking and/or by other act of God beyond our control.

SIGNATURE OF THE AGENCY

Place :  
Date :

SIGNATURE OF GENERAL CONTRACTOR

Place :  
Date :



## **F. Flooring**

### **F -1 - CERAMIC TILING:**

Providing and laying white/coloured ceramic tiles of approved make like Kajaria, Johnson or equivalent, conforming to IS: 777-1989 for flooring including 20mm thick cement mortar 1:4 including neat cement float, filling joints with neat cement slurry, curing and cleaning complete.

#### **F-1.1 General:**

The item pertains to providing and laying white/colour ceramic tiles for flooring of specified size and quality.

#### **F-1.2 Material:**

White or colour ceramic tiles including specials, if any, shall be of approved make and quality and shall conform to IS:777-1988 in all respects. Samples of tiles shall be got approved from the Engineer in-Charge, who shall keep them in his office for verification and composition. White or colour cement shall be of approved make. The tiles shall be tested as per IS: 777-1988 from the approved Laboratory by the contractor at his cost and test reports be furnished to the Engineer-in-Charge who will properly record the same.

#### **F-1.3 Mortar Bedding:**

The mortar shall be of 1:4 proportions and shall be about 20 mm thick average, laid on prepared sub-base of appropriate level and grade. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in the preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed, the base shall be cleaned of all dirt, scum or laitance and loose materials and then well wetted without forming any pools by the use of screed battens to proper level of slope. The thickness of the bedding shall not be less than 20 mm. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles.

#### **F-1.4 Fixing Tiles:**

The tiles before laying shall be soaked in water for at least 2 hours. Tiles which, are fixed in the floor adjoining the wall shall be so arranged that the surface of the round edge tiles shall correspond to the skirting or dado. Neat cement grout of honey like consistency shall be spread over the bedding mortar just to cover the area that can be tiled within half an hour. Paste of cement shall be applied to the back side of tiles in such a fashion that, when the tile is firmly placed in the position, the paste spreads evenly on entire area of back side of the tile to ensure proper adhesion to the bed. The edges of the tiles shall be smeared with neat white cement slurry in respect of white tiles and coloured cement slurry, matching the coloured tiles in respect of coloured and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight lines. The joints between the tiles shall not exceed 1.5 mm wide. The joints shall be grouted with slurry of white cement in respect of white tiles. Where coloured glazed tiles are specified joint shall be grouted with slurry of white cement mixed with appropriate colour matching the colour of tiles laid.

#### **F-1.5 Curing :**

After fixing the tiles finally in an even plane, the flooring shall be covered with wet saw dust and allowed to mature undisturbed for 7 days.

**F-1.6 Cleaning :**

After the tiles have been laid in a room or at the day's fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, the floor shall be carefully washed clean and dried. When dry, the floor shall be covered with oil free dry saw dust which shall be removed only after completion of the construction work and just before the floor is occupied.

**F-1.7 Item to Include :**

The item shall include all labour, materials, tools and equipment required for the operations to carry out the item for providing and fixing the white or coloured ceramic tiles as specified above. The item also includes Cement Mortar 1:3 mortar bed 20 mm thick.

**F-1.8 Mode of Measurement and Payment :**

The area of the flooring shall be measured in sqm correct up to 2 decimals. The contract rate shall be per sqm for the specified quality of white or coloured ceramic tiles.

**F 2 – GLAZED TILING.**

Providing and laying coloured glazed tiles of approved size , make colour and quality for walls, dado & skirting in required position & in line and level on a bed of 1:3 cement plaster including cement slurry, filling the joints with matching colour cement slurry, curing and cleaning etc. complete.

**F-2.1 General :**

The item pertains to providing and fixing the white or coloured glazed tiles.

**F-2.2 Material :**

White or colour glazed tiles including specials if any shall be of approved make and quality and shall conform to IS:777-1988 in all respect. Samples of tiles shall be got approved by the Engineer-in-Charge, who shall keep them in his office for verification and composition. White or coloured cement shall be of approved make. The samples of the tiles shall be tested as per provisions in the IS:777-1988 in the approved laboratory and test reports be furnished to MIDC for record.

**F-2.3 Plastering to Walls :**

Providing cement plaster 1:3, 20 mm thick or similar to providing of mortar bed i.e. providing plaster to walls is included in the item.

**F-2.4 Fixing of Tiles :**

Dado or skirting work shall be done only after fixing tiles on the floor. The white/coloured glazed tiles shall be soaked in water for at least 2 hours before being used for skirting or dado work. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff. The back of tiles shall be covered with a thin layer of neat cement paste and the tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from the bottom of wall upwards without

any hollows in the bed or joints. Each tile shall be fixed as close as possible to the one adjoining. The tiles shall be joined with white cement slurry in respect of white tiles and coloured cement slurry matching the colour of the tiles in respect of coloured tiles. Any difference in the thickness of tiles shall be evened out in cushioning mortar to that all tile faces are in one vertical plane. The joints between the tiles shall not exceed 1.5 mm in width and they shall be uniform. While fixing tiles in dado work care shall be taken, not to break joints vertically if the pattern of fixing tiles have not been specified. After fixing the dado, skirting etc., they shall be kept continuously wet for 7 days. If doors, windows or other openings are located within the dado area, the sills, jambs, angles etc., shall be provided with glazed tiles and appropriate specials according to the foregoing specification and such tiled area shall be measured net along with the dado.

**F-2.5 Item to Include :**

The item includes all material, labour, tools and equipments, for providing mortar cushioning, fixing of tiles, filling of joints, curing cleaning etc, complete. The item also include 20 mm thick cement mortar 1:3 plaster.

**F-2.6 Mode of Measurement and Payment :**

The measurement shall be the area of the dado or skirting provided in sqm correct up to 2 decimal. The tile area provided for jambs, sills etc. shall be measured, net along with the area of dado or skirting. The rate specified is the extra rate over the rates worked out the rates adding the rates for specified sub-items of item Bd/A/8 plus Bd/A/9, if required and this additional rate for dados and skirting.

**F-3 - FLOORING IN KOTAH.**

Providing & laying 25 mm thick hand dressed/machine cut green polished kotah of approved quality, selected and sorted for uniform colour, in floor, otta, sill, dado etc., in required sizes above 60 cm and upto 90 cm, in normal pattern and as per design and drawing, including cement mortar 1:6 bedding of required thickness, joints & pointing as specified, three or more coats of polishing (with oxalic acid) upto mirror finish surfaces with different grades of Emery, curing, daily moping with water & kerosene as directed for atleast 15 days or upto the satisfaction of the Architect/Customers representative & Engineer-in-charges etc. complete. (NO WAXING WILL BE PERMITTED).

**F-3.1 Materials :**

Water shall be free from injurious amounts and deleterious materials with PH generally not less than 6.0. Cement mortar for bedding in 1:6. Polished kotah shall be of reasonably uniform colour.

**F-3.2 Workmanship :**

F-3.2.1 Each slab shall be cut to the required size and shape and fine chisel, dressed at all the edges. The sides thus dressed shall have full contact if laid along a straight edge. The sides shall be table rubbed with coarse sand, before paving. All angles and edges of the slabs shall be truly square and free from chipping and shall give a plane surface. The thickness of the slab shall be 25 mm. (average) as specified in the item but not less than 20 mm. at any place of the slab.

F-3.2.2 Bedding for the kotah slab flooring shall be of cement mortar 1:6 (1 cement : 6 coarse sand) or lime mortar 1:1.5 of average thickness 20 mm. as given in the description of the item. Sub grade shall be cleaned, wetted and mopped. Mortar of the specified mix and thickness shall be then be spread on an area sufficient to receive one kotah slab. The slab shall be washed clean before laying. It shall be laid on top pressed, tapped gently to bring it in level with the other slabs. It shall then be lifted and laid aside. Top surface of the mortar

shall then be corrected by adding fresh mortar at hollows or depressions. The mortar shall then be allowed to harden a bit. Over this surface, cement slurry of honey-like consistency shall be applied. The slab shall then be gently placed in position and tapped with wooden mallet till it is properly padded in level with and close to the adjoining slab. The joint shall be as fine as possible. The slabs fixed in the floor adjoining the wall shall enter not less than 10 mm. under the plaster, skirting or dado. The junction between the wall and floor shall be finished neatly. The finished surface shall be true to levels and slopes, as directed.

F-3.2.3 While laying, any chiselling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm., between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required, shall be provided as per the drawing and design.

F-3.2.4 In places where full tiles cannot be fixed, the tiles shall be cut to the size and smoothened at edge to give straight and true joints.

F-3.2.5 All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect/Customers representative/Engineer-in-charge.

F-3.2.6 The floor shall be kept wet for a minimum period of 7 days, so that bedding and joints set properly.

F-3.2.7 Polishing shall be normally commenced after 14 days of laying the slab. First polishing shall be done with carborundum of 60-120 grade grit fitted in the heavy machine and then second polishing shall be done with carborundum of 220 to 350 grade grit fitted in the heavy machine. Water shall be properly used during polishing. The flooring shall then be washed clean with water and oxalic acid. As directed by the Architect/Customers representative/Engineer-in-charge and as specified in the item, no waxing will be permitted.

F-3.2.8 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

F-3.2.9 The holes required for Nahni traps, pipes any other fittings shall be made without any extra cost.

F-3.3 Mode of Measurements and Payment :

F-3.3.1 Kotah slab flooring shall be measured in m<sup>2</sup> for visible area of work done.

F-3.3.2 No deductions shall be made nor extra paid for any opening in the floor area upto 0.1 m<sup>2</sup>. Nothing extra shall be paid for use of cut tiles or for laying the floors at different levels in the same room or court yard. Kotah slabs laid in floor borders and bands etc. shall be measured in the same item and nothing extra shall be payable on account of these or similar bands formed of half or multiples of half size standard tiles/or other uncut tiles.

F-3.3.3 The treads of stairs and steps paved with tiles without nosing shall also be measured under this item.

F-3.3.4 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, at all floors, at any height and level, as described above. It

shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be got approved by the Architect/Customers representative/Engineer-in-charge before placing orders.

F-3.3.5 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

F-3.3.6 The rate shall include for fixing the flooring in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

F-3.3.7 The basic rate, if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

F-3.3.8 The risers of steps, skirting or dado shall be measured in m<sup>2</sup>. Length shall be measured along the finished faces of risers, skirting or dado. Height shall be measured from finished level of treads or floor to top. Lining of pillars shall be measured under this item.

F-3.3.9 The rate shall be for a unit of one m<sup>2</sup>

#### **F-5 – GRANITE IN STAIRCASE,**

Providing & fixing jet black polished granite of average 20 mm. thick of uniform size and colour for platforms, staircase riser and treads, sinks, shelves, sills etc. upto 1.0 m. long, including necessary machine-cut edges (uniform thickness) rounded edges, necessary cement mortar bedding in CM 1:2 of required thickness, etc. complete

##### **F-5.1 Materials & Workmanship :**

The thickness of granite shall be 20 mm. and shall be double polished. The size of the granite shall be up to 1.0 m. only. Waxing shall not be permitted. The polishing shall be done manually instead of machine polishing and bedding shall be in CM 1:2.

##### **F-5.2 Mode of Measurements and Payment :**

The rate shall be for an unit of one m<sup>2</sup>.

#### **F-6. ANTISKID SURFACE,**

Providing roughened strip 2.5 cm. wide to form antiskid surface on any flooring as per design, including forming straight deep curved gishi (groove), 5.0 x 3.0 mm. wide on two sides of the roughened area, chiseling etc. complete.

##### **F-6.1 Workmanship :**

The roughened strip 2.5 cm. wide shall be provided as and where directed. The roughening shall be carried out by providing two curved grooves on either side of roughened strip provided with machine.

##### **F-6.2 Mode of Measurements and Payment :**

The length of the groove and roughened strip clearly visible shall be measured. The rate shall be for an unit of one meter.

#### **F-7 IPS 1:2:4**

Providing and laying cement concrete pavement 50 mm. thick I.P.S (Indian Patent) 1:2:4 (1 cement : 2 coarse sand : 4 graded aggregate 20 mm. nominal size), laid in one layer finished with floating coat of neat cement.

##### **F-7.1 Materials :**

Aggregate 20 mm. nominal size. Cement concrete 1:2:4 proportion measured by volume shall conform to relevant specification of ordinary grade 1:2:4 concrete.

##### **F-7.2 Workmanship :**

###### **F-7.2.1 Preparation of Surface:**

Before the operation for laying the topping is started, the surface of the base concrete shall be thoroughly cleaned of all dirt, loose particles, caked mortar droppings and laitance, if any, by scrubbing with coir or steel wire brush. Where the concrete has hardened so much that roughening of surface by wire brush is not possible, the surface shall be roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid.

###### **F-7.2.2 Laying:**

F-7.2.2 a. The screed strips shall be fixed over the base concrete dividing it into suitable panels. Before placing the concrete for topping, neat cement slurry shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish. Concrete of specified proportion and thickness shall be laid in alternate panels to required level and slope and thoroughly tamped and cement concrete 1:2:4 shall conform to relevant specifications of section 2.00.

F-7.2.2 b. The cement concrete flooring of 40 mm. thick (Average) is to be laid as per the site condition. The concrete shall be mixed in a mechanical mixer at the work. Hand mixed may however be allowed for smaller quantities of work and in case of failure of machines or as permitted by the Engineer-in-charge. It shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However, in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mechanical mixing shall be done for a period of 1.5 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose. Flooring of specified thickness shall be laid in accordance with approved pattern or as directed. Finishing operation shall start shortly after the cessation of beating and shall be spread over a period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be left for some time till moisture disappears from it. Fresh quantity of cement shall be mixed with water to form a thick slurry and spread over the surface while the concrete is still green. Use of dry cement or cement and sand mixture sprinkled on this surface to stiffen the concrete or absorb excessive moisture shall not be permitted. The cement slurry shall then be properly pressed twice by means of iron floats, once, when the slurry is applied and the second time when cement starts setting and is to be finished smooth. The surface shall be marked with string or B.R.C. fabric jali to make the surface non-slippery as and when directed. The

junction of floors with wall plaster, dado or skirting shall be rounded off where so required upto 25 mm. radius. Flooring in lavatories and bath rooms shall be laid after fixing of water closet and squatting pans and floor traps which shall be plugged while laying the floors and opened after the floors are completed. Any damage, done to water supply or sanitary fittings during execution of work shall be made good.

F-7.2.2 c. After the final set, the concrete shall be kept continuously wet, if required by ponding, for a period of not less than 7 days from the date of placement.

F-7.2.2 d. The form work shall be provided if necessary as directed by Architect/Customers representative/Engineer-in-charge. Concreting shall be done as per alternate bay method with necessary centering either by mastic or cement mortar as directed.

#### F-7.3 Finishing the Surface:

After the concrete has been fully compacted it shall be finished by trowelling or floating with neat cement rendering. Finishing operations shall start shortly after the compaction of concrete and the surface shall be trowelled three times at intervals so as to produce an uniform and hard surface. The satisfactory resistance of floor to wear and tear, depends largely upon the care with which trowelling is carried out. The time interval allowed between successive trowelling is very important. Immediately after placing cement rendering, only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to bring a layer in cement to the surface. Sometime, after the first trowelling, the duration depending upon the temperature and atmospheric conditions and the rate of setting of the cement used, the surface shall be retrowelled to close any pores in the surface and to bring to surface and to scrape off any excess water in concrete or any laitance. No dry cement shall be used directly on the surface to absorb moisture or to stiffen the mix. The final trowelling shall be done well before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface.

If directed by the Architect/Customers representative/Engineer-in-charge, approved mineral pigment shall be added to the rendering to give desired colour and shade to the flooring at no extra cost.

When 1:2:4 mix is specified the topping shall be rendered with 1:1:2, (1 part cement mortar with a suitable mineral pigment (if directed), 1 part sand and 2 parts grit - 6 mm. and down size), instead of cement only. If specified in the schedule of quantities, the flooring shall be machine polished as per Architect/Customers representative/ Engineer- in-charge's instructions.

Wherever the patent flooring is used as a finishing on roof, the joints shall be filled with an approved bitumastic filler in a workman-like manner.

#### Ironite Topping:

Instead of finishing the top with rendering coat of 1:1 cement mortar, the top shall be finished with ironite topping. Unless, otherwise specified, one part of ironite and four parts of ordinary cement by weight shall be mixed dry thoroughly. This dry mixture shall be mixed with grit 6 mm. (1/4") and down size or as otherwise directed in the ratio of 1:2 by volume and well turned over. Just enough water shall be added to this dry mix and mixed thoroughly well and laid to uniform thickness of 12 mm. and compacted. After the initial set has started the surface shall be finished as directed.

**F-7.3.1 Mode of Measurements and Payment :**

F-7.3.1 a. The rate shall include the cost of all materials and labour involved in all the operations described above. No deduction shall be made or extra paid for any opening upto  $0.1 \text{ m}^2$  in area, in the floor, nothing extra shall be paid for laying the floor at different levels in the same room or the courtyard.

F-7.3.1 b. The rate shall be for an unit of one  $\text{m}^2$ .

**F-8 – BROKEN CHINA MOSAIC FLOORING:**

Providing & laying broken china mosaic flooring for plain and curved surfaces, comprising of 12 to 20 mm. size broken pieces of ceramic/glazed tiles (one or more colours, as directed), laid over cement mortar 1:3 bedding, on plain or sloped surfaces. The flooring shall be tampered to bring the mortar cream up to the surface, including rounding of the junctions and extending them upto 15 cm. along the parapet wall. The rate shall include bands, if different colour is used, any pattern or design as per drawing and direction, curing, cleaning with water and oxalic acid, etc. complete.

F-8.1 Materials: White and coloured glazed tiles and make such as Johnson and Johnson, Somany or equivalent, first quality.

**F-8.2 Workmanship:**

**F-8.2.1 Bedding:**

F-8.2.1 a. The sub-grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface, as described above, tamped and corrected to desired level and allowed to harden enough to offer a rigid cushion to tiles and to enable the mason to place wooden planks across and squat on it.

F-8.2.1 b. The white/coloured glazed tiles shall then be laid on the cement mortar bedding of 12 mm. thickness, in CM 1:4. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of the bedding. The base shall be cleaned and well wetted, before laying. The mortar shall then be spread in thickness not less than 10 mm. at any place and average 12 mm. thick. The proportion of the cement mortar shall be as specified in the item.

**F-8.3 Fixing tiles :**

F-8.3.1. The tiles before laying shall be soaked in water for atleast two hours. Neat grey cement grout at 3.3 Kg./Cement/ $\text{m}^2$  of honey-like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be smeared with neat cement slurry. The tiles shall then be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

F-8.3.2. The tiles shall not have staggered joints. The joints shall be true to center line both ways. The Nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible.



Where full size tiles cannot be fixed, they shall be cut (Sawn) to the required size and the edges rubbed smooth to ensure straight and true joints. After the tiles are laid, the joints shall be cleaned of grey cement grout with a wire brush to a depth of about 5 mm. and then grouted with white cement with or without pigment to match the shade of the topping of tiles. The same cement slurry shall then be spread over the whole surface in a thin coat to protect the surface from abrasive damage and to fill up pin holes that may exist on the surface. White cement with or without matching pigment shall be used for pointing the joints. After fixing the tile finally in an even plane the flooring shall be kept wet and allowed to cure undisturbed for 7 days.

F-8.3.3. While laying, any chiselling which may be required for making the skirting or dado flush with the plaster and/or other finishes shall be done. Necessary grooves of required size in cm., between plaster and/or other finishes, dado or skirting (if required) shall be provided. Forming machine-cut/rounded edges, gutters, sills, platforms, channels, curbing, etc. if any, if required shall be provided as per the drawing and design.

F-8.3.4. In places where full tiles cannot be fixed, the tiles shall be cut to the size and smoothened at the edges to give straight and true joints.

F-8.3.5. All necessary slopes, gradients and levels shall be truly maintained as required and directed by the Architect/Customers representative/Engineer-in-charge.

#### F-8.4 Cleaning:

F-8.4.1 The surplus cement grout that may have come out of the joints shall be cleared off before it sets. Once the floor has set, it shall be carefully washed and cleaned by dilute acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the construction.

F-8.4.2 If any tile is disturbed or damaged it shall be refitted or replaced, properly jointed and polished.

#### F-8.5 Mode of Measurements and Payment:

F-8.5.1 The work done shall be measured in m<sup>2</sup>. for the visible area of work done in floor and dado. The length and width of the flooring shall be measured between the faces of skirting or dado or plastered face of walls as the case may be. The paving under dado or skirting shall not be measured. No deduction shall be made nor extra paid for any opening in the floor of area upto 0.1 m<sup>2</sup>. Nothing extra shall be paid for laying the floors at different levels in the same room. The dado will be measured from the finish floor level to the top of tile fixed.

F-8.5.2 The rate shall include the cost of all materials (inclusive of all taxes, levies, and delivery at site), labour & sundry involved in all the operations, at all floors, at any height and level, as described above. It shall also include for breakage and wastage. Floating materials and margin of profit shall also be included. All material samples shall be got approved by the Architect/Customers representative/Engineer-in-charge before placing orders.

F-8.5.3 No extra shall be paid for any small quantities like narrow widths, mitred & returned ends, rounds & cutting, fixing and making good upto & around pipes, fittings and fixtures etc.

F-8.5.4 The rate shall include for fixing the flooring in composite pattern as per the drawings, using different materials and sizes. The measurements of the different materials shall be taken category-wise separately and paid accordingly.

F-8.5.5 The basic rate if at all provided or agreed upon includes cost of material, all taxes, levies & cost of delivery at site.

F-8.5.6 The rate shall be for a unit of one m<sup>2</sup>.

#### **F-9 WHITE MARBLE:**

Providing & laying approved quality white (light and/or dark green Ambaji or of approved origin) marble 20 mm. thick, as per design and in required sizes and shapes (size not exceeding 0.6 x 0.9 m.), including necessary white cement mortar bedding of 1:4 proportion and white cement pointing in joints, polishing, curing etc. complete. (Only finished marble work shall be measured). The work will be carried out in diagonal or rectangular pattern with motifs as per detailed drawings and direction.

##### **F-9.1 Materials :**

Marble slabs shall be of the best Indian marble of white or other approved colour as specified in the item. They shall be hard, dense, uniform and homogeneous in texture. They shall have crystalline grain and shall be free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges shall be machine-cut, true to square. The rear face shall be rough enough to provide a key for the mortar.

No slab shall be thinner than the specified thickness at its thinnest part. The sizes of the slabs shall be as specified in the respective items.

##### **F-9.2 Workmanship :**

###### **F-9.2.1 Dressing of slabs :**

Every shall be cut to the required size and fine chiselled, dressed to give a smooth and even surface on all sides, to the full depth. A straight edge laid along the sides of the slab shall be fully in contact with it. Chisel dressing shall also be done on the top surface to remove any waviness. The sides and top surface of the marble slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of slabs shall be truly square and free from chipping.

F-9.2.2 The thickness of the slab shall be 20 mm. The allowable tolerance shall be 2 mm. The tolerance shall be 15 mm. in length and breadth.

###### **F-9.2.3 Bedding :**

Bedding of marble slabs shall either be in lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) or cement mortar 1:3 (1 cement : 3 coarse sand) of average thickness 20 mm. as given in description of the item. Minimum thickness at any place shall not be less than 10 mm.

###### **F-9.2.4 Laying :**

The surface of sub grade shall be cleaned, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one marble slab. The slab shall be washed clean before laying. It shall be laid on top, pressed and tapped gently to bring it in level with other slabs. It shall then be lifted and laid aside. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar shall then be allowed to harden and over this surface, cement slurry of honey-like consistency at 4.4 Kg.cement/m<sup>2</sup> is spread. The edges of slabs already paved shall be buttered with grey cement. The slab shall then be gently placed in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slab. The joints shall be as fine as possible. Surplus cement on the surface of the slabs shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster, skirting or dado. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and slopes as directed.

**F-9.2.5 Curing :**

The floor shall be cured for a minimum period of seven days.

**F-9.2.6 Polishing and finishing :**

Unevenness at the meeting edges of slab shall be removed by fine chiseling. Finishing etc. shall be done as per relevant specifications of item no. 9.01.a of terrazzo tiles flooring except that cement slurry with/without pigments shall be applied on the surface before each polishing. All exposed edges shall be squared, chamfered or rounded as per drawing or as directed by Architect/Customer Representative/Engineer-in-Charge. All such exposed edges shall be hand polished to match the adjoining surface polish.

**F-9.3 Mode of Measurements and Payment :**

**F-9.3.1** Marble flooring with various kinds of marble shall be measured in m<sup>2</sup>. The length and breadth shall be measured between the finished face of skirting or dado or wall plaster. No deduction shall be made nor extra shall be paid for any openings in the floor of area upto 0.05 m<sup>2</sup>. Nothing extra shall be paid for laying at different levels in the same room. Treads and steps of stairs paved with marble slabs shall also be measured under this flooring.

**F-9.3.2** The rate shall be considered as per the relevant specifications of item no. F-1. The rate shall be for an unit of one m<sup>2</sup>.

**F-10. MARBLE/GRANITE SLAB PARTITIONS,**

Providing and fixing 20 mm. thick marble/granite slab partitions, in walls in CM 1:2, including making zaris 25 mm. deep, fixing and making good all around, complete as directed.

**F-10.1 Materials :**

Marble/granite slab 20 mm.

Marble/ granite slabs shall be of the best Indian marble/granite of white/jetblack or other approved colour as specified in the item. They shall be hard, dense, uniform and homogeneous in texture. They shall have crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface on both sides and edges machine cut true to square or any other shape desired.

No slab shall be thinner than the specified thickness at its thinnest part. The sizes of the slabs shall be as specified in the respective items.

**F-10.2 Workmanship :**

**F-10.2.1 Dressing of slabs :**

Every piece shall be cut to required size and fine chisel dressed to give a smooth and even surface on all sides to the full depth. Chisel dressing shall also be done on both the surfaces to remove any waviness. The sides and top and bottom surfaces of marble/granite slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of slabs shall be true, square and free from chipping.

**F-10.2.2** The thickness of shall be 20 mm. The allowable tolerance shall be 2 mm. allowable. The tolerance shall be 15 mm. in length and breadth.

**F-10.2.3 Fixing :** A minimum 25 mm. deep zari shall be made in the wall where the partition is to be fitted. The thickness of the zari will be slightly more than the thickness of the marble slab. The zari shall be cleaned and well watered before grouting in the CM 1:2. The marble slab shall then be pushed in firmly in true plumb. All the excess mortar shall be pressed into the sides as much as possible before flushing the junction. After the mortar has harden a little, the joint at the junction of the wall and marble slab shall be raked and pointed with white or pigmented neat cement slurry, to match the colour of the partition slab.

**F-10.2.4 Curing:** Curing shall be done for at least 7 days.

**F-10.3 Polishing:** Hand polishing shall be done after the curing period to give a good polished appearance.

**F-10.4 Mode of Measurements and Payment:**

**10.4.1** The rate shall be for a unit of m<sup>2</sup>. And clear visible area shall be measured.

**10.4.2** The rate shall include for all materials, labour and sundry involved in operation of the above specified item.

**F-11 GRANAMITE TILING**

Providing and fixing of fully vitrified high gloss Granamite tiles in floor and dado.

**F-11.1 Materials**

**F-11.1.1** Tiles shall be granamite or equivalent, fully vitrified with high gloss polished surface. The surface hardness of the tiles shall be min 7 on Mohr's Scale. The thickness of tile shall be uniform for approved quality of tiles. Tiles shall be true to shape & shall have sq edge. The surface shall be perfectly in level. Bent tiles or tiles with variation in dimensions shall not be used.

**F-11.1.2** Mortar shall be cement mortar 1:4

**F-11.1.2** Slurry shall be neat cement paste of honey like consistency.

### F-11.2 Workmanship

F-11.2.1 The tile pattern Shall be first established and approved by Architect/Customers representative/ Engineer-in-charge. The positioning of the cut pieces shall first be approved by Architect/Customers representative/ Engineer-in-charge. Internal cut pieces shall not be permitted. If the area where the tiles are to be laid is not perfect Rectangular or Square, the difference shall be adjusted at edges away from the visible or open areas in consultation with the Engineer-in-charge/Architect/Customers representative. Diagonal Pattern in such areas may be permitted.

F-11.2.2 In case of irregular shaped areas & where diagonal Pattern is provided, extra care shall be taken to fix triangular tile pieces.

F-11.2.3 The bedding Mortar & Fixing Grout shall be carried out as described in 1.

F-11.2.4 Tiles with chipped off Surface Finish shall not be used.

F-11.2.5 Entire tile work shall be protected by laying over it a thick layer of Gypsum plaster or loose full size plywood boards.

11.2 Curing shall be as per F-1.5

11.3 Measurement shall be as per F-1.8

### F-13 Lining for walls in pump room:

F-13.1 Scope: This specification covers the waterproofing of vertical walls of the tank using polyolefin membranes.

#### F-13.2 General:

The area where waterproofing system needs to be installed shall be made free from all other activities that could disrupt the installation of the system.

The products specified shall be installed strictly in accordance with the manufacturer's written instructions and by a specialist applicator approved by the manufacturer.

All products in the system shall be manufactured by an ISO 9001 certified company and shall meet the key performance properties listed below against each. Should the applicator or contractor prefer to use alternative equivalent product(s), the Applicators shall provide proof of compliance to the specified key performance properties.

The applicator shall ensure that all products in the system are received in good condition without damage and stored as per manufacturer's instructions.

All products in the specified system shall be produced by a single manufacturer. Should the applicator or contractor prefer to use products from different sources they shall submit proof of compatibility between them.

#### F-13.3 Substrate:

The main contractor or the applicator shall take effective preparatory measures to maintain the water level below the level of lean concrete bed until the completion of the waterproofing works, including such measures as installation of a sump and pump system of sufficient capacity.

The applicator shall inspect and ensure that the substrates - the lean concrete bed slab in the basement and the concrete retaining walls – are free of cracks, protrusions and damage to surface integrity. Should any defect be present in the substrates, the contractor or applicator shall carryout all the necessary rectification works and preparatory works before the installation of the specified waterproofing system.

Cracks running through the sections, internal porosity and visible weak spots on the surface shall be repaired using high pressure injection with cementitious slurry modified with non shrink additive, and SBR based polymer additive as per manufacturer's specifications.

Any surface cracks shall be chased open into a 'V' groove, and filled with a ready to use, non shrink repair mortar.

The substrate shall be rendered sound, free from contaminants such as fungus, algae, dust, etc., by removing all weak layers and cleaning with up to 5% solution of Sodium Hypochlorite (to remove biological growth) and high pressure water jet.

#### **F-14 Placing of inserts.**

Placing and fixing of SS flange/ spouts/ plates /inserts etc ( supplied by client ) in concrete walls / columns/ beams as per fixing instructions and procedure including required wooden shuttering , line leveling and maintaining centers using laser beam. Including maintaining the distances from reference points during concreting/ grouting including applying lubricant/grease to parts to be kept open and clean after deshuttering. Making inserts /cutouts to finish size and face along with water tightness of joints. Getting approval from (tank room) client before concreting /grouting is must.

**F – 15** Laying M-25 grade concrete with cement as per design mix (approx. 410kg/cum) . In floors, 150 mm thick well compacted, mechanically vibrated, finished to required levels, de-watered by vacuum process TREMIX or equivalent floated with neat cement and power trowelled to get desired smooth finishing over 75 mm thick plain cement concrete of mix 1:3:6 as a leveling course over rubble soling, including MS shuttering wherever required, curing etc. complete for both operations of concrete work. The construction joints to be formed by cutting with mechanical saw. The size of the groove to be cut in both directions i.e. along the panels and across the panels in concrete. The operation should be carried out after final curing of concrete. The groove joints should be filled with clean dry sand at bottom and finished with polysulphide joint sealant at top. The surface tolerance should not exceed 3 mm in three-meter length measured by straight edge in any direction. (All work to be measured paid under respective items in the schedule. This rate is extra over the schedule rates for vacuum de-watering and finishing only.)

F-15.1 The base to receive the concrete shall be prepared as directed by Engineer in Charge.

F-15.2 The M-25 and M-10 grade concrete shall be provided of specified thickness as per IS: 456-2000.

F-15.3 The reinforcement shall be provided as per IS.

F-15.4 Joints shall be cut and filled as specified above. The payment for all above works will be paid under relevant items.

F-15.5 The dewatering shall be done by using vacuum process TREMIX or equivalent floated with neat cement & power traveled to get desired smooth finishing.

F-15.5.1 Process of Vacuum: The surface where the TREMIX flooring is to be provided shall be cleaned properly.

F-15.5.2 Equipment : All equipments required for vacuum process TREMIX are included under the item.

F-15.6 Mode of Measurement and Payment : The payment of work completed in all respect shall be per sqm basis of contract rate.

## **G . PAINTING**

**G-1 Oil bound washable distemper** (3 coats) of approved manufacturer like Asian, Berger, Nerolac or equivalent and of required shade, on any surface to give an even shade, including a priming coat with alkali resistant primer and applying two coats of putty after thoroughly brushing the surface free from mortar dropping and other foreign matter and also including preparing the surface even and sand papered smooth etc., after applying one coat of putty, complete, as directed.

### **G-1.1 General :**

The item pertains to providing and applying washable Oil Bound Distemper of approved colour to old or new plastered or masonry surfaces for the specified number of coats.

### **G-1.2 Material :**

Oil emulsion (Oil Bound) washable distemper (IS:428) of approved brand and manufacture shall be used. The primers where used as on new work shall be cement primer or distemper primer as described in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day's work shall be prepared. The distemper and primer shall be brought by the contractor in sealed tins in sufficient quantities at a time to suffice for a fortnight's work, and the same shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empty tins shall not be removed from the site of work, till this item of work has been completed and passed by the Engineer-in-Charge. The empty carriers shall be the property of the contractor and however will not be removed from site without permission of Engineer-in-Charge.

### **G-1.3 Scaffolding :**

G-1.3 1. Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No bullies, bamboos or planks shall rest on or touch the surface.

G-1.3 2. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

G-1.3 3. For white washing the ceiling, proper stage scaffolding shall be erected.

### **G-1.4 Preparation of Surface :**

G-1.4 1. For new work the surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.

G-1.4 2. In the case of old work, all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease, dirt etc. Pitting in plaster shall be made good with plaster of Paris mixed with the colour to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

**G-1.5 Priming Coat :**

The priming coat shall be with distemper primer or cement primer, as required in the description of the item. The application of the distemper primer shall be as described above.

Note : If the wall surface plaster has not dried completely, cement primer shall be applied before distempering the walls. But if distempering is done after the wall surface is dried completely, distemper primer shall be applied.

**G-1.6 Application of Oil Bound Distemper :**

G-1.6 1. Oil bound distemper is not recommended to be applied, within six months of the completion of wall plaster. However, newly plastered surfaces if required to be distempered before a period of six months shall be given a coat of alkali resistant priming paint conforming to IS: 109 and allowed to dry for at least 48 hours before distempering is commenced.

For old work no primer coat is necessary.

**G-1.6 2. Distemper Coat :**

For new work, after the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. One coat of distemper properly diluted with thinner (water or other liquid as stipulated by the manufacturer) shall be applied with brushes in horizontal strokes in both direction followed immediately by vertical ones in both direction, which together constitutes one coat. The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied over the primer coat to obtain an even shade. A time interval of at least 24 hours shall be allowed between successive coats to permit proper drying of the preceding coat. For old work the distemper shall be applied over the prepared surface in the same manner as in new work. One or more coats of distemper as are stipulated shall be applied to obtain an even and uniform shade. 15 cm double bristled distemper brushes shall be used. After each days work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes, which are dirty and caked with distemper, shall not be used on the work.

**G-1.7 Protective Measures:**

Doors, windows, floors, article of furniture etc. and such other parts of the building not to be white washed, shall be protected from being splashed upon. Splashing and droppings, if any shall be removed



by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

**G-1.8 Item to Include:**

Item includes all labour, material, equipments such as brushes, scrappers, polish papers etc., scaffolding, cleaning of the area etc. complete as per the specifications. The item also includes removing nails, marking good holes, cracks, patches etc. The item also includes cleaning of windows / doors / flooring etc spoiled during painting.

**G-1.9 Mode of Measurement and Payment:**

G-1.9. 1. Length and breadth shall be measured correct to a cm. and area shall be calculated in m<sup>2</sup> correct to two place of decimals.

G-1.9.2. Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area. Corrugated asbestos cement sheet 20% Semi corrugated asbestos cement sheet 10%

G-1.9.3. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

G-1.9.4. The number of coats of each treatment shall be stated. Not exceeding 50 sqm. each with material similar in composition to the surface to be prepared.

G-1.9.5. Work on old treated surfaces shall be measured separately and so described. The contract rate shall be per sqm area painted including all material and labour involved in all the operations described above.

**G-2 Providing and applying plastic emulsion paint:**

**G-2.1 Materials:**

The plastic emulsion shall conform to IS: 5411-1969(Part-1).

**G-2.2 Workmanship:**

The relevant specification of item no. G-1 shall be followed except that plastic emulsion paint shall be applied on any surfaces. For flat and pearl luster (semi gloss) paint of same specification shall be followed except that the type of paint shall be changed as per the direction of Architect/Customers Representative/Engineer-in-charge, to give the desired finish.

**G-2.2.1 Scaffolding:**

The relevant specifications shall be followed.

**G-2.2.2 Preparation of surface:**

The relevant specifications of item No. G-1, shall be followed.

**G-2.2.3 Preparation of Mix:**

This shall be done as per the manufacturer's instructions. The thinning of emulsion is to be done with water and not with turpentine. The quantity of thinner to be added to shall be as per manufacturer's instructions.

### G-2.3 Application:

G-2.3.1 Before pouring into small containers for use of applying, the paint shall be stirred thoroughly in its container. Also, the paint shall be continuously stirred in the smaller container, so that its consistency is kept uniform.

G-2.3.2 The paint shall be laid on evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

G-2.3.3 The paint shall be applied with brush for first two coats and final coat shall be done with roller only. The surface shall be treated with minimum one coat of alkali resistant primer and putty as specified in relevant specification of workmanship of item no.G-1 The second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking of the brush being used.

G-2.3.4 The surface on finishing shall present a flat velvety smooth/pearl luster (semi gloss) finish, as specified in the item. It shall be even and uniform in shade without patches, brush marks, paint drops etc.

### G-2.4 Precautions:

- (a) Old brushes if they are to be used with emulsions paints shall be completely dried of turpentine or oil paint by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and shall be kept immersed in water during break periods to prevent the paint from hardening on the brush.
- (b) In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.
- (c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.
- (d) Washing of surfaces treated with emulsion paint shall not be done within 3 to 4 weeks of application.

G-2.5 Protective measures : The relevant specifications of item shall be followed.

### G-2.6 Mode of Measurements and Payment :

G-2.6.1 The relevant specifications of item No. G-1 shall be followed.

G-2.6.2 The rate shall be for a unit of one m<sup>2</sup>.

**G-3** Providing & applying three coats (first two coats are with brush and final coat is with roller) of Glossy, flat, pearl **lustre** and Matt enamel paint of desired shade, of approved make, shade, brand and manufacture, on any surfaces, at all heights, to give an even shade, including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand papering smooth. The paint shall be applied after applying a coat of primer and putty.

**G-3.1 Materials :**

Glossy, Flat, Pearl Lustre and Matt enamel paint shall conform to IS : 1932-1964 and M-44B.

**G-3.2 Workmanship :**

G-3.2.1 The materials required for work of painting work shall be obtained directly from approved manufacturers or approved dealer and brought to the site in maker's drums, cage etc. with seal unbroken.

G-3.2.2 All materials not in actual use shall be kept properly protected, lid of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. The materials which have become stale or flat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in smaller container. No left over paint shall be put back into stock tins when not in use. The paint shall be stirred thoroughly in its container before pouring into small containers.

G-3.2.3 If for any reasons, thinning is necessary, the brand of thinner recommended by the manufacturer shall be used.

G-3.2.4 The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, damp or otherwise unfavourable weather and all the surfaces shall be thoroughly dry before painting work is started.

G-3.2.5 For Glossy, Flat, Pearl lustre and Matt finish, painting of same specification shall be followed except that the type of paint shall be changed as per the direction of Architect/Customers representative and Engineer- in-charge, to give the desired finish.

**G-3.3 Application:**

G-3.3.1 Brushing operation are to be adjusted to the spreading capacity advised by the manufacturer of particular paint. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

G-3.3.2 Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from PMC & Engineer-in-charge before next coat is started.

G-3.3.3 Each coat shall be lightly rubbed down with sand paper of fine pumice stone and cleaned off dust before the next coat is applied. No hair marks from the brush or clogging of paint puddles in the corners of panels angles of mouldings etc. shall be left on the work.

G-3.3.4 Special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

G-3.3.5 Approved best quality brushes shall be used.

G-3.4 Mode of Measurements and Payment:

G-3.4.1 The new steel and other metal surface shall be measured under this item.

G-3.4.2 All the work shall be measured net, in the decimal system as executed, subject to the following limits unless otherwise stated herein after:

G-3.4.2. a Dimensions shall be measured to the nearest 0.01 m.

G-3.4.2.b Areas shall be worked out to the nearest 0.01 m<sup>2</sup>.

G-3.4.3 No deductions shall be made for openings not exceeding 0.5 m<sup>2</sup> each and no addition shall be made for painting to beading, mouldings, edges, jambs, soffit etc. of such opening.

G-3.4.5 In case of fabricated structural steel and iron work, primer coat of oil paint shall be included with fabrication. In case of trusses, if measured in m<sup>2</sup>, compound girders, stanchions, lattices, girder and similar work, actual area shall be measured in m<sup>2</sup> and no extra shall be paid for painting on bolts, heads, nuts, washers etc. No addition shall be made to the weight calculated for the purpose of measurements of steel and iron works for paint applied on shop or at site.

G-3.4.5 The different surfaces shall be grouped into one general item, areas of uneven surface being converted into equivalent plain areas in accordance with the relevant I.S. code for payment.

G-3.4.6 The rate shall include the cost of all materials, labour, scaffolding, protective measures etc. required for the above specified operation, at all floors, at any height, in any position. Scrapping of surface, washing etc. of surfaces spoiled by smoke, soot, removal of oil and grease spots, treatment for infection with efflorescence, moulds, moss, fungi, algae and lichen shall not be paid extra. This shall also include conveyance, delivery, handling, unloading, storing work etc.

G-3.4.7 The rate shall be for an unit of one m<sup>2</sup>.

**G-4** Providing and applying **Silicone paint** solvent base/water based over exposed concrete and brick surfaces and plastered surfaces, as directed with a minimum 5 years guarantee on stamp paper to the employer directly. (The Contractor should specify the % concentration of silicone while quoting the rate.)

G-4.1 Materials: Silicone paint shall be of approved quality like Repelin or equivalent (water repellent paint) as approved by the Architect/Customers representative/ Engineer-in-charge.

G-4.2 Workmanship :

G-4.2.1 The silicone paint shall be diluted with water in proportion, 1 part of silicone to 8 parts of water. The paint shall be sprayed with spray gun as directed.

G-4.2.2 A guarantee bond on appropriately stamped paper shall be given by the Contractor to the Client in the manner form prescribed below:

#### G-4.3 FORM OF GUARANTEE BOND

"I/We .....(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by water or any other humid conditions, for a period of 5 years after completion of the work of Silicone painting as per the terms and conditions of the contract and Contractor hereby indemnifies and agrees to save the Client from any loss and or damage that might be caused on account of exposure to water and hereby Guarantees to make good any loss or damages suffered by the Client and further guarantee to redo the affected work without claiming any extra cost."

G-4.3.1 This guarantee shall remain force for the period of 5 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 5 years.

#### G-4.4 Mode of Measurements and Payment:

G-4.4.1 The rates shall include for work at any height, position, and floor and for all necessary scaffolding, etc. as may be required. The rates shall also include for hacking and/or bush hammering to form key for plaster and for spatter dash treatment, as specified, as and where necessary.

The rates shall also include for all work in narrow width, arises, rounded angles, chamfered external angles, drip moulds, grooves and for making good after all trades.

The rate shall also include for groove with cement finish up to 12 mm. x 6 mm. to be formed in plaster at junction of slab and beam and slab and brick without any extra charge. The rate shall also include for similar grooves in plaster at the junction of masonry and wood or steel door/window/ventilator frame or at bottom of beam/lintels as drip moulds without extra charge.

G-4.4.2 All plastering shall be measured in m<sup>2</sup>, unless otherwise specified. Length, breadth or height shall be measured correct to a centimetre.

G-4.4.3 Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooved or open joints in brick work, stone work, etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm., at any point on the surface.

G-4.4.4 The measurement of wall plastering shall be taken between the walls or partitions (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.

G-4.4.5 Soffits of stairs shall be measured as plastering on ceilings. Flowing/folding soffits shall be measured separately.

G-4.4.6 For jambs, soffits, sills, etc., openings exceeding 0.5 sqm and not exceeding 3.0 sqm, area deductions and additions shall be made in the following manner: -

G-4.4.6.a. No deductions shall be made for end joints, beams, posts, etc. for openings not exceeding 0.5 sqm. Each and no addition shall be made for reels, jambs, soffits, sills, etc. of these opening for finish to plaster around ends of joints, beams, posts, etc.

G-4.4.6.b. Deduction for openings exceeds 0.5 sqm. but not exceeding 3.0 sqm. each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings.

(i) When both faces of any wall are plastered with same plaster, deduction shall be made for one face only.

(ii) When two faces of any wall are plastered with different types of plasters or if one faces is plastered and the other pointed, deductions shall be made from the plaster or pointing on the side of frame for door, windows, etc. on which width of reveals is less than that on the other side but no deductions shall be made on the other side. Where width of reveals on both faces of all are equal, deductions of 50% of area of opening on each face shall be made from area of plaster and/or pointing as the case may be.

G-4.4.7 For openings having door frames equal to projection beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.

G-4.4.8 In case of openings having area above 3.0 m<sup>2</sup>. each, deduction shall be made for the opening but jambs, soffits, and sills shall be measured additionally.

G-4.4.9 The rate shall be for an unit of one m<sup>2</sup>.

G-4.5 The deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one year after completion of the work and 10% of shall be retained for the balance of defects liability period and shall be refunded only after the completion of the defects liability period.

**G-5** Providing and applying **Cement paint** in two coats from Snowcem or equivalent on exterior surfaces, at all heights to give even shades, including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth etc. complete.

G-5.1 Materials:

Cement water proofing paint shall conform to IS: 5410-1969, and shall be of approved shade. Contractor to get the field approved by sample application.

Water shall be clean potable water with hardness not more than 40mg/l

G-5.2 Workmanship:

G-5.2.1 Scaffolding: The relevant specifications of item shall be followed.

G-5.2.2 Preparation of surface:

The relevant specifications of item no. G-1 shall be followed except that the work oil bond distemper shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

**G-5.2.3 Preparation of paint:**

Cement paint shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brush able consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, the manufacturer's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thicken, affecting flowing and finish. The lids of cement paint drums shall be kept tightly shut when not in use.

**G-5.3 Application of Paint:**

**G-5.3.1** No painting shall be done when the paint is likely to be exposed to a temperature of below 7°C within 48 hours after application.

**G-5.3.2** When weather conditions are such as to cause damage, the work shall be carried out in shadow as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

**G-5.3.3** To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the container.

**G-5.3.4** For undecorated surfaces, the surface shall be treated with minimum two coats of water proof cement paint. Not less than 24 hours shall be allowed between two consecutive coats. Next coat shall not be started until the proceeding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the preceding coat shall be slightly moistened before applying the subsequent coat.

**G-5.3.5** The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.

**G-5.3.6** The cement paint shall be applied with a brush with relatively short stiff hog or fibre bristles. The paint shall be brushed in uniform thickness and shall be free from excessively heavy brush marks. The lumps shall be well brushed out.

**G-5.3.7** Water proof cement paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

**G-5.4 Curing:** Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for atleast two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water say about 12 hours after the application.

G-5.5 Protection measures shall be taken as per item No. G-1

G-5.6 Mode of Measurements and Payment:

G-5.6.1 The relevant specifications of item G-1 shall be followed.

G-5.6.2 The rate shall be for a unit of one m<sup>2</sup>.

**G-6** Providing and applying, 100% **Acrylic paint** of approved shade, and make on any surface in (3 coats) after thoroughly brushing the surface to remove all dirt and remaining all loose powdered materials

G-6.1 Material

Paint shall be from Asian/J &N/or any other approved manufacturer only.

G-6.2 Workman ship

G-6.2.1 The shade shall be selected from the sample to applied on site by the contractor.

G-6.2.2 Each shade in the sample as well as the selected Final shade shall be procured by computerized mixing machines only. No hand mixing by stainer on the site shall be allowed.

G-6.2.3 All preparation shall be carried out as per G-1

G-6.2.4 complete external surface shall be thoroughly wetted first after cleaning, before basecoat is applied.

G-6.2.5 One Coat of approved make Cement paint of shade closer to the final selected shade shall be applied taking care as described in for 7.02/7.04.

G-6.3 Measurement

G-6.3.1 This shall be in sqm basis.

**G -7** Providing and applying 2/3 coats of **synthetic enamel** of approved colour to new structural steel work in buildings, including scaffolding if necessary, cleaning and preparing the surface by solvent degreasing and derusting by manual scrapping/mechanically by sand blasting and primer coat complete.

G-14.1 General:

The item pertains to providing and applying Synthetic Super Enamel paint conforming to IS:2932, with specified number of coats, over a primer coat.

G-14.2 Material:

Synthetic Super Enamel paint shall be conforming to IS:2932-1991 of approved brand and manufacture shall be used. Only ready mixed paint (Exterior grade) as received from the manufacturer without any admixture shall be used. Approved paints shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall brought in at a time in adequate quantities to



suffice for the whole work or at least of fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge. The empties shall be property of the contractor.

**G-14.3 Scaffolding:**

G-14.3.1. Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No bullies, bamboos or planks shall rest on or touch the surface.

G-14.3.2. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches.

**G-14.4 Preparation of Surface:**

The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar dropping and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced. Painting shall not be started until the Engineer-in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work. Painting of external surface should not be done in adverse weather condition like hail storm and dust storm. Painting, except the priming coat, shall generally be taken in hand after practically finishing all other building work. The rooms should be thoroughly swept out and the entire building cleaned up, at least one day in advance of the paint work being started.

**G-14.5 Application:**

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers, when applying also, the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. The painting shall be laid on evenly and smoothly by means of crossing laying off, the latter in the direction of the grains. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction, two or three times and then finally brushing lightly in a direction at right angles to the same in both directions. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat. Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is laid. No left over paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moulding etc. shall be left on the work. In painting doors and windows, the putty round the glass panes must also be painted but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting. However, bottom edge of the shutters where the painting is not practically possible, need not be done nor any deduction on this account will be done but two coats of primer of approved make shall be done on the bottom edge before fixing the shutters. On painting steelworks, special care shall be taken while painting over bolts, nuts rivets overlaps etc. The additional specifications for primer and other coats of paints shall be as according to the detailed specifications under the respective headings.

**G-14.6 Protective Measures:**

Doors, windows, floors, article of furniture etc. and such other parts of the building not to be painted, shall be protected from being splashed upon. Splashing and droppings, if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture of fittings and fixtures shall be recoverable from the contractor.

**G-14.7 Item to Include:**

Item includes all labour, material, equipments such as brushes, scrappers, polish papers etc., scaffolding, cleaning of the area etc. complete as per the specifications. The item also includes removing nails, marking good holes, cracks, patches etc.

**G-14.3 Mode of Measurement and Payment:**

G-14.3.1. Length and breadth shall be measured correct to a cm. and area shall be calculated in m<sup>2</sup> correct to two place of decimals.

G-14.3.2. Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area. Corrugated asbestos cement sheet 20% Semi corrugated asbestos cement sheet 10%

G-14.3.3. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

G-14.3.4. The number of coats of each treatment shall be stated. Not exceeding 50 sqm. each with material similar in composition to the surface to be prepared. The contract rate shall be per sqm area painted including all material and labour involved in all the operations described above.

**J. DOORS AND WINDOWS –**

**J- 1** Providing and fixing best quality superior **Indian teak wood frame** for doors, windows and ventilators including all moulding, rebating, jointing, hold fasts of MS flats of minimum size 20 x 3 mm, having length of 225 mm for doors & 150 mm for windows and finishing with 3 coats of French polish or one coat of primer and synthetic enamel paint in two coats as directed etc. complete.

**J-1.1 General :**

The item pertains to supply of Indian Teak Wood, preparation of frame for doors, windows and ventilators as per the drawings and fixing the frame in position, with hold fast, polishing or painting as directed.

**J-1.2 Material :**

Indian Teak Wood :

The Teak wood shall be well seasoned wood. It shall be free from decay, knots rotten portion, termite or other insects, damaged portion. The wood section used for frame shall be used from the heart of the teak tree of matured growth. It shall be of uniform grains, substance, straight fibres and shall be free from cluster knots, flaws, bends, warp, or defect of any other kind. The Teak wood shall be of uniform colour and grains and well seasoned. Section of teak wood as be of such a size that after planing the size of frame shall be as stipulated and shown on the drawing.

**J-1.3 Frame Making :**

The Teak wood section for preparing the frame for doors, window or ventilator shall be used as mentioned in the drawing or as directed maintaining true right angle. The material, workmanship, construction, finishing etc. shall conform to IS: 1003. The vertical and horizontal members of the frame shall be of uniform section. For doors and windows with or without ventilators, the vertical post of the frame

shall extend beyond the top of the head for the ventilator portion. The horns shall be interlocked with the heads for about the full section. Normally now the all the joints of Teak Wood frame shall be tongue and groove type. The length of tongue and groove shall be equivalent to width of frame. Two holes shall be drilled at each tongue and groove joint in which small wooden pegs shall be driven to bring fixity to the joint. The nail or screws shall not be used in lieu of wooden pegs. No horizontal horns be provided with top and bottom members of frame but cut, since such horns due to swelling develop cracks in the wall. The vertical and horizontal member of the frame abutting wall shall be provided with 6 mm x 6 mm groove on the faces right angle to wall to provide key with plaster provided on jam's. The faces of horizontal and vertical members of the frame abutting wall shall be provided with two coats of bitumen to arrest for the safety of the Teak Wood frame. The sections of vertical frame of doors to be embedded in the concrete shall be provided with 2 coats of bitumen for the safety of the Teak Wood frame. Teak wood sills are not provided for doors and hence the vertical posts shall be fixed in the concrete for floor for a depth not less than 100 mm till the frame is fixed in position, a wooden batten of section 40 mm x 15 mm shall be fixed temporarily at bottom to keep the vertical members in true alignment and position. Three MS hold fast each of 20 x 3 mm size and 225 mm in length shall be fixed on both sides of the frame with screw and shall not be nailed. All the joints shall be properly tight and the moldings if used shall be fixed in position.

**J-1.4 Fixing :**

The frame shall be erected in position by tying the same and checked for plumb line from all directions. The frame shall be fixed in the wall as the work progresses and the hold fast shall be embedded in the wall in C.C. M-15 grade as it is being built. After finishing the construction of wall the frame shall be further fixed by plastering on both the sides of the frame.

**J-1.5 Finishing :**

The exposed portion of the frame shall be polished with three coats of French polish, after finishing the wood by emery paper. If directed the frame shall be painted with 2 coats of synthetic enamel paint of approved colour and shade and of approved make, over one coat of wood primer.

**J-1.6 Item to Include :**

The item includes all labour, materials and tools and equipment for preparing the frame for doors, windows or ventilators as per above specifications. It also includes fixing of the frame in position and finishing the same with French polish or synthetic enamel paint as directed. The embedded portion shall be painted with coal tar paint in two coats wherever necessary or as directed.

**J-1.7 Mode of Measurement and Payment :**

The measurement of the woodwork shall be in cum of teak wood used. The sectional measurement shall be correct upto  $\pm 2$  mm and the lengths shall be measured in m, correct upto 1 cm. The mouldings if used shall be measured considering the least dimensions of the rectangular section form, which the moulding or the rounding could be prepared. The dimensions shall be measured limited to as shown in the drawings or as directed. The contract rate shall be for the cum of the teak wood used for the frame including the cost of hold fast, screw fixing, finishing etc. complete as specified.

**J-2** Providing and fixing approved quality factory made **solid core flush door** in single/double leaf 38mm thick BWR type plywood surface on both sides , TW bidding on all edges ,doors to be of exterior

grade as per the detailed drawings including fixing the door and finishing with two coats of synthetic enamel of approved shade and make over a coat of primer etc. complete.

a) 30 mm Style. b) 35 mm Style. c) 38 mm Style.

J-2.1 General : The item pertains to providing and fixing solid core flush door in single leaf of specified thickness, hot pressed as per following specifications.

J-2.2 Material : The teak wood beading for fixing around the flush door shall be of 12 mm thick and of the width flush to the flush door.

Shutter : The solid core shutter shall be of the ply finish type of the exterior or interior grade as mentioned in the item or drawing. It shall conform to the relevant specifications for the type and grade given in IS 2202/1973 and 1966. Specifications for wooden Flush Door Shutters (solid core type). It shall be obtained from manufacturers from the approved list. The finished thickness of the shutter shall be as mentioned in the item. If decorative finish is specified from exterior or interior side or both sides the same shall be paid extra under relevant item incorporated in the tender concealed lock rail of teak wood shall be provided in shutter. Specific instructions be issued to the manufacturer while placing the order.

J-2.3 Finishing : The wood work shall be applied with synthetic enamel painting as mentioned as specified or as directed. The synthetic enamel painting shall be done in two coats of approved make and shade on one coat of primer as specified by the Engineer-in-charge.

J-2.4 Item to Include : The item includes solid core shutter all labour, materials and equipment to provide and fix the solid core flush doors as specified. The fixtures shall be paid separately.

J-2.5 Mode of Measurement and Payment : The shutters shall be measured of the clear unrebutted opening within door frame in sqm. The dimensions shall be measured correct upto 1 cm. The contract rate shall be for one square metre.

### J-3 PRESSED STEEL DOOR SHUTTER

**Pressed steel shutters** shall be hollow type with 18 gauges pressed steel sheet welded at meeting of the sheets with pad plate of MS flat 3mm thick all along per meter. The cavity shall be packed with rigid phenolic foam board adequately cut into shape to fully fit into the box cavity without gaps / or with injected rigid PU foam.

The shutter shall be formed by machine bending of 18 gauge pressed steel sheet in form of hollow box making an overall thickness of 40mm forming truly square edge in accordance with the shutter profile. It shall further be braced with channel shaped horizontal stiffeners formed by folding 16 gauge MS sheets ( 35 mm wide ) @ 500 mm maximum and fixed by flush riveting 3mm thick MS pad plates shall be welded inside at required locations for fixing of hardware's such as tower bolt, al drop etc.

For double shutter doors, an MS T angle 45mm x 45mm x 3mm thick shall be welded to one of the shutters providing a minimum 25mm wide rebate for the other shutter at the meeting point during closed condition.

The shutter surfaces shall be painted with electro statically powder coating/two coats of synthetic enamel paint over a priming coat of red oxide zinc chromate conforming to IS 2074/IS 1477 (Part-II) as specified on drawing or in the schedule of rates.

The shutters shall be fixed to the door frame by means of heavy duty MS stainless steel butt hinges as specified of 50mm size conforming to IS specifications.

In case of air tight door shutters, approved quality continuous neoprene rubber beading shall be provided continuously along the door frame rebate fixed with neoprene rubber adhesive of approved make.

In case of partly glazed door shutters, glass as specified shall be fixed with glazing clips and solid drawn 10mm x 10mm. Aluminium beading backed with putty and fixed by countersunk screws. Necessary rebate for fixing the glass shall be provided by arranging the shutter bracing accordingly.

The overall shutter shall ensure smooth operation, proper sizing and shaping as per drawings.

The shutters shall be provided with locking device of 'Dorma' or equivalent make, handle and other hardware as specified or as shown on drawing. The locking device, handle and other hardware as per accepted sample!

#### **J-4 ALUMINIUM GLAZED DOORS / WINDOWS / VENTILATORS.**

##### **J-4.1 General**

Aluminium glazed doors / windows / ventilators shall be of specified sectional size, dimension and profile as per drawing.

##### **J-4.2 Materials**

All aluminium sections shall be extruded sections of aluminium alloy as per IS 733 and IS 1285. Aluminium sections shall be anodized as per IS 7088 `.

Glass used for glazing shall be amongst the following types as specified: -

J-4.2.a. 5.5. mm thick wired glass conforming to IS 5437

J-4.2.b. 6.3 mm thick laminated safety glass conforming to IS 2553

J-4.2.c. 5.5 mm thick transparent sheet glass conforming to IS 2535 or 4mm thick transparent float glass and / or 5.5 mm thick figured glass as specified on drawing.

J-4.2.d. 4mm thick float glass grounded as specified.

##### **J-4.3 Workmanship**

-Door frames for hinged Doors shall be related

-Door/Frame& window sections both for hinged doors & pivoted doors/openable or fixed windows shall be approved by Architect/Customers representative/PMC.

- All corners of Door/windows frame heads, junctions of top rail & stiles of the door/window Shutters shall have mitered joints or butt joints but shall be reinforced with appropriate inserts.
- The section shall have designed housing for all gaskets. Gasket shall not be only pasted over the sections but shall be inserted into.
- All aluminium sections shall be polyester powder coated when specified in BOQ shall be from approved coater. The coating shall be 15 micron.
- All aluminium sections when specified as anodized shall be anodized to 20 micron.
- No exposed screws in the entire assembly shall be permitted.
- The windows Shall be fixed with a box sub frame around first, firmly embedded in masonry.
- Sample of the complete door/window/vent shall be first approved by owner/Architect/Customers representative.
- All edges of the External door windows /Jambs shall be sealed with Sealants of approved make and Type.

#### **J-4.5 Measurement**

- Door/windows and Ventilators shall be measured by outer actual size of the assembly including the sub frame if any specified.
- Measurement shall be Inclusive of all fixtures, Fastenings, glass, gasket, sealing along the external jams with sealant.

**L. SANITATION AND PLUMBING –**

**L -1] SYSTEMS AND MATERIALS:**

**1.0 SCOPE:**

1.1 This section covers the general description of systems and materials for the work.

1.2 The system included in the scope of the work is as follows:

- a) Entire water supply system.
- b) Entire sewage disposal system.
- c) Sanitary appliances and fittings.
- d) Pipe sleeves for RCC tanks and other structures.

**2.0 WATER SUPPLY SYSTEM:**

2.1 The water from the underground storage tank shall be through the overflow from the underground fire fighting reserves.

**3.0 DRAINAGE SYSTEM:**

3.1 The drainage shall be Two Pipe System with separate piping for soil and waste water upto inspection chambers.

**4.0 MATERIALS:**

a)	WATER SUPPLY PIPING: i)Underground and concealed ii)Open	GI C Class GI C Class
b)	WATER SUPPLY VALVES: i) Upto 40 mm ii) 40 mm and above	Ball valve with SS 304 internals Butterfly
c)	SEWAGE PIPING: i) Branch piping ii) Ceiling suspended headers and vertical drainage iii) External underground drainage	100 mm salt glazed, stone ware. CI Neco Centri. RCC NP2 and NP3.

**L-2] MAKES OF MATERIALS:**

**SCOPE:**

1.1 This section covers the recommended makes of the materials, equipments and components. The final choice of the materials shall be indicated at the time of finalizing the order.

1.2 The makes of the materials offered by the contractor shall be indicated at the space provided, for the proper evaluation of the offer and shall be one of the recommended makes. In the absence of such indication, the decision rests with the Architect/Customers representatives/clients.

2.0 MAKES RECOMMENDED:

NO.	ITEM	MAKE RECOMMENDED	MAKE OFFERED
1	Sanitary Appliances	Parry ware, Hindustan, Nycer, Splendor	
2	Sanitary Fittings (Taps showers etc.)	Drip less, Jaguar	
3	Flush Valves	Nelson, RA	
4	<b><u>Pressure Pipes</u></b> GI GI Fittings	Tata, Zenith, ISI 'R', ISI	
5	<b><u>Gravity Pipes:</u></b> PVC CI Pipes and Fittings	Prince, Supreme Neco Centri	
6	Valves	Leader, Audco	
7	Storage Tanks	Sintex	
8	Kitchen Sink	Diamond, Nirali, Frankee	
9	Geyser and Boilers	Racold, Spherehot	
10	Chamber Covers and Gratings	CI make 'ASHOK', Neco, RCC make 'PRATIBHA'	

3.0 Where specified make and model nos. are indicated in the schedule of material, the bidders should quote for the same items. In case of acceptance of other make/model the rate shall be arrived at by adding/subtracting the difference in basic cost of material to/from the rate quoted.

L-3] MODE OF MEASUREMENT:

1.0 GENERAL:

1.1 The supply items shall include the main items specified, standard accessories and fittings.

1.2 Installation:

1.2.1 The installation rates shall include the installation, testing and commissioning of the individual items as well as the testing and commissioning of the entire system. The rate shall include all fixing materials, accessories, consumables, tools and instruments required for installation, testing and commissioning. The rates shall also include supports and fasteners, anti-corrosion treatment, painting and identification marks, flow direction indication, chasing and subsequent covering in masonry , anticorrosive bitumen impregnated wrapping of concealed pipes, excavation for underground pipes , subsequent covering them back, bedding of sand or gravel into the trenches for underground pipes.



1.2.2 Cutting and chasing in concrete shall be excluded.

1.2.3 The installation of the material supplied by the owner shall include taking delivery and transporting of the material to the site.

	MODE OF MEASUREMENT	ITEM INCLUDED	ITEM EXCLUDED
2.0	<u>PUMPS:</u> Each pump shall be measured as one unit.	Pump, motor, base frame, vibration mounts, Pump cover, fixing materials and accessories.	Foundation and electrical work.
3.0	<u>STORAGE TANKS:</u> Each storage tank shall be measured as one unit	Tank, flanged inlet, outlet, drain and overflow nozzles, fixing materials and accessories.	Foundation.

#### 4.0 SANITARY APPLIENCES AND FITTINGS:

Supply and installation of each sanitary appliance shall be measured as one unit and shall include all fixing materials and accessories.

#### 4.1 WC PANS (EUROPEON/INDIAN/ORISSA):

	ITEM NAME	INCLUDES	EXCLUDES
4.1.1	Wall hung EWC	WC, seat, seat cover, chair, 100 mm dia CI connector upto external face of the wall, 15 mm dia angle stopcock (1 No.), 15 mm dia copper CP flexible tube (1 No.) 32 mm dia GI flush pipe concealed in wall and flush tank assembly	Nil
	<u>ITEM NAME</u>	<u>INCLUDES</u>	<u>EXCLUDES</u>

4.1.2	Floor mounted EWC	WC, seat, seat cover, P/S trap, 15 mm dia angle stopcock (1No.), 15 mm dia copper CP flexible tube (1No.). 32mm dia GI flush pipe concealed in wall and flush tank	Nil
4.1.3	Orissa Pan WC	WC pan, P/S trap, Brick masonry seat around, GI flush pipe concealed in wall.	Nil

#### 4.2 FLUSHING TANK:

	ITEM NAME	INCLUDES	EXCLUDES
4.2.1	Flushing Tank	Flushing cistern/tank, flush pipe supporting bracket.	Nil

#### 4.3 SANITARY CP BRASS FITTINGS:

The sanitary fittings shall be individually measured or as an assembly as indicated in the schedule of materials.

	ITEM NAME	INCLUDES	EXCLUDES
4.3.1	Flush Valve Assembly	Flush valve with flanges, concealed flushing pipe, CP bend/elbow.	Nil
4.3.2	Wash Basin Assembly	Pillar cock with or without mixer as specified, angle stopcocks with flange, CP connectors, waste coupling, bottle trap assembly etc.	Nil
4.3.3	Shower Assembly	Bath spout, mixer assembly with flange, shower diversion arm and head.	Nil
4.3.4	Bib Cock	Bib cock with wall flange.	Nil
4.3.5	Sink Assembly (Each sink assembly shall be measured as one unit)	Sink with drain board, wall spout with mixer as specified, waste bottle trap assembly, bracket, and concealed outlet pipe upto 1200 mm length.	Nil

4.3.6	Geyser/Boiler Assembly (Each Geyser/Boiler assembly shall be measured as one unit)	Geyser with thermostatic control, pressure and vacuum release valve NRV, angle stop cock, CP flexible pipe connections (2 Nos.) CP angle stop cock with wall flange (2 Nos.).	Nil
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4.3.7 CP Brass/S.S. Accessories: Each accessory shall be measured as one unit with fixing materials.

**5.0 GI PIPING:**

	ITEM NAME	INCLUDES	EXCLUDES
5.1	GI piping (Shall be measured on the basis of unit length).	Pipes, fittings, clamps, supports and wrapping of hessian cloth. Anti corrosive bituminous paint for hot water and cold water pipes. Cutting holes and chasing in walls and floors and making good the same.	Nil
5.3	Valves (Each valve shall be measured as one unit and shall be classified based on the type, size and material.	Valves, flanged joints for the flanged valves.	Nil

**6.0 EXCAVATION:**

	ITEM NAME	INCLUDES	EXCLUDES
	Excavation and back filling (It shall be measured on the basis of unit volume unless specified in the specifications)	Cutting by hand, by excavator or by breaker. Refilling, compaction, carting away the surplus soil as directed.	Nil

**7.0 EXTERNAL PIPING:**

7.1 The external drainage piping shall be measured on the basis of unit length (metre) and shall be classified based on the size of the pipe.

7.2 It shall include the pipe, fittings, inspection windows, fixing materials, brackets, hangers and clamps etc.

### 8.0 DRAINAGE ANCILLARIES:

	ITEM NAME	INCLUDES	EXCLUDES
a	Gully Trap (Each gully trap shall be measured as one unit)	Salt glazed stoneware gully trap, PCC base, masonry chambers, GI/RCC covers, excavation and refilling.	Nil
b	Inspection Chambers (IC):	PCC base, hunching masonry/concrete chamber, CI/RCC covers with frames, external CM plaster (sand faced), internal CM plaster (smooth finished), waterproofing excavation, refilling, carting away the surplus.	Nil
c	Circular s (each shall be measured as one unit).	PCC base, hunching masonry/concrete chamber, CI/RCC covers with frames, external CM plaster (sand faced), internal CM plaster (smooth finished), waterproofing excavation, refilling, carting away the surplus, CI foot steps at 300 mm c/c.	Nil

### 9.0 SUPPORT STRUCTURES:

	ITEM NAME	INCLUDES	EXCLUDES
9.1	Structural Supports, hangers etc. shall form the part of the item supported and hence no additional payments.	Structural Supports, grouting, final 2 coats of enamel paint of approved shed.	Nil

### 10.0 NOTES:

10.1 The make and model of sanitary appliances indicated are to obtain bids at par. The final make and model shall be decided by the architects/owners. The bidders are hence requested to get the approval in writing from the Architect/Customers representatives/owners before ordering/procuring the materials.

10.2 Also the bidders are requested to furnish the basic price or the list price along with the tender to arrive at the actual cost in case of change in the make and model of the appliances and fittings.

#### L-4] SANITARY APPLIANCES AND FITTINGS:

##### 1.0 SCOPE:

1.1 This section covers the specifications and details of the sanitary appliances and fittings.

##### 2.0 STANDARD SPECIFICATIONS:

2.1 The standard specifications applicable shall be covered under the respective sections.

##### 3.0 GENERAL REQUIREMENTS:

3.1 All sanitary appliances and fittings shall be new, of best quality and of the make and model specified.

3.2 All the appliances and fittings shall be with ISI approval mark, of first quality and without any defects.

3.3 All ceramic appliances and accessories shall be vitreous glazed chinaware with special colours, unless otherwise specified. All appliances shall be complete with all accessories and fixing materials.

3.4 All sanitary fittings shall be heavy-duty brass with Chromium Plating on exposed surfaces. The fittings shall be complete with all accessories, wall flanges etc.

##### 4.0 SANITARY APPLIANCES:

4.1 Wash Down (EWC): The European Water Closet (EWC) shall be sitting pan of one piece construction with S or P trap conforming to IS: 2556 Part 3, and having a minimum size of 550mm x 345mm x 390mm. The EWC's shall be without flushing tanks and shall be with inlet horn, self draining flushing rim of box with adequate discharge holes, weep holes, anti syphonage vent horn etc. The EWC shall be floor mounted or wall hung as indicated in the drawing and schedule of materials. The wall hung EWC's shall include CI supporting chairs. The EWC's shall be with hinged plastic solid seats and covers.

4.2 Urinals: The urinals shall be of flat back stall one piece construction confirming to IS: 2556 Part 6, having a minimum size of 610mm x 400mm x 365mm.

4.3 Seats and Covers: The WC seats and covers shall be made of plastic confirming to IS: 2548 with pair of brass CP hinges hooks.

4.4 Urinal Flushing Apparatus: The urinal cisterns or flush tanks shall be high level plastic or vitreous chinaware automatic, self acting type, confirming to IS: 2326. The capacity of the cistern shall be based on

the number of urinals served at 2.5 liters per urinal at the interval of not less than 10 minutes and not more than 20 minutes.

4.5 Wash Basins: The wash basins shall be flat back wall mounted or counter top, one piece construction, confirming to IS: 2556 Part 4, with waste over flow single, 2 or 3 hole inlets. The wash basin shall have minimum size of 550mm x 400mm. The flat back wash basin shall be with CI wall mounting brackets confirming to IS: 775.

4.6 Indian WC: The Indian WC's shall be Orissa Pattern squatting pans confirming to IS: 2556 Part 14, and shall have a minimum size of 650mm x 450mm. The WC shall be complete with self draining flushing rim of box with adequate number of discharge holes, supply horn, weep hole, anti-slip foot rest etc. The pans shall be preferably with integral P trap. The exterior surface the outlet shall be rough, non-glazed to get proper bonding between the WC outlet and the pipe.

4.7 European W.C: The EWC shall be sitting pan of one piece construction with S or P trap confirming to IS specification and having size of 550mm x 345mm x 390 mm. The EWC shall be with or without flushing tanks and shall be with inlet horn, self-flushing rim of box with adequate flushing holes, anti syphonage vent horn. The EWC shall be floor mounted or wall hung as indicated in the drawing/schedule of quantities. The wall hung European WC's shall include CI supporting chairs. The EWC's shall be with hinged plastic solid seats and cover of approved colour, with brass CP hinges.

4.9 Urinal Flushing tank: The urinal flushing tanks shall be high level vitreous chinaware automatic confirming to IS specifications The capacity of flushing tank shall be as 5 Ltrs. per two urinals.

4.10 Wash Basins: The washbasin shall be flat back wall mounted or counter bellow, one piece construction confirming to I.S. specifications. The wash basin shall have minimum size of 550mm x400mm the flat back wash basin shall be with CI wall mounting brackets and counter bellow basin will have supporting bracket at waste coupling level.

4.11Laboratory Sinks: The laboratory sinks shall be as per IS specifications and shall be of size 500mm x 350mm x 150 mm. The sinks shall be complete with inlet and outlet fittings and shall have pair of CI supporting brackets.

4.12 Kitchen and pantry sinks: The kitchen/pantry sinks shall be of stainless steel with single bowl and drain board complete with inlet and out let fittings.

#### L-5] INSTALLATION OF SANITARY APPLIANCES AND FITTINGS:

##### 1.0 SCOPE:

1.1This section shall cover installation of sanitary appliances, fittings and ancillaries.

##### 2.0 SPECIFICATIONS:

2.1 The appliances and accessories and fittings shall be installed to match the interior and tile pattern heights and properly leveled.

2.2 The screws shall be fixed to the wall by providing wooden rawal plugs or anchor fasteners in wall depending upon the weight. All screws shall be SS.

2.3 All brackets, clamps shall be finished with two coats of synthetic enamel paint of approved colour.

2.4 The water supply and drainage pipe connections to the fittings and assemblies shall be made of approved leak proof joints.

2.5 The Indian and Orissa W C shall be set in bk. bat conc.1: 2:4. The wall hung EWC shall be supported by C.I. floor mounted chairs.

2.6 The urinals shall be fixed to wall by C.I. bracket and two CI wall clips. Cistern shall be fixed to wall with C.I. or RS brackets.

2.7 The urinal partitions shall be fixed to wall with SS clips.

2.8 The semi-circular white glazed earthen ware channels shall be laid in perfect slope and fixed in C.M.1:2 with white cement joints.

2.9 The towel rods, towel rings, robe hooks shall be fixed to walls / doors as per tiling pattern.

2.10 WC flush assembly shall consist of 32mm dia flush valve, regulating valve, flushing pipe, bend or elbow with wall flanges.

2.11 The wash basin water supply assembly shall consist of pillar tap, angle stop cock, CP flexible connector. The waste assembly shall consist of 32 mm waste coupling, bottle trap with extension piece and 32 mm dia GI 'C' class pipe concealed in wall and in floor upto the nearest nahani trap (Approximate pipe length 1200 mm).

2.12 The sink water supply assembly shall be wall or sink mounted with swan neck spout, hot and cold mixer, and pair of angle valve with flexible pipe. The sink waste assembly shall consist of 40mm waste pipe with extension pipe and wall flange and 40mm dia GI C class pipe concealed in wall floor upto the nearest nahani trap (Approximate pipe length 1200 mm).

#### L-6] PRESSURE PIPES AND FITTINGS:

1.0 SCOPE: This section covers the details and specifications of pipes, pipe fittings for pressure piping.

#### 2.0 SPECIFICATIONS:

2.1 The pipes and pipe fittings shall conform to the relevant IS specifications.

#### 3.0 GENERAL REQUIREMENTS:

3.1 The pipes and pipe fittings shall be one of the recommended makes and of the best quality without any defects. The inside and outside surfaces shall be smooth with uniform wall thickness. The pipes and the pipe fittings shall bear the manufacturer's name and the ISI mark and must be supplied along with the manufacturer's test certificates.

3.2 The size indicated shall be clear inside diameter unless otherwise specified. The pipes should withstand the test pressure for the various types and classes of pipes indicated in the relevant IS specifications.

3.3 The pipes shall be suitable for the fluid it carries, the temperature and the pressure of the fluid and the system.

#### 4.0 PIPING MATERIALS:

4.1 The piping material for the various utilities shall be as shown in the 'Schedule of Materials and Rates'.

#### 5.0 GI PIPES:

5.1 The GI pipes shall be medium or heavy class with screwed ends as indicated in the schedule of work.

5.2 The fittings shall be of heavy quality of 'R' brand or with ISI mark and shall include couplings, tees, bends, reducers, nipples and plugs.

5.3 The fittings shall be forged steel, of heavy quality, hot deep, galvanized and with screwed ends.

#### 6.0 STONEWARE PIPES:

6.1 The stoneware pipes and fittings shall confirm to the following:

a)	IS: 651	Salt glazed stoneware pipes and fittings.
b)	IS: 3006	Chemically resistant glazed stoneware pipes and fittings.

6.2 The stoneware pipes and fittings shall be Socket and Spigot type.

6.3 The stoneware pipes shall be thoroughly and evenly burnt and shall be free from cracks, air bubbles, fiber blisters etc. The pipe shall give a sharp clear tone when struck lightly by a hammer.

6.4 The pipes shall be minimum 600mm long. The wall thickness and the weight shall confirm to IS: 651.



## 7.0 CAST IRON PIPES:

7.1 The cast iron pipes and fittings shall be of 'Neco Centri' make, confirming to IS specifications.

7.2 For fixing the pipes use MS 25mm x 6mm strap saddle clamps painted with 2 coats of enamel on one coat of primer.

7.3 Nahani traps shall be of CI with deep seal with SS grating cover.

7.4 All vertical pipes shall be fixed clear off the finished surface of the wall belling by minimum 25mm.

7.5 All exposed fixing clamps shall be epoxy painted to avoid rusting.

## 8.0 VALVES:

8.1 The valves for the various sizes shall be as indicated below:

No.	Pipe Diameter	Valve Type	MATERIALS OF CONSTRUCTION FOR	
			Body	Internal
1	Up to 50mm	Ball Valve	Gun Metal	Bronze
2	65 mm and Above	Butterfly Valve	Cast Iron	SS 316, SG Iron

## 9.0 STOP VALVES:

9.1 The stop valves shall be 'gate' or 'butterfly' as indicated in the drawing and the schedule of materials, and shall be confirming to IS: 778 and IS: 780. The stop valves shall be capable of complete stoppage of flow, shall be handled with solid wedge, split wedge or parallel double disc type.

9.2 The butterfly valves shall be with circular or lens type disc pivoted in the body by two unions. The operating handle shall be provided with locking facility and shall have flow indication.

#### 10.0 CHECK VALVES:

10.1 The check valves/ NR valves shall be of unidirectional flow, allowing the normal flow in one direction and completely stop the flow in the reverse direction. The check valves or the reflex valves shall be suitable for horizontal as well as vertical installation and shall be with circular disc hinged at one end.

#### 11.0 FOOT VALVES:

11.1 The foot valves shall be made up of Brass and shall be suitable for the pump suction. The foot valves shall be accompanied with NR valve and strainer.

#### 12.0 SCREWED GI PIPE ASSEMBLY:

12.1 The GI pipe assembly shall be done using screwed fittings.

12.2 The pipe ends shall be filed using round files to remove burrs. Threading of proper length and size shall be made confirming to IS: 554, so that the joint is lick proof with adequate strength. Care shall be taken that no excess threading is exposed.

12.3 Shali kote or Teflon tapes shall be applied on the entire length of threading before assembling.

12.4 Union connections shall be provided at the equipment connections and at intervals up to 30 meters on straight length.

#### 13.0 ANTICORROSION TREATMENT:

13.1 The pipe assembly shall be provided with outer coating to prevent the corrosion of the pipes.

13.2 The pipes laid above ground shall be provided with the following type of anticorrosion coating:

- a) Two coats of paint of approved colour over one coat of red oxide primer.
- b) Two coats of paint of approved colour for GI piping.

13.3 The pipes laid underground or concealed in the building structure shall be provided with one coats of bituminous paint and wrapped with Hessian cloth strips. And again one coat of bituminous paint shall be applied. If the wrapping cloth is bitumen impregnated the second coat of bitumen is not necessary.

#### 14.0 UNDER GROUND PIPING:

14.1 The pipes laid under the ground shall be laid in trenches having a minimum cover of 600mm and a sand cushion of 150mm above the pipe.

14.2 The pipes GI/PP/PVC crossing roads, pavements etc. shall be taken through 150mm dia RCC NP-3 pipes.

14.3 The drainage and sewage underground pipes in trenches shall be minimum 600mm deep below ground and shall be laid with 200 mm sand/crushed grit cover all around.

**15.0 VALVES:**

15.1 The valves shall be incorporated in the piping system as shown on the drawings and shall be installed at such locations and levels so that they are easily accessible for operation, maintenance and replacement.

15.2 The screwed valves wherever provided shall be easily removable for repairs or replacements.

15.3 Check valves/NR valves shall be incorporated as indicated on the drawings to counter the reverse flow. These are to be installed generally at the following places:

- a) Discharge points of centrifugal pumps.
  - b) Outlet points of boilers.
  - c) Outlets of equipments, which are prone to damages due to reverse flow and higher static heads.
- 15.4 Air release valves shall be incorporated at places subject to air locks, height points in the piping circuit and at the outlets of heat exchangers. Isolation (closing) valves are to be provided before the air release valves.

15.5 supports shall be provided for the pipes at the each end of the valve to relieve pressure on the valve joint. In addition to this, additional supports are to be provided for the pipes fixed above ground/floor at 3 meters interval.

**16.0 TESTING:**

16.1 All the piping shall be pressure tested by filling water, removing air locks and applying pressure of 10 kg/cm<sup>2</sup> using hand or hydraulic pest pumps unless otherwise specified.

16.2 The pressure shall be maintained for a minimum period of 2 hours and achieve pressure drop within 0.5 kg/cm<sup>2</sup>.

16.3 The testing shall be carried in a section by blocking both the ends or closing the valves, if provided. After completion of the entire installation and connecting to the mains or pumping system, the installation shall be once again tested and flaws, if any, shall be rectified or replace the defective material or workmanship.

16.4 Sewage and waste water pipes under floor/plinth and underground shall be tasted by smoke test before refilling the trenches.

16.5 After commissioning the system, each valve shall be tested for effective working by opening and closing for a number of times. All the testing shall be carried out in the presence of owner/site engineer, owner/Architect/Customers representatives and test register shall be maintained. Water, labour, equipments and register required for the testing shall be the responsibility of the contractor and to remove water resulting from the testing, and bare the costs for the same.

**L-7] ASSEMBLING AND LAYING VERTICAL AND UNDER GROUND PIPES:**

**1.0 SCOPE:**

1.1 This section shall cover the assembly and laying of gravity pipes and the connected ancillary items of work for drainage system.

**2.0 STANDARDS:**

2.1 All the materials shall confirm to the respective IS specifications.

**3.0 GENERAL REQUIREMENTS:**

3.1 The assembly and laying of drainage pipes shall confirm to all the safety codes and measures required for the various type of work involved and shall be carried out to achieve smooth flow with lick proof joints. The piping work shall confirm to relevant standard specifications and shall be easily accessible for repairs and maintenance.

3.2 The pipes and fittings shall be cleaned and thoroughly inspected for cracks and any other damages before assembling. The damaged pipes and fittings shall be stored separately and shall be taken away from the site.

3.3 The pipe assembly and laying shall be carried out in lines and levels as specified and indicated on the drawings with proper slope to obtain smooth flow. The branch connections to the stack [vertical pipe(s)] shall be made using 'Y' junctions with clean out plugs.

3.4 The pipe assembly shall be supported at close intervals to avoid sagging of pipes by providing supports on both the sides of the joints.

3.5 Pipes laid underground shall be provided with anti corrosion coating and shall be laid on properly leveled and compacted bed with a minimum sand cushion of 150mm thick. The pipes crossing roads, pavements etc. shall be taken through 150mm dia RCC NP-3 pipes to enable easy repairs and maintenance, without cutting and damaging the road. The slope shall be set out with boning rods and sight rails. The pipes laid underground shall have a minimum cover of 600mm above the pipes.

3.6 The excavation for the trenches shall be carried out only after the preparatory work for laying the pipes is completed and a stage has been arrived that laying of pipes and refilling the trenches can be undertaken immediately.

3.7 The pipes laid under floor shall be encased in PCC 1:2:4. The pipes laid above floor slabs shall be supported on concrete pedestals.

3.8 The storm water drains and sewers shall be laid in straight lines and to alignment and slope as shown on drawings/design sheets. Suitable boning rods and sight rails fixed at intervals not exceeding 15metres. Leveling instruments shall be provided to check and maintain the invert levels. Additional sight rails and other suitable level checking instruments shall be provided at bends and at all the changes in the line's

direction. The reference levels, boning rods and sight rails shall be accurate and shall not be tampered once installed and verified.

#### 4.0 CI PIPE ASSEMBLY:

4.1 The CI pipes shall be tested for their soundness using hammer and thoroughly cleaned and washed before laying and assembling. The jointing shall be carried out with molten pig lead confirming to IS: 782 for pipes encased in masonry and CM 1:1 for pipes fixed exposed.

4.2 At least one lap of clean white hemp spun yarn shall be driven into the bottom of the socket and the spigot of the pipe forced into the pipe and centered. Laps of tarred yarn is forced into the joint and caulked tight leaving sufficient space for the lead. Sufficient quantity of molten lead is filled into the joint in one running and caulked tight after cooling, using caulking tool and 2 kg hammer. The lead should project to a length of 3mm beyond the socket and shall become flush with the socket surface after caulking making the joint neat and smooth.

4.3 In flanged joint, both the faces of the flanges shall be properly painted with red lead and bolted after inserting 3 ply rubber gasket of minimum 3mm thickness. The joints shall be finished with a thin fiber of lead wool to make it watertight. The pipes' interiors shall be cleaned using brush disk plate.

4.4 The CI pipes shall be carefully laid in trenches using shear legs, chain and pulleys and other tackles to prevent the entry of sand, earth or other materials. The pipes are to be laid aligned, to the levels and slopes as shown on the drawings/design sheets. Cuts in trenches shall be made for the sockets to seat into them. The pipe ends shall be closed with wooden plugs to prevent the entry of dirt, foreign materials and rodents. The pipe jointing, testing and closing of trenches shall be carried out soon after laying the pipes to avoid damages to the pipes.

#### 5.0 STONE WARE PIPING:

5.1 The joints of SW pipes shall be with 1:1 CM. The barrels, spigot and sockets shall be cleaned, scrapped and brushed properly. Moist yarn shall be paved around the joint and strains of yarn is added and rammed before the mortar is placed caulked tightly.

5.2 The depth of yarn and mortar shall be as follows:

No.	Pipe Size (mm)	Socket Depth (mm)	Yarn Depth (mm)	Mortar (mm)	Depth
1	100	50	22	28	

2	150	60	28	28
3	250	65	32	32

#### 6.0 RCC PIPING:

6.1 The RCC pipes shall be assembled by butting together and fitting the dowel with 1:1 CM. Loose collar with rough inside surface shall be brought to the joint and the space between the pipe and the collar is caulked with bitumen soaked hemp yarn for 100mm to 150mm width at the center of the joint and collar. The balance space is caulked with CM 1:1 and finished smooth at 45°.

#### 7.0 TESTING:

7.1 All the pipes shall be inspected for manufacturing defects and damages during transport and storage. The CI pipes shall be tested before laying by keeping filled with water for at least 10 minutes and struck with hammer.

7.2 The CI drain pipes shall be tested by filling up the stack by water after plugging up all the openings and connections. The total head in the stack shall however not exceed 3 meters. The drain and the vent pipes shall be tested by smoke test and rendered leak proof.

7.3 All the pressure pipes shall be pressure tested by filling water, removing airlocks and applying pressure of 10 kg/cm<sup>2</sup> using hand or hydraulic test pumps. The pressure shall be maintained for at least 2 hours and achieve pressure drop within 0.5 kg/cm<sup>2</sup>. The testing shall be carried in a section by blocking both the ends or closing the valves, if provided. After completion of the entire installation and connecting to the mains or pumping system, the installation shall be once again tested and flows, if any, shall be rectified or replace the defective material or workmanship. After commissioning the system, each valve shall be tested for effective working by opening and closing for a number of times.

7.4 All the testing shall be carried out in the presence of owner/site engineer, owner/Architect/Customers representatives and test register shall be maintained. Water, labour, equipments and register required for the testing shall be the responsibility of the contractor and to remove water resulting from the testing, and bare the costs for the same. The material found defective during the test shall be replaced. Any damages to the building, furnishing and fittings, and open burst of pipes shall be rectified free of cost.

7.5 All the testing shall be carried out in the presence of owner/site engineer, owner/Architect/Customers representatives and test register shall be maintained. Water, labour, equipments and register required for

the testing shall be the responsibility of the contractor and to remove water resulting from the testing, and bare the costs for the same.

#### L-8] DRAINAGE ANCILIARIES:

##### 1.0 SCOPE:

1.1 This section covers miscellaneous items and ancillary structures for the drainage system as floor trap, floor gratings, s, drop connections etc. All the materials used shall confirm to the respective IS specifications.

##### 2.0 FLOOR TRAPS:

2.1 Floor traps of CI inlet hopper with necessary inlets shall be provided wherever indicated or required. The joint between hopper inlet sockets and shall be lead caulked. The hopper connections with p or s trap shall be with minimum 50mm seal. The floor trap and inlet hoppers shall be set in PCC 1:2:4.

##### 3.0 FLOOR GRATINGS:

3.1 The floor and urinal traps shall be provided with 100mm or 150mm square or round Brass CP or Stainless Steel grating with minimum 5mm thickness and of approved sizes.

##### 4.0 S AND INSPECTION CHAMBERS:

4.1 : General: The item addresses to providing chambers of specified size. It consists of Foundation concrete, Brick masonry walls, C.C. benching, RCC top slab and pre-cast cover with reinforcement and frame. The C.I. steps are to be provided of appropriate size.

At every change of alignment, gradient diameter of a drain, there shall be or Inspection chamber. Bends and junctions in the drains shall be grouped together in only. The maximum distance between s shall be 30m.

Construction of Chamber: s of different types and sizes specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the approved drawings or as directed by the Engineer-in-charge. The size specified shall indicate the inside dimensions between brick faces of the . Where the diameter of the drain is increased, the crown of the pipe shall be fixed at the same level and necessary slope be given in the invert of the chamber by providing benching. In exceptional cases and where unavoidable, the crown of the branch sewer may be fixed at lower level but in such cases the peak flow level of the two sewers shall be kept same by providing benching. Sewers of unequal sectional areas shall not be joined at the same invert. The invert of the smaller sewer at its junction with main sewer shall be at least  $\frac{2}{3}$ rd the diameter of the main sewer above the invert of the main sewer. The branch sewers shall deliver sewage/effluent in the in the direction of main flow and the junction must be made with care by providing benching so that flow in main is not impeded. No drain from house fittings, e.g. gully trap or soil pipe, etc. to shall normally exceed a length of 6 m unless it is unavoidable.

s 800 x 800 mm shall generally be constructed within compound for house drainage only. s 1200 mm x 900 mm are generally constructed for main drainage work for depths less than 1.5 m.

The width of s shall be increased more than 900 mm on bends or junctions or pipes with diameter greater than 450 mm and that the benching width on either side of the channel is minimum 200 mm.

Excavation : The excavation for shall be true to dimensions and levels shown on the plans or as directed by the Engineer-in-Charge.

Bed Concrete : The shall be built on a bed of cement concrete M-15 grade, (20 mm nominal size aggregate). The thickness of the bed concrete shall be 100 mm for s up to 4.25 m in depth and 200 mm for depths beyond 4.25 m unless otherwise specified or directed by the Engineer-in-charge. In weak soils, properly designed foundations as suitable, shall be provided as directed by the Engineer-in-Charge.

Brick Work : The brick work shall be with IInd class bricks in cement mortar 1:3. The external joints of the brick masonry shall be finished smooth, and the joints of the pipes with the masonry shall be made perfectly leak proof. The walls shall be built of one brick thickness (230 mm) for depths up to 1.5 m. Below a depth of 1.5m in ordinary subsoil the wall thickness shall be increased to one and half brick (350 mm) and at 4.0 m below ground two brick thick walls (450 mm) shall be built.

Plaster and Pointing : The walls of the s shall be plastered inside with 20 mm thick cement plaster in C.M.1:3 finished smooth with neat cement. Where the saturated soil is met with, the external surface of the walls of the shall be plastered with 20 mm thick cement plaster in C.M.1:3 finished smooth upto 30 cm above the highest sub-soil water level.

Approved quality of water proofing compound shall be used as specified by manufacturers code of practice while preparing cement mortar for rendering water proof plaster. For earthwork excavation, bed concrete brickwork, plaster and pointing, R.C.C work and refilling of earth, respective specifications shall be followed.

Benching : The channels and benching shall be done in cement concrete M-15 grade, 200 mm nominal thickness and rendered smooth with neat cement finish.

Steps : All s deeper than 0.8 m shall be provided with C.I. foot rests as per the drawing or as directed by Engineer-in-Charge. These shall be embedded 20 cm deep in 20 x 20 x 10 cm blocks of cement concrete 1:2:4. The concrete block with C.I. foot rest placed in its centre shall be in cast in situ along with the masonry and surface finished with 20 mm thick cement plaster in C.M.1:3 finished smooth. Footrests shall be painted with coal tar epoxy paint, the portion embedded in the cement concrete block being painted with thick cement slurry before fixing.

Top RCC Slab : The frame of cover shall be firmly embedded to correct alignment and levels in R.C.C. slab of 100/150 mm thick in concrete 1:2:4 with reinforcement as per approved drawing.

## **7. FALSE CEILING , FALSE FLOORING, UNDERDECK INSULATION AND PARTITIONING**

### **1.0 FALSE CEILING GRID SYSTEMS**

1.1.1 Galvanized Steel Grid System: Galvanized steel grid system shall be erected for the purpose of supporting mineral fiber false ceiling tiles.



#### 1.1.1.1 Material

Main Runner: Main runner shall be of hot dipped galvanized steel and T shaped of 24mm x 38mm size and 0.33 mm thickness with double rotary stitching.

- Cross Runner: Cross runner shall of hot dipped galvanized steel and T shaped of 24mm x 30mm size, 0.25mm thickness, 1200mm long and 24mm x 25mm size. 0.25mm thickness, 600mm long with double rotary stitching.
- Perimeter section: Material shall be same as runners. Sections shall be 22mm x 22mm size of 0.45mm thickness. Exposed areas of all the metallic members shall be powder coated ( 25 micron)

#### 1.1.1.2. Erection.

Main runners shall be placed at the spacing of maximum 1200 mm c/c cross runners shall be fixed @ max. 600mm c/c to obtain a grid of 600mm x 600mm.

The grid shall be suspended by means of 4mm dia MS wire. 6mm thick MS clear of 25mm x 25mm section dash fasteners and level adjustors.

The overall grid system shall be rigid by self locking joints in accordance with false ceiling patterns, perfectly leveled and aligned at desirable height as per drawing.

#### 1.1.2 Aluminum Grid System

Aluminum grid system for supporting false ceiling tiles shall be of approved make and shall be perfectly leveled, aligned at desired height and in accordance with the false ceiling pattern as per drawings.

##### 1.1.2.1. Material

- A. Main Runner: Main runners shall be of extruded anodized (25 microns aluminum Tee sections of 25mm x 35mm size –approved make) 2.5mm thk
- B. Cross Runner: Cross runners shall be of extruded anodized (25micron) aluminum Tee sections of 25mm x 25mm size (approved make) 2.5 mm thk
- C. Ceiling Sections (Cross runners)

GI channel shaped ceiling sections shall be 0.5 mm thick having a knurled web of 51.1 mm and two flanges of 26mm each with lips of 10.5mm. The ceiling sections shall be fixed to the intermediate channels in perpendicular direction at 450mm c/c with the help of connecting clips.

GI grid system for supporting false ceiling tiles shall be perfectly leveled aligned at desired height in accordance with false ceiling pattern.

#### 2. FALSE CEILING TILES

The tiles shall be placed in position over the supporting grid system by means of hold down clips at four corners of each tiles and one in center of each side. The finished false ceiling shall be perfectly leveled and aligned at desired height as per drawings.

Necessary electrical and AC and other fixtures shall be provided as per drawing and in co-ordination with relevant construction activities.

## 2.1 Mineral fiber tiles.

Mineral fiber false ceiling tiles shall be with durable regular edging having NRC value of mm 0.50 light reflectance value of min. 80% K value of 0.052 to 0.057 w/m deg C and fire performance conforming to class I as per BS: 476. The tiles shall be of 600mm x 600mm x 15mm size. The tiles shall have fissured or granulated texture on the front side as specified. Backside shall be provided with protective coating.

## 2.2 Particle board tiles

Particleboard tiles shall be made of teakwood particleboard conforming to IS 3087 (3 layer flat pressed particle board bounded with BWP type phenol formaldehyde Synthetic resin and as per IS 848 categorized as class I for surface of very low flame spread as per IS 1642 treated with anti fungus chemicals.)

The tiles shall either be painted or laminated as specified. Lamination shall be 0.5mm thick and of approved quality, shade and texture fixed by hot press method and shall conform to BS 476 Part-7. The tiles shall be painted at the bottom surface ( facing the floor) with two coats of approved colour acrylic emulsion paint ( of approved make) after sanding off the surface with 120 grit sand paper and applying particle board primer. The other surface shall be painted with 2 coats of linseed oil varnish.

Tile sizes shall be 600mm x 600mm x 12mm and all four edges of the tiles shall be painted with a coat of approved quality primer.

## 2.3 Gypsum board tiles

Gypsum board shall conform to IS 2095. The gypsum boards used for false ceiling shall have following properties.

- |      |                         |              |
|------|-------------------------|--------------|
| i)   | Thermal conductivity    | 0.16 W/mk    |
| ii)  | Thermal Resistance      |              |
| a)   | For 9.5mm thick board   | 0.06 sqm K/W |
| b)   | For 12.5 mm thick board | 0.08 sqm K/W |
| c)   | For 15mm thick board    | 0.09 sqm K/W |
| iii) | Fire propagation.       |              |

### a) Fire propagation

Index of performance Not exceeding 12 and a sub index not exceeding 6 (when Each side is tested separately to BS 476 Part-6)

### b) Surface spread of flame Class 1 (both sides) as per test to BS 476 part-7)

Gypsum boards shall be of specified thickness and of specified finish (painted with plastic emulsion paint / laminated with 0.5mm thick lamination). The gypsum board shall be screw fixed to the underside of false ceiling grid system with 12.5mm dia dry wall screw @ 230mm c/c by drilling machine. Joints in the board

shall be finished flush with fillers, finisher and primer as per manufacturer's recommendation to give a seamless finish.

#### **PARTITIONS AND PANELLING.**

1. M.S. Frame

MS frame for partitioning and paneling shall consist of horizontal & vertical members of 185 WG 52mm x 38mm MS sections. The members shall be welded to each other at maximum 600mm c/c both ways. The frame shall be fixed to the floor ceiling, wall with GI roulette, plug, screw and washers and 300mm maximum c/c. The members shall be provided with one coat of red oxide zinc chromate primer.

The frame work arrangement shall be in accordance with the pattern for partition including doors / windows etc.

2. Gypsum board for partitioning and paneling.

Gypsum boards for partitioning and paneling shall be 12.5 mm thick and same as specified in clause 2.3.

Number of gypsum board layers (single skin or double skin) shall be as specified and with finishing (painting or lamination) as specified.

Framework along with the edges shall be concealed with partition/panel boards. Necessary cutouts for electrical, AC return air etc and other fixtures shall be provided in the boards. Glazing if any shall be fixed with putty and wooden beadings.

I. Laminated particle board for partitioning and paneling.

Particle board for partitioning/paneling shall be 12mm thick and shall be same as in clause no 2.2.

Number of particle board layers (single skin or double skin) shall be as specified and with finishing (painting or lamination) as specified.

Framework along the edges shall be concealed with partition/panel boards. Necessary cutouts for electrical, AC returns air etc and other fixtures shall be provided in the boards. Glazing if any shall be fixed with putty and wooden beadings.

#### **MEASUREMENT AND RATES.**

For item rate tenders. False ceiling/flooring. Insulation, partition, paneling shall be measured in sqm. Correct up to two places of decimal. Dimensions shall be measured correct up to 0.01 M.

No deduction shall be done for cut outs for fixtures, cables etc upto 0.18 sqm area . No extra shall be paid for providing such cutouts.

Rate for item rate tenders shall include all materials, labour, transport, conveyance, erection, storage, other incidental expenditures involved in carrying out the items.

## **MODE OF MEASUREMENT**

Note : The method of measurements for various items of the work shall be as under. However for any of the items for which specific mention is not made, the same shall be referred to the Architects and Architect/Customers representatives. Their decision shall be final and binding to the contractors.

### **1. EXCAVATION**

For measuring the excavation works for mass excavation, foundations, basement, footings & trenches the plan size with PCC shall be considered, or the actual space left by the contractor whichever is less. The quantity of excavation shall be calculated by multiplying the plan area, as derived above, by actual depth of excavation or as stipulated. If extra depth is excavated contractor has to refill the area with M10 grade concrete with his own cost. The tenderer shall built in their rate the extra excavation required for allowing the ramps, slopes, working space etc and no extra on this account shall be allowed. The excavation for piping works shall be measured as per relevant IS, if it is not included in the item itself.

#### **B) Plinth Beams**

Depth of excavation for plinth beam shall be measured from ground level upto bottom of beam and width equal to width of beam. If a leveling course is ordered, it shall be measured upto and bottom of the leveling course

- C) Where excavation is made in trenches, measurements for cutting shall be taken by means of tape and staff and the width of concrete or rubble packing as shown on the drawing shall be considered as width of excavation.
- D) Where excavation is made for leveling the site, levels shall be taken before start and after completion of work and total quantity of excavation computed from these levels in manner approved by the Architect/Customers representative.

### **2. Earth & murum filling :**

Filling shall be measured from cross sections of embankments, levels of which are recorded by means of levels before start of work and after completion of work. When it is not possible to measure filling from cross sections it may be measured from loose stacks or lorry measurements with previous written permission from the Architect/Customers representatives and 20% deduction shall be made from the measured quantity to arrive at the net quantity payable.

### **3. Rubble packing.**

This shall be measured in square meter of the area covered if depth is specified in schedule of quantities. Otherwise it shall be measured in cum for the depth laid.

### **4. Brick Masonry**

The brick walls one brick width or wider than that shall be priced per unit of 1 cum and for all brick on edge, half brick walls shall be priced per unit of 1 sqm.

The measurement shall be their full heights (upto the soffit or the slab or beam as the case may be, lengths (excluding the columns) and thickness.

Deductions for all openings, recess and lintels shall be made except for the following:

- a) Such voids and openings which measure less than 0.10 sq m in area on the surface and also templates, ends of beams, joints etc.
- b) Pots and wall plates which do not take up the entire thickness of the walls. No extra shall be allowed for openings and recesses mentioned in the deductions above. Measurement of brick work in arches including flat arch shall be along with the brickwork of specified thickness. The measurement of all brick cornices, architraves, hands etc shall be measured in running meter. The measurement of brick on edge coping of specified thickness shall be in square meter on plan.

5. Rubble Masonry

Except where otherwise described, stonework and stone walling generally shall be given in cubic meter and fascia work in square meters. When measuring walls, the thickness shall be measured to the nearest one cm. Deduction shall be made as described under brick work.

6. Plaster.

Neeru finished and sand faced plaster :

Plastering on brick and concrete surface shall be measured in sq m of the superficial area plastered. No extra shall be allowed for headed, chamfered or rounded arises or curved angles. No deductions shall be made for opening less than 0.1 sq m and the measurements of the plastered jambs shall not be added.

The measurement of all cornices, string courses, and such moulded work which shall be of section as per drawing including finish and shall be taken in running meter along the wall and shall be inclusive of the core. The rate for plaster work shall include the jad finishing between the skirting tile and the plaster work, or dado work and the plaster work. No extras shall be allowed for the jari work

7. Flooring, skirting, dado

The measurements of laying tiles, stones or patent stone to floors and wall dados shall be in the square meter of actual area covered. Areas less than 01. Sq m shall not be deducted. The measurement of floorings shall be in sq m taking horizontal measurements between side walls after the completion of the job and measurements of dado shall be sq m of the area of the wall covered (length into height.)

The measurement of skirting to walls shall be in sq m and shall be measured along the length of the wall.

The measurements of treads and risers shall be in running meter or in sq m as specified in bill of quantities and shall be the clear visible dimensions, neglect the bearings etc in plaster or masonry.

8. Carpentry & Joinery

Carpenter and joiners' work shall be of the material including glazing and hardware and finish as mentioned in the bill of quantities.

All scantlings of shapes other than rectangular, which are, intended to be measured as in cum shall be measured as the smallest rectangular prism from which each separate piece of such scantling could be cut. In all carpenters and joiners' work on allowance of 1.5 mm on the specified size shall be made for each planned surface. The measurement of all posts, beams, joints and such other scantlings shall be taken overall including tennons, laps, joints and bearing. They shall be measured in cubic meter.

Portions embedded in masonry or concrete or flooring shall not be measured separately.

- Doors, windows & Fan lights\_

These shall be as per drawing and specifications mentioned in the bills of quantities. The measurements of joints, sills, transoms and frames of doors and windows shall be measured along with the items specified. Horns, beams and holdfasts are specified or shown on the drawings shall not be measured nor paid for. The complete item work of door, windows and fanlight shall be clear measurements in square of the opening after the entire completion of the job.

The measurements of doors with steel framing shall be in sq m of the area of the door including the framework. Rate shall include for steel frame as shown on the drawings. The measurements of doors windows etc with curved outline in elevation shall be of the full enclosing rectangle. Those curved in plan shall be measured in sq mt with their extreme girth in width and height. The rate per sq m of doors, windows, fanlight etc shall be inclusive of the cost of fixtures and fittings including labour charge for fixing.

#### Cover Moulding .

This shall be of the shape and size as mentioned on the drawings and shall be made for notching or skew outs.

#### Partitions.

These shall be in sq m including the framework. The rate to include for the entire work as mentioned in the bills of quantities including fixing of glass.

#### Handrails

This shall be measured in running meter, including bends and rounds.

#### Wall paneling

This shall be as per the specifications and shall be measured in sq m of the actual area covered. The rate to include wall paneling and its ground.

#### Steel doors, windows, ventilators and louvers

Clear width between side jambs and clear height between floor and bottom of lintel/beam shall be measured. Hold fasts or portion embedded in masonry or flooring shall not be measured.

#### Rolling shutter/ rolling grilles

Clear width between side jambs and clear height between floor and bottom of lintel / beam shall be measured. Hood shall not be measured separately. The rate in sqm should be inclusive of the cost of hood.

#### Glazing

Shall be measured in square meter.

#### False ceiling

The measurement of false ceiling or suspended ceiling shall be measured in sqm of the total area covered, excluding bearings, if any.

The rate to include for the necessary cradling work and suspension work as mentioned in the bills of quantities. Deductions for light fixtures and air conditioning grills shall not be accounted for.

#### Waterproofing

##### a) Toilets

The measurement of waterproofing to toilet blocks is the sum of area of the floor treated with brick bat coba including waterproofing and the area of the wall treated with only waterproof cement plaster. Brick bat filling in the toilets or sunk portions shall be measured in cubic meter.

##### b) Terrace waterproofing.

The measurements of waterproofing including the brickbat coba and shall be the total area of the flooring covered including bearing and the area of the parapet treated with waterproofing.

##### c) Basement waterproofing by box type method

The measurement shall be total of the plan area of the PCC below raft plus the area of concrete wall treated including the vatas at the junction which shall not be paid separately.

##### d) Waterproofing to lift pit, water tank etc.

Length and breadth of inner / outer surface shall be measured along the finished surface including vata, curves etc. No deduction shall be made for inlet, outlet, scour connections ( area upto 0.02 sq m.) but the same shall be finished as required.

##### e) Waterproofing over the basement roof

The measurement shall be as per that of terrace waterproofing.

- Painting – As per IS : 1200

All painting work shall be measured in sq mtr. Net area of the surface painted shall be measured No deductions will be made for sun painted surface of end joints, beams, posts etc and openings not exceeding 0.05 sq m each and no addition shall be made for reveals, jambs, soffits, sills etc of these openings.

The following multiplying factors for obtaining equivalent areas shall be adopted.

Description of work	Mode of measurement	Multiplying Factor
Paneled, ramed, edged ,braced and battened.	Measured flat (not girthed) including frame, edges, chocks, cleats etc shall be deemed to be included in the item.	1.1/4 ( for each side)
Flush, part paneled and part glazed or gauzed	Measured flat (not girthed) including frame, edges, chocks, cleats etc shall be deemed to be included in the item.	1.1/8 ( for each side)
Fully glazed or gauzed, or glazed louvered ventilators	Measured flat (not girthed) including frame, edges, chocks, cleats etc shall be deemed to be included in the item.	½ ( for each side )
Fully louvered (not with glazing)	Measured flat (not girthed) including frame, edges, chocks, cleats etc shall be deemed to be included in the item.	1 ½ ( for each side )
Weather boarding	Measured flat (not girthed) supporting framework shall not measured separately.	1 1/8 ( for each side )

Trellis (or jaffri work) one way or two way	Measured flat overall no deductions shall be made for opening (supporting members shall not be measured separately.)	1 (for each face)
Guardbars, alustrades, gratings, grilled railings, grilled doors, grill partitions etc	Measured flat overall no deduction shall be made for opening (supporting members shall not be measured separately)	1 ( for each side)
Gates and open palisade fencing including standards, braces, rails, stays etc	See note below	1 for painting all over
Carved or enriched work	Measured flat	2 ( for each side )
Steel rolling/alligator type shutters	Measured flat over jamb guides, bottom rails and locking arrangement etc shall be deemed to be included in the item.	1.25 ( for each side )
Fully glazed or gauzed steel windows or partitions.	Measured flat	1 (for all over)

Note : The height shall be taken from the bottom of the lowest rail, if the palisades do not go below it ( for from the lower end of palisades, if they project below the lowest rail) up to the top of palisades, but not up to the top of standards, if they are higher than the palisades; similarly for gates, depth of roller shall not be considered while measuring the height.

#### Measurements of the concrete items

Plain, reinforced, ordinary and controlled concrete.

The cement concrete items under various heads shall be measured to the exact dimensions, as per the drawing or of the works executed under the orders of Architect/Customers representatives or RCC specialist. The thickness of plastered finishing shall not be taken into account in measurements.

The rate for any particular item shall include all materials including all the concrete mixed as per the specifications and placing in position, and curing the concrete work, including all necessary centering, shuttering and framework. The steel reinforcement shall be measured and paid for separately.

Concrete shall be measured, as executed. No deduction shall be made for the following:

i) Volumes of any steel embedded in concrete.

ii) Voids not exceeding 0.1 sq m in area measurement and 0.03 cum in volume measurement.

a) Lean concrete

Lean concrete shall be measured in cubic meter to the exact dimensions as shown on the drawings. The depth of lean concrete shall be the difference in levels before and after pouring the lean concrete in place. Measurement for filling in the pockets or extra filling below the bottom of raft slab by lean concrete, shall



be allowed only if they are approved and filled as per the instructions of the Architect/Customers representative.

b) Inverted Beams

Shall be measured in cubic meter, being the products of (i) the length between the faces of columns, (ii) the breadth of the stem projecting above the raft and (iii) the depth of the beam above the raft.

c) Footing & pedestals

Footings – shall be measured in cubic meter, and shall be the sum of the straight and the sloping portion. The straight portion shall be the product of the area into the height and the sloping portion shall be calculated by the trapezoidal formula

$$V = h/3 (A_1 + A_2 + \sqrt{A_1 \times A_2})$$

Pedestals – shall be measured in cubic meter, being the product of the area of the cross section multiplied by the heights measured from the top of the footings upto the top of the floor concrete

d) Walls and columns

Concrete walls shall be measured in cubic meter. Only such voids which measure more than 0.1 sq m shall be deducted. The length of the wall / column shall be exclusive of columns / walls etc and the height shall be measured from the top of the floor to the bottom of the ceiling.

e) Slab

Slabs shall be measured in cubic meter. The measurements of slab shall be the area including bearing, no deductions shall be made for the portion of the slab which forms parts of the beams below (T beam or L beam) or above (inverted beams). The openings less than 0.1 sq m shall not be deducted.

f) Floor beams

These shall be measured in cubic meter being the product of (a) the length between the faces of the supporting beams or columns or the length including the bearings if resting on walls (b) the breadth of the stem projecting below the slab and (c) the height or depth (average if carrying) projecting below the underside of the slab. In case of inverted floor beams the product is of (a) the length from column face to column face (b) the breadth of the stem projecting above the slab and (c) the height or depth projecting above the top slab. No extra shall be paid for cantilever beams

g) Lintels

Lintels shall be measured in cubic meter, and shall be the product of the length, including the bearings and the cross sectional area.

h) Bands

Concrete bands of specified thickness shall be measured in sqm. The width shall be considered including its bearing in the masonry.

i) Storage tank

Slab and wall shall be measured as specified above.

- Mild steel / high yield strength deformed bar reinforcement

Reinforcement as detailed in schedule of quantities shall be measured for payment linearly as per the cutting lengths nearest to cms. Shown in bar bending schedule. Architect/Customers representative's representative and weights calculated based on the standard weights as per I.S per meter length. No allowance shall be made in the weight for rolling margin. Only authorized laps shall be measured.

The cost of the steel used by the contractor in the reinforcement of the beams, slabs, columns etc. will be paid as per rate of reinforcement only up to the extend shown on the drawings. As far as laps in bars shall be avoided. Any laps and hooks provided by the contractor other than authorized as per approved bar bending schedule will be considered to have been provided by the contractor for his own convenience and shall not be measured for payment. Pins, chairs, spacers shall be provided by the contractor, wherever required as per drawing and bar bending schedule and as directed by Architect/Customers representative. They shall not be measured for payment. However, the weight of such pins-chairs-spacers etc shall be taken into account for reconciliation statement of steel. Fan hooks as required shall be provided by the contractor under this item and shall be measured for payment.

The rate shall include the cost of all materials and labour required including transport, wastage and the binding wire required which will not be measured and paid for separately.

Structural steel work– As per IS mode of measurement.

Road & side walls

- a) Dry rubble packing  
This shall be measured in square meter of the area covered if thickness is specified or otherwise cubic meter w.r.t. thickness laid.
- b) Asphalt road, concrete road and terrazzo side wall  
As work shall be carried out as mentioned in the specifications of each item of work and shall be measured in square meter.
- c) Kerbing  
Shall be measured in running meter.

**9. RELEVANT IS CODES –**

**MATERIALS**

**1. Cement**

- |   |         |  |
|---|---------|--|
| 1 | IS 269  | Ordinary and low heat Portland cement  |
| 2 | IS 455  | Portland slag cement                   |
| 3 | IS 8041 | Rapid hardening Portland cement        |
| 4 | IS 1489 | Portland Pozzolana Cement              |
| 5 | IS 8112 | High Strength Ordinary Portland Cement |
| 6 | IS 8043 | hydrophobic Portland Cement            |
| 7 | IS 6909 | Supersulphated Cement                  |

**1.a Testing of Cement**

- |   |         |   |
|---|---------|---|
| 1 | IS 4031 | Testing of Cement                                       |
| 2 | IS 650  | Physical Tests of Hydraulic<br>Cement Standard Sand for |

2.Aggregates	
1 IS 383	Coarse & fine aggregates from natural
	sources for concrete. IS 2386 Methods
	of Tests - Part I to VIII) for aggregates
	For concrete.

3. Concrete	
1 IS 1199	Methods of sampling and analysis

2 IS 516	Methods of test for strength of concrete
3 IS 1881 (Part VI)	Analysis of hardened concrete
4. Water	
1 IS 3025	Method of sampling and test for water used in industry

5. Steel	
1 IS 432	Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
2 IS 1139,	Hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcement.
3 IS 1786	Cold twisted steel bars for concrete reinforcement
4 IS 1566	Hard drawn steel wire fabric for concrete reinforcement
5 IS 226/IS 2062	Structural Steel
6. Admixtures	
1 IS 2645	Integral cement waterproofing compound
2 IS 9103	Admixtures for concrete

7. Light Metal and Alloys	
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1 IS 1285	Wrought Aluminium & Aluminium alloys extruded round tube and hollow sections
2 IS 737	Wrought Aluminium & Aluminium Alloys Sheet and Strips.
8. Blocks Precast Concrete	
1 IS 2185	Specification for glazed earthenware tiles
9. Waterproofing and Damp proofing Materials	
1 IS 3384	Specification for bitumen primer for use in waterproofing and damp proofing.
10. Builders Hardware	
1 IS 204	Specification for tower bolts (2nd Rev).
2 IS 205	Specification for nonferrous metal butt hinges (2nd Rev.)
3 IS 1341	Specification for steel butt hinges (Revised)
4 IS 1823	Specification for floor door stoppers (first revision)
5 IS 3847	Specification for mortise night 1966 latches
11. Wood Products Plywood	

1 IS 1328	Specification for veneered decorative plywood
2 IS 1659	Specification for block boards
3 IS 4990	Specification for plywood for concrete shuttering work

12. Particle Boards and Fiber Boards	
1 IS 3087	Specification for wood particle boards (Medium density) for general purpose
2 IS 3097	Specification for veneered particle boards
IS 3478	Specification for high density wood particle boards.
13. Doors and Windows	
Wooden door & window frame and shutters	
1 IS 2191	Specification for wooden flush door shutters (cellular and hollow core type)
2 IS 2202	Specification for wooden flush doors shutters (solid core type)
14. Metal Doors & Window Frames	
1. IS 1038	Specification for steel doors, windows & ventilators(1st revision)
2. IS 1948	Specification for aluminium doors, windows and ventilators

IS 4351-1967	Specification for steel door frames
15. Water Based Paints	
1 IS 5410 .	Specification for cement paint colour as required
16. Masonry	
1 IS 1077	Specification for common burnt clay building bricks
2 IS 3952	Specification for burnt clay hollow blocks for walls and partitions
3 IS 1597-1967	Part-I - Rubble stone masonry

17 Constructional Practices and Safety

A) Foundations	
1 IS 2911	Code of Practice for Design and Construction of Pile Foundation.
B) Masonry	
1 IS 1597	Code of practice for construction of stone masonry
2 IS 1597-1967	Part-1 Rubble stone masonry (Part-1)
3 IS 1597-1967	Part-2 Ashlar masonry ( Part – II)
4 IS 2212	Code of Practice for brick work

5 IS 2572	Code of Practice for construction of hollow concrete block masonry.
C) Roofing	
1 IS 3007	Code of Practice for laying of asbestos cement sheets
2 IS 3007-1964	Part-1 Corrugated Sheets (Part-I)
3 IS 3007-1965	Part-2 Semi Corrugated Sheets (Part-II)
D) Flooring and Finishing's	
1 IS 2114	Code of Practice for laying in situ terrazzo floor finish.
2 IS 3036	Code of Practice for laying lime concrete for a waterproofed roof finish
3 IS 3140 .	Code of Practice for painting asbestos cement building products

E) Water Supply	
1 IS 4985	Specification for un plasticised pipes PVC pipes for potable water supply
2 IS 3114 -1965	Code of practice for laying of cast iron pipes
F) Steel/Concrete	
1 IS 3370	Code of Practice for concrete structures (Part-I to IV)



2 IS 2751	Code of Practice for welding of mild steel bars used for reinforced concrete construction
3 IS 2502	Code of Practice for bending and fixing of bars for concrete reinforcement
4 IS 4014	Code of Practice for steel tubular Scaffolding (Part-I & Part-II)
5 IS 3414	Code of Practice for design and installation of joints in building
6 IS 2750	Specifications for Steel Scaffolding
G) Construction Safety	
1 IS 3696	Safety Code for Scaffolds and Ladders (Part-I & Part-II)

H) Structural Steel	
1. IS 816	Use of Metal Arc Welding for General Construction in Mild Steel.
2. IS 226 and IS 2062	Specen for structural steel
3. IS 1363	Specification for Black Hexagonal Bolts & Nuts.
4. IS 1364	Specification for Precision and semi-precision Hexagonal Bolts & Nuts
5. IS 8114	Specification for covered Electrodes for Metal and welding of Mild steel.

**SPECIFIC MATERIAL GUIDE –**

Cement	Ultratech, ACC, Birla Super, Coromandal
Acrylic weather proof paint	Asian, Nerolac, Dulux
Synthetic Enamel Paint	ICI Dulux/Shalimar/British Berger/ Asian Paint – Apcolite / JN.
Oil Bound Paint	Asian Paints / Nerolac / JN
Anti Termite -	PCI or equivalent
G I Pipes	Tata / Zenith
Plumbing fittings	Jaguar
Sanitary ware	Hindustan / Neycer / CERA/Parryware
Glass (High performance )	Saint gobain/Triveni/Modi Float / Asahi Float.
Roofing and cladding sheets	National/CRIL/Tata blue scope/Lloyd
Plasticizer and floor hardener	Sikka/Degussa/Fosrok
Chemical anchor fastener	Hilti/Fischer
Welding Rod	Advani Oerlikon /Indian Oxygen /Philips/Esab
PVC Pipes, Plumbing	Supreme / Prince
Tile Adhesives	Zentrival PL of MC / Fosrok
Tile Joint Filler	Terragroa, Rofftile J6 116, Fosrok
Integral Waterproofing Powder	MC.Special DM / Asko Rock
Liquid	MC.Special DM / Asko Rock/Hardcrete/ Fosrok / STP/Sikka/Kemper
Waterproof Plywood / Flush Doors	Anchor / Swastik / Merino / Tower
Vitrified and Ceramic Tiles	RAK / Kajaria / Bell / Jhonson
Aluminum Sections for doors, windows and partitions	Jindal / Indal
Sealants	GE / Hindustan Minaral / Sika / Fosrok/Dow-Corning
Expansion Joint Fillers	STP/Polysulphide/Heavy duty Epoxy
Tor / Mild steel reinforcement	Sail, Tisco, RINL
Interlocking paver block	Innovative, Shivam or equivalent
Raised Flooring	KABEO or equivalent
Structural Steel/ Pipe	Sail/Jindal/Tata/ISPAT/ESSAR
Epoxy flooring	Sikka or equivalent
Steel and fire doors	Shaktimate/MPP
Door fixtures and fastenings	Dorma

## **TECHNICAL SPECIFICATIONS ELECTRICAL**

1. This specification covers in brief the requirements for the installation HT works, related LT power & control Cable works, earthing, Transformer installation and the downstream installation. It is not the intent to specify herein all the details of material, equipment, installation, testing and commissioning; however the same shall be of high standard of engineering and shall comply to all currently applicable Standards, Regulations and Safety Codes, Maharashtra State Electricity state Board practices. Also it is not possible to specify the quantity of every item, but it is Bidders' responsibility to execute the job with recommended engineering practices in best workable manner. Material specification for major equipment such as Metering Kiosk, HT Panel, LT Panels, Transformer, DG, UPS, LT Panels and Cables etc. shall be issued separately provided these are part of contractor's scope of supply. The same shall be confirmed by contractor in writing with client/ consultant prior to material procurement.
2. Necessary clearances such as- horizontal clearances from structures/live conductors/building, vertical Clearances from ground, span, sag etc. as per I.E. rules and other statutory Requirements shall be followed. The drawing furnished along with tender is indicative and contractor to prepare working details.
3. Necessary correction in 'tender Bill Of Quantities' and rates thereof shall be carried out as the final arrangement is decided, in such cases rates shall be derived from unit rates quoted or as per 'rate analysis' submitted by contractor and evaluated by CONSULTANT / DIRECTOR IITM PUNE.
4. HT/LT Switchgear Panels, HT/LT Cables, Power and Lighting DB and Control Panel.
5. This shall be applicable to switchgear panels, power and light distribution boards, instrument distribution boards, DCDB, control panel, etc. Manufacturer's instructions, drawings and instructions of the Engineer-in-Charge should be studied and strictly followed during handling, erection, testing and commissioning of the switchgear. The panels should be handled with care, avoiding impact to the equipment, by the experienced riggers under the guidance of a competent supervisor. Dragging of the panels should be avoided and use of a crane and trailer should be made for the handling purpose while transporting to various sites. The panels should be properly supported on the truck or trailer by means of ropes to avoid any chances of damage or tilting due to heavy vibrations. The panels should be lifted by making use of lifting eye-bolts only, fully tightened after ensuring that panel supports, nuts and bolts are all intact and tightened. When lifting panels, utmost care should be taken to avoid any damage to insulators, bushings, metering and protective equipment. The panels should be preferably kept inside the cases till foundations are ready.
6. The panels should be taken out from the packed cases and moved one by one to the proper place. All the panels should be assembled, aligned and levelled and it should be ensured that panel to panel coupling bolts, busbar links fit properly without any strain on any part. It should also be checked-up that lowering, lifting, racking in and out operation of the breaker and all other motions are free from any obstruction. The fixing bolts should be grouted only after satisfying all these requirements. All Switchgear of any other equipment supplied & installed by contractor shall be tagged with engraved name-plate indicating device no & the source of supply panel.

7. The panel erection will consist of the following:

Placing the panels on the foundation, aligning and grouting / tack welding to supporting structure wherever possible. Levelling shall be within  $\pm 1$  mm with respect to the level specified. The panels shall be made vermin and dustproof with M-Seal for Interpanel joints as directed by CONSULTANT/Client. Checking the equipment for any apparent damages and informing the Director IITM Pune. Measuring the insulation resistance value and improving the same, if required by approved methods.

Checking the control circuit for operation, interlock, indication with only control supply 'ON' and all control connections made.

Checking the name-plate details of the feeders as per drawings.

Checking the bimetal relay ranges for the motors and setting the relay at full load current stated on the motor name-plate.

Dressing and clamping of cables inside the equipment.

Cleaning the equipment with vacuum cleaner before energising.

Pre-commissioning tests like continuity checking, megger, interlock checking, direction of rotation of motor, operation of motors from various control points.

Painting the cable numbers on the respective compartments (near terminal block)

Tightening the busbar / link connection and checking connections at terminal block. Draw out modules shall be taken out if required.

Pasting the vendor wiring diagram reference on compartment door (inside).

Checking the mechanical operation of all switches, circuit breaker and similar items and the door interlocking arrangement.

Connecting the earth busbar of the equipment to the main earthing ring and painting the same green for easy identification.

Checking the measuring and indicating instruments for operation.

Plugging the unused cut-outs for cable glands in the equipment after completing the cable connections.

Touch-up painting of panels, wherever required.

Checking of all Components in Feeders with respect to vendor SLD and Bill of Material.

Prior to Panel hand-over, all feeder Nos. & description shall be provided on new engraved name plates in place of old ones.

### **Transformers**

#### **Handling**

When lifting a transformer by the lugs or shackles provided for this purpose, simultaneous use should be made of all such lugs and shackles in order to avoid any unbalance while lifting. Before lifting, complete transformer, it should be ensured that all cover bolts are tightened fully. In case where it is necessary to use jacks for lifting, projections provided for the purpose of jacking should be used. Jacks should never be used under valve or cooling tubes.

It may be necessary under certain circumstances to place jacks under stiffening curbs on the tank base. For transporting transformers from

stores to site, the transformers shall be loaded on a suitable capacity truck or trailer.

The transformers shall be properly supported by steel ropes and stoppers on the trailer to avoid tilting of the transformers in transit due to jerks and vibrations. At no instance, a transformer shall be kept on bare ground. Where it is not possible to unload the transformer directly on a foundation, these shall be unloaded on a properly built wooden sleeper platform. A transformer shall never be left without putting stoppers to the wheels. Damages of any nature shall be brought to the attention of AEPPL/Client before lifting material from stores failing which it will be to contractor's account.

Following checks are to be carried out:

All the accessories have been fixed properly and transformer body and neutral are properly earthed. The transformer dehydration is over and results are satisfactory and approved by the Engineer-in-Charge.

The oil level, in the transformer conservator tank and all the bushings is up to the marked point and the oil has been tested for dielectric strength.

The Silica gel is in reactivated condition; the breather pipe is clear from any blocking and contains oil up to the proper level.

The explosion vent diaphragm does not have any dents accumulation of any oil and air had been released.

The operation of off-load and on-load tap changers on all the tap positions is satisfactory. The mechanical parts of the on-load tap changer are lubricated. Break shoes are OK.

Motor IR value taken and tap position mechanical indicator on the transformer and tap position indicator meter on the control panel are reading the same tap positions. Tap changer limit switch are operating alright on the maximum and minimum tap position, on load tap changer contact pressure and resistance is as per manufacturer's recommendations. Oil level of tap changer tank is OK and oil has been tested for dielectric strength.

The Buchholz relay has been checked up for any friction in the movement and floats are free. All the other protective relays, alarm and annunciation relays have been tested.

All the metering equipment has been tested. Polarity test of transformer winding is alright. Phase sequence and connections have been checked for proper vector group.

The ratio test on all the tap positions is alright.

Gaps of arcing horns for the bushings are alright and earth connections for the surge diverters have been checked.

The winding & oil temp. Thermometer pockets contain oil.

The transformers fitted with fan for forced air cooling have been checked. The simulation tests for all the alarm, annunciation and trip circuits have been checked and are alright.

The insulation resistance of all the control circuits and IR value of the transformer windings and all the incoming and outgoing cables have been checked and in order.

All the valves in the cooling system and valve between the Buchholz relay and the conservator tank are in open position.

The transformer has been cleaned from outside.

The earth leads have been removed if shorted for testing purposes.

All the tools and other materials have been removed from the transformer vicinity.

The setting of all the protective relays in at the desired value and DC trip supply is available. The fire fighting equipment is ready.

#### **CABLES**

Cables shall comply with the latest editions of following standard, as applicable,

BIS : 1554 Part 1 PVC insulated electric cables (Heavy duty)

BIS: 7098 Part 2 Cross- Linked Polyethylene Insulated PVC sheathed cables

BIS : 8130 Conductors for insulated electric cables and flexible cables

1.1 KV grade cables: All LT power cables shall be 660/1100V grade, with aluminium conductor for size 10 Sq.MM and above. Power cables of sizes up to 6 Sq.mm. shall be with copper conductors

##### **Construction**

- Conductor – Shall be solid up to and including 6 Sq.mm. and stranded above 6 Sq.mm. Conductor shall be as below –
  - Copper conductor – Stranded, class2, as per IS 8130
  - AL conductor - Stranded, grade H4, class 2 as per IS 8130
- Insulation- Conductor insulation shall be of extruded PVC compound type
- Inner Sheath –extruded, black, PVC compound type ST-1
- Armour - made up of Al. strip / or single G.I. strip / G.I. wire
- Outer sheath- extruded, black, PVC compound type ST-1
- 

##### **22kV Earthed Grade XLPE cables**

Cables shall have following construction:-

- Conductor – AL conductor - Stranded ,grade H4,class 2 as per IS 8130
- Conductor Screen – Extruded semi conducting compound in combination with non- magnetic metallic tape and XLPE compound insulated
- Inner Sheath – Extruded black PVC compound type ST-2
- Outer Sheath – Extruded black PVC compound type ST-2
- Armour - Steel strip Al / G.I.
- Cores shall be identified by Printed numerals of Phase.
- Voltage rating will be 22kV Earthed.

##### **Tests**

- All routine tests as per relevant IS shall be carried out on each size of cable required for the project.
- The manufacturer will furnish type test certificate.

a)

- In addition to above mentioned test the cables shall be subjected to following tests: -  
Water tightness test.  
Saline bath test (in accordance with CEGB recommendations 628)
- Inspection of cables will be held at the manufacturer's works at following stages:  
During manufacturing process while applying insulation.

Final inspection for carrying out tests.

- The copies of routine and type tests shall be submitted at least one week prior to final inspection.

#### **Cable Drums**

- Cables shall be supplied in non-returnable drums of sturdy construction. All ferrous and other metal of drums shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage.
- The length of cable on each drum shall be determined by the manufacturer considering the transport limitations from manufacturer's works to the site.
- The cut ends shall be sealed by means of non-hygroscopic sealing materials.
- The cable drum shall be marked with following information :-
  - a) Trade name
  - b) Cross sectional area of the cable with no of cores.
  - c) Voltage grade and type of cable.
  - d) Lengths of cable, weight of cable drum including cable.
  - e) Direction of rotation of drum by arrow marking.
  - f) IS certification mark.
  - g) Manufacturer shall indicate the maximum length for each size of cable, which can be furnished on one drum. However, before packing the cables on drums, the successful manufacturer shall obtain purchasers' approval for the drum length.

**Cable Accessories** Manufacturer shall include in his offer, the equipment and materials required for making cable splice and cable terminals. Full details of the splicing and terminating procedures shall be given by the manufacturer.

- The total creepage distance of the outdoor porcelain insulators of cable sealing ends shall be suitable for heavily polluted saline atmosphere and shall in any case not be less than 25 mm per KV of highest line to line voltage. The protected creepage distance shall be half of the total creepage distance. The insulators shall be washable under live conditions by hot line washing equipment.

#### **Information to be given by manufacturer**

In addition to the standard information, the manufacturer shall provide the following information with the offer.

Detailed drawings with dimensions of the cable and all accessories including

Cross sectional view of cable, indicating the material used in each type of construction.

Splices, straight joints and trifurcating boxes.

Terminations, showing mounting arrangement

Complete specifications of covering used to protect sheath and reinforcing tapes from corrosion.

Describing information regarding cable and accessories and test of installations of similar cables now in service with description, cable performance, and outages suffered and cause of outages.

Recommended method for locating conductor faults, apparatus required for locating the faults and their price.

Transporting the cables from stores to place of installation. The drums under the custody of the contractor shall be neatly arranged in the yard near his site office. The drum shall not be rolled for transportation more than 10m Truck / Trailer shall be used for transportation for distance more than 10m.

The cables shall be rolled out for equipment and cutting shall be as per site requirement. Cable jacks and cable rollers shall be used during laying of cable.

Electrical Contractor shall cut all cable length by actual measurement at site as per final route determined. Cable lengths indicated in Cable Schedules shall be used only to get an idea of length involved.

The cables shall be tested for insulation value before laying. Drum Schedule to be prepared by contractor.

The Cables shall be laid in trenches, trays, along walls or structural support as per the requirement. The cables shall be neatly laid and clamped. The crossing of cables shall be avoided. The arrangement of cables on the tray / trench shall be decided based on the cable schedule and layout drawings and shall be approved by the CONSULTANT/Client.

Clamping of cable shall be done by 18 SWG thick aluminium clamps at an interval of 0.5 mtr. for vertical run and 1 mtr. for horizontal run. When cables are cleated on wall / structures, the spacer and saddle shall be used at 300 mm interval or less depending on the location and shall be approved by CONSULTANT/Client.

The cable terminations shall be done as per standard practice and crimping type of terminations shall be considered.



The glanding shall be done with suitable arrangement for earthing the gland. Wires / sleeves required for effectively earthing the glands shall be included in the termination materials.

The unused cores of the multicore cables shall be properly taped. The tag carrying the cable number shall be at interval of 20 mtr. for underground cable and 30 mtr for above ground cable and at all bends and route changes of the cable run. Material of tag will be aluminium for above ground cables and of lead for buried cables. Sample of tags shall be approved by CONSULTANT/Client.

The cable numbers shall be painted near the terminal blocks in MCC / Distribution Boards / Switchboards.

For main power cables loops shall be provided near terminations.

All cables coming from floor / trench shall be taken through a G.I. Pipe. The length of the pipe shall be decided by the contractor and approved by the CONSULTANT/Client.

The glands supplied by the contractor shall be suitable for cable sizes mentioned and if necessary reducers shall be provided by the contractor. The contractor shall indicate the requirement of reducers and supply the same after approval of rates by Director IITM Pune.

The contractor shall supply and install the ferrules for multicore cable connections. The ferrule markings shall be identical to the wires connected to the terminals.

The Lugs used shall be tinned Copper for Copper Cable and Aluminium Lugs for Aluminium Cable, crimping type of reputed make. The Lugs used for multistrand control cable shall be PVC sleeved crimping type copper lugs.

The connections between the junction boxes/control panels to components like pressure switches, limit switches shall be through flexible conduits. The length of each of the flexible conduit shall not exceed 120 cm.

The cables coming from switchboards to the cable tray shall be taken through branch trays and the cables shall be clamped neatly. The arrangement shall be approved by CONSULTANT/Client.

Main cable runs are to be routed as shown on the contract drawings. Any modifications found necessary due to site conditions must be approved by CONSULTANT. Details of routes not shown on these drawings are to be determined on site by discussion with CONSULTANT/Client.

PVC insulated and / or served cables shall not run parallel within 100 mm of, or be installed above and in line with, any heated pipes or duct. Where crossing above heated pipes or ducts is unavoidable the cable must be kept at least 150 mm from the outer surface of such pipes or ducts or the insulation thereof.

On main horizontal cable runs where cables are supported, suitable mild steel saddles, cleats or clips shall be used. Between these fixing points cables shall be laid neatly in position on the intervening racks. On vertical cable runs and horizontal runs other than the main horizontal runs, cables shall be fixed at one metre intervals. Where different sized cables are together the maximum fixing intervals are to be those required for the smallest cable, unless the smaller cables are bunched with larger cables and supported by them throughout the complete multi-cable run.

**NOTE:** Where the contract drawings indicate that the cables are to be run or fixed other than in accordance with this specification, the drawings shall be deemed to be correct.

Cable run in RCC trenches are to be run on the floor along the sides on suitable brackets and located 75 mm minimum from floor of trench. Cable ducts in the ground shall be sealed against the ingress of water, foreign matter and vermin, at both ends by means of non-setting compound and / or suitable wood plugs fitted over the cable and into the duct. Where ducts are not in use they shall be sealed in a similar manner.

Cables laid direct in the ground shall be laid on a bedding of 150 mm of sand and covered by 150 mm layer of sand, on top of sand tiles / bricks covering to be done. The depth of laying shall be such as to provide 750 mm minimum cover for low voltage cables and 1000 mm cover for high voltage cables.

All non used open entries in equipment and open ends of conduit are to be sealed by means of conduit plugs (or blanking plates if entries are not of standard conduit sizes) at all time.

**NOTE:** This is particularly important where equipment is located in position, but electrical installation is incomplete.

Where cables pass through floors, they shall be protected by metal / PVC pipes or other suitable means. Holes in floors, walls, etc. will be made and reinstalled by the contractor unless otherwise stated.

All cables laid underground shall be protected with good quality brick and interlocked concrete tiles marked "Electric" or "Telephone" cables.

Cable joints shall be mechanically and electrically sound and except for buried cables they shall be accessible for inspection.

Underground joints shall be specially protected with a double layer of bricks and cast iron joint markers (marked 'Cable-Joint'), shall be installed to indicate the position of the joint.

Where corrosion of armour or gland might occur, it shall be effectively protected by suitable means.

The contractor shall test all cables for proper insulation before they are transported for laying and shall furnish a certificate of acceptance to this effect. Any damage to the cable subsequently shall be made good by the contractor at his own cost. After the test of insulation, the cut ends of cables shall be sealed properly with waterproof material to prevent ingress of moisture.

Cable Marking

All Cables shall be externally marked at either end with the respective identification numbers by means of non-deteriorating material. Cable Markers shall be approved by CONSULTANT/Client. Where conductors are left to be terminated by another party or left to be connected later, they must be individually identified.

#### **Heat Shrinkable Type H T Cable Termination Kits**

Cable termination kits shall be outdoor or indoor type as specified in the BOQ.

These kits shall be of PVC heat shrinkable type only. Compound Filling type termination kits are not acceptable.

Cable termination kits shall be suitable for XLPE cable of given size.

Voltage grade Of the kit shall be considered as EARTHED type that is 33 kV (E)As per cable voltage grade.

#### **Cable Glands**

When preparing cables prior to fitting glands, the gland manufacturer's instruction for cable preparation shall be observed. In all cases where armoured cables are used care shall be taken to ensure that the lay of the armour is maintained after the gland is completely fitted.

Where compound boxes are used for terminating cables, the compound must penetrate fully and leave no air holes. Where hot pouring of compound is employed, 'topping up' must be carried out as soon as possible after the first filling. The pouring temperature of the compound must not be high enough to damage the cable insulation.

All terminations of paper insulated cable shall incorporate damp barriers in each conductor. The insulation shall be removed to leave approximately 15 mm to 20 mm of the conductor exposed, and the conductor shall be soldered at this point.

The preferred method of terminating conductors is by means of solder less compressed connectors. Deviations from the above shall be subject to approval of CONSULTANT/Client.

Connectors shall be of the correct size for the conductor concerned and as manufactured by Dowell's or approved equivalent.

All connectors shall be marked with the size reference for identification with the correct compression tool. This reference shall be located on the palm of the connector and shall be remote from the contact faces where possible.

The palm of the connector shall be of such shape and size that standard washers to relevant IS applicable to the size of stud for which the connector is designed shall lie flat on both faces of the connector palm when the holes in the washers and the palm are co-incident.

Compression tools shall be designed and supplied for specific use with the connectors used, and shall be regularly serviced by the maker.

#### **LT PANELS**

### **Construction**

- The switchboard shall be totally enclosed, metal clad, sheet steel fabricated, compartmentalized, dead front type, dust and vermin-proof, freestanding, floor mounting type. It shall be of unit construction suitable for splitting into sections for shipping to site and to be correctly re-erected on prepared foundations without skilled supervision. The individual shipping section length shall not preferably exceed 2 metres. Provisions shall be made for addition of future units on either ends of a switchgear line-up after its installation on site. End busbar fishplates shall be provided.
- The switchgear shall be easily extensible on either side by the addition of vertical sections. It shall be possible to extend the switchgear, irrespective of the type of end panel and the design shall be such as to permit addition of extension panels of a type other than the type of end panel. Any adapter panels required shall be included in the basic price and indicated clearly in the technical particulars furnished.
- The switchboard shall be fabricated preferably from cold rolled sheet steel of minimum thickness 14/16 gauge.
- The height of the switchboard shall be constant throughout its length, but not exceeding 2400 mm.
- Adequate lifting facilities such as hooks for ease of handling on site shall be provided. These hooks when removed shall not leave any openings in the switchgear.
- Front access shall be available to all components in each cubicle, which require adjustment, maintenance or replacement. Checking and removal of components shall be possible without disturbing adjacent equipment. All auxiliary equipment shall be easily accessible. Setting of relays shall be possible without de-energizing other equipment.
- Rear access shall be available to all cable glands and multicore terminal blocks by means of sheet steel hinged doors, designed to give the maximum possible access to the cable terminations. The cable alley door shall be provided with bolts, which can be opened with special keys by authorized persons.
- Each unit of switchgear shall have necessary interior barriers to form separate compartments for buses, switching devices entering cable connection etc. All barriers shall be manufactured from non-inflammable material, preferably of sheet steel.

- Each compartment shall be constructed and segregated to confine any damage caused by an internal fault to that compartment.
- Adequate barriers shall permit personnel to work safely within an empty switching device compartment or one from which the switching device assembly has been temporarily removed with bus energized.
- The arrangement of feeders in the switchboard shall take into consideration the number and size of cables required for the feeders.
- The arrangement of the feeders shall ensure that operating handle of the switch / breaker shall be above 300 mm but below 1800 mm from ground level.
- Removable type undrilled gland plates shall be provided on bottom of the panel. Gland plates shall be 3 mm thick sheet steel.
- Suitable provision shall be made for clamping cables inside the switchboard.
- The cable terminations inside the cable alley shall be completely shrouded so that it shall be possible to work on any one of the terminations by switching OFF the corresponding feeder switch only.
- All bezels, handles, screws, bolts, washers, hinges and other embellishments shall be of the best quality electro galvanized or passivated to withstand attack from corrosive atmosphere.
- The fabricated parts shall undergo a treatment of degreasing, pickling and two coats of primer before being given the stoved enamel finish. The final finish shall be of colour shade 631 as per IS-5 or RAL-7032. Two coats of final paint shall be applied. Proper care shall be taken to grind the welded joints to give a smooth appearance after painting.
- The external finish of the board shall be of the highest standard.
- The external and internal surface of the board shall be stove enamelled finish unless otherwise specified.
- Adequate packaging against damage and deterioration shall be provided for transportation to site and subsequent storage prior to re-assembly.

- Horizontal busbar chambers shall be at the top of the board. Busbars shall be completely shrouded to prevent metal pieces falling on the busbar during maintenance.
- The busbars shall be of aluminium with continuous rating as given in the SLD. All busbars and their main current carrying connections shall have preferably the same sectional area throughout their length. The busbars shall be colour coded.
- The busbar sizes shall be determined taking into consideration the continuous rating without exceeding the final temperature of 45o C over maximum ambient temperature and the fault level specified. The busbars shall be supported by insulators on non-carbonizing material resistant to acid and alkali and having non-hygroscopic characteristics and braced to withstand the fault level specified.
- Auxiliary busbars each of minimum size 18 sq mm copper shall be provided for following applications. Exact number of busbars shall depend on various control, metering and auxiliary power distribution requirements specified in specific requirements.
  1. Panel / Motor space heater supply.
  2. AC / DC control supply for breaker tripping closing and indication circuits.
  3. AC / DC control supply for breaker spring charging motors.
  4. AC control supply for motor starter control and indication circuits.
  5. AC potential supply for KWH meters.
- Earthing - Two earth terminals shall be provided on each switch cubicle, at the back, near the floor. An earth bar of at least 50 x 6 mm copper shall be fixed to these terminals. The earth bar shall be electrically continuous and shall run the full extent of each board. Each unit shall be constructed to ensure satisfactory electrical continuity between all metal parts not intended to be alive and earth terminals of the unit. Suitable holes with bolts and lugs shall be provided at each end of earth bar of switchgear for connection to a main earthing grid of 50 x 6 mm GI bus. The earth bar shall be accessible in each cable entering compartment either directly or through a branch extension to ground the cable armour and shields.
- Busbars and connections shall be secured in such a manner that the insulators are not subjected to bending forces under short circuit conditions. The vertical dropper shall be sized to carry continuously at least the rated current of the connected switching devices. When multiple switching devices are combined in tiers for a vertical unit, the droppers shall be able

to carry the total current resulting from the combination of all switching devices. The vertical busbars shall be completely shrouded with the cut-out for connection tappings.

- In case of copper to aluminium connections, proper treatment shall be given to minimize the bimetallic effect. That is, all joint surfaces at aluminium to copper joints shall be silver / tin plated, alternatively Cu-Al. washers (bimetallic washers) may be used.
- Any unused circuit breaker compartment shall be fully equipped and provided with compartment door, vertical bus bars and control terminals / wiring, etc., such that the same could be used for housing outgoing breakers in future without any modifications to the panel. All quotations must indicate the number of circuit breakers, which could be provided in unused space for each switchboard line up. Unit price for providing such outgoing circuit breakers shall be quoted which could be considered during placement of order.
- The arrangement of feeders in the switchboard shall take into consideration the number and size of cables required for the feeders.
- Incomer and Bus Coupler ACB shall be limited to one per panel.
- Nameplate or polyester adhesive stickers shall be provided for each equipment (lamps, push buttons, switches, relays, auxiliary contactors, etc.) mounted on the switchboard. Special warning plates one each on each front of a shipping section shall be provided on removable covers of doors giving access to cable terminals and busbars. Special warning labels shall be provided inside the switchboard also, wherever considered necessary. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram.
- Engraved nameplates shall preferably be of 3 ply (Black-White Black) lamicoid sheets or anodized aluminium. Nameplates shall be fastened by screws and not by adhesives.
- ACB feeders for outgoing shall be limited three per panel subject to Director IITM Pune approval on GA diagram.
- SFU feeders for outgoing shall be limited to three per panel.
- The feeders shall be arranged in the ascending order of alphabets followed by ascending order of equipment, e.g. A33801, M3402, and P211.

- Manufacturer shall furnish the general arrangement drawing of switchboard along with the quotation. The General Arrangement drawing of switchboard shall be subject to Director IITM Pune approval.

### **Circuit Breakers**

The circuit breaker shall be triple pole, air break, and draw out type with solid manually detachable type neutral. Unless otherwise stated elsewhere, the circuit breakers shall be draw out type.

The charging mechanism of the circuit breaker shall be manual / motor operated spring charged independent type. The close / trip control switch to be interlocked to trip before close. The closing and tripping circuits shall be self-opening on completion of their respective functions irrespective of the position of the control switch. Manual closing devices shall also be provided.

- The circuit breaker shall be electrically and mechanically trip free.
- For all electrical circuit breakers anti-pumping device shall be incorporated.
- The breaker shall be provided with minimum 6NO + 6NC auxiliary contacts. 20% auxiliary contacts (Min. 3 NO + 3 NC) shall be provided for Director IITM Pune exclusive use. All spare contacts shall be wired upto terminal blocks. Auxiliary contactor or relay shall be used to multiply contacts.
- The auxiliary contact for the shunt trip shall be of advanced nature such that the auxiliary contact close before main contacts.
- The main and secondary isolating contacts of the circuit breaker shall be of self-aligning type.
- The main isolating contact shall have continuous rating equal to the rating of the breaker.
- The secondary isolating contact shall be of wiping contact type.
- The fixed portion of the circuit breaker shall have rail arrangement over which the chassis can move smoothly.
- It shall be possible to bring the circuit breaker to isolated position with the help of external lever without opening the compartment door.



- The breaker shall have 3 distinct positions, such as "SERVICE", "TEST" and "ISOLATED".
- Proper mechanical indication shall be provided to locate these three positions without opening the compartment door.
- It shall be possible to further withdraw the breaker from isolated position for inspection of the circuit breaker "withdrawn" position.
- A stop block shall be provided on the slide rails to prevent the forward movement of the circuit breaker when it reaches the isolated position so that any accidental fall can be avoided. Provision shall be provided to padlock the breaker in all the three positions.
- The following interlocks shall be provided on the circuit breaker:
  1. It shall not be possible to withdraw the circuit breaker from the service position with the contacts of the breaker closed.
  2. It shall not be possible to close the circuit breaker unless any one of the three positions is located, the service position, a definitely located test position, or isolated position.
  3. It shall not be possible to open the compartment door when the circuit breaker is ON.
  4. It shall not be possible to push breaker in if either set of safety shutter is not free and not in its normal closed position.
  5. The circuit breaker can be padlocked in OFF position.
  6. The castle interlocking shall be provided as per the SLD.
- The circuit breaker shall be provided with mechanical ON/OFF, TRIP and SPRING CHARGED indication, mechanical trip push button, operating handle or 'close' push button, in case of electrically operated circuit breaker and padlocking facility wherever specified.
- In case of electrically operated breaker, emergency operating handle shall be provided.
- It shall be possible to close the circuit breaker with the emergency operating handle without opening the compartment door.

- Wherever cutouts are provided for the control box, proper gaskets shall be provided. Provision shall be made for closing the cutout provided for the control boxes when the C.B. is taken out of the compartment.
- The circuit breaker shall be provided with automatic safety shutters, so that before the breaker reaches 'isolated' position the main isolating contacts are completely shrouded.
- The circuit breaker compartment shall be so designed that hot gases produced shall be lead away from the operator.
- The protective relays and instruments shall be mounted as near to the circuit breaker as possible. Separate compartment for the instruments and relays shall be provided.
- When the circuit breaker compartment door is open, it must not be possible to touch the live parts.
- All removable covers protecting live parts shall be clearly labelled with warning notices reading "LIVE PARTS. ISOLATE ELSEWHERE BEFORE REMOVING COVER".
- It shall be possible to readily remove the arc chutes for routine inspection of the contacts with the circuit breaker in the "withdrawn" position.
- All circuit breakers of same rating shall be identical in all respects and shall be interchangeable.
- All the non-conducting metal parts of the circuit breaker trolley shall be bonded together and shall make perfect electrical connection to earth through substantial sliding contacts, at service and test positions. Such sliding contacts shall be arranged to make before power plug in and interrupt after power draw out.

#### **Switches –**

- The switches shall be quick-make, quick-break heavy-duty type.
- The switches shall be able to make and break 300% of the rated current at 0.3 P.F. as required by IS-4047.
- The operating handle shall be mounted on the door of the compartment housing the switches. The switches shall be provided with an interlocking arrangement such that when the switch is ON it shall not be possible to open the compartment door.

- It shall also be ensured that closing of the switch when the compartment door is open shall not be possible.
- To facilitate closing of switch with door open during maintenance / testing, interlock defeat mechanism shall be provided.
- The castell interlock shall be provided, wherever specified in the SLD.
- In case of switch fuse feeders, the switch rating shall be equal or greater than the fuse rating.
- The switch shall be provided with padlocking facility in OFF position.
- All removable covers protecting live parts shall be clearly labelled with warning notices reading "LIVE PARTS. ISOLATE ELSEWHERE BEFORE REMOVING COVER".
- Rating of the switches shall be as given in the SLD.

### **HRC Fuses**

- Fuses provided shall have rupturing capacity greater than the fault level specified.
- Fuses shall be of link type and shall conform to the relevant Indian Standards. They shall be of class 3 AC duty.
- Fuses for motor feeders shall be decided taking into consideration bimetal relay characteristics provided.
- Rating of the fuses shall be as given in the SLD.
- Delayed action fuses shall be preferred for motor feeders.
- Indication shall be provided in the fuses to indicate the fuse has operated. Operating indicator shall be visible without removal of fuses from service. Removal of fuses, however, must be possible, although full voltage may exist at the terminals. Fuses shall be pressure fitted type.
- Fuse handle shall be supplied along with switchboard.

### **Contactors**

The air break contactors shall be of triple pole type. Contactor shall have at least 2NO + 2NC contacts for Director IITM Pune use. The auxiliary contacts shall be wired to the terminals. The contactor coil shall be suitable for control voltage of 230V AC. The coils shall have

grade 'E' insulation and shall be suitable for use in the ambient temperature. The design of the contactor shall ensure easy access to auxiliary contacts and coil. Mechanical ON-OFF indication shall be provided for the contactors. Wherever mechanical indications are not provided, indicating lamps shall be provided for ON indication of the contactor. The contactor shall pick up at 85% of the control voltage and shall not drop out for voltage upto 45%. The control voltage for motor starter circuit shall be 240V, single phase, 50 Hz, unless otherwise specified.

### **Relays**

- The relays shall conform to the requirements of IS-3231 and IS-4483.
- All relays specified shall be flush mounted in dust proof cases and shall match the appearance of the instruments mounted on the same panel.
- Protective relays shall be of the easy withdrawable type. Trip circuits shall be automatically broken and current transformer secondary circuits shorted, when a relay is withdrawn from its case. A marking strip shall be provided in front of each terminal block and a diagram plate at the back of each case to identify connections.
- Relays contacts shall withstand repeated operation and shall make or break the maximum currents in their circuits without deterioration. All spare contacts shall also be wired upto the external terminals.
- Relay coils shall carry their normal currents indefinitely and such currents as can occur under fault conditions. Relay mechanisms shall not be affected by vibration or magnetic fields, which may occur in normal operation.
- All relays in tripping circuits shall have mechanically operated flag indications. Indicators shall be capable of being reset without opening the relay case. It shall not be possible to operate any relay by hand or to alter its setting without opening the case. For relays with combined functions such as inverse time and instantaneous trip, separate indications of each function as specified shall be provided.
- Master tripping relay (Lock-out Relay) shall be of the hand reset type and shall have a reasonable number of spare contacts, both normally open and normally closed, in addition to those required by the protection and tripping scheme.

- Provision shall be made for insertion of test plug at the front for testing and calibration using external source of power without disconnecting permanent wiring. Test plugs shall permit the shorting of any current transformer circuit.
- Relay covers shall be of non-ignitable materials. Relays on which the function of a contact may be changed from NC to NO and vice-versa by simply changing the contact arrangement are preferred.
- All relays pertaining to a feeder shall be accommodated in the same vertical section.

### **Bimetal Relay**

Bimetal relays shall be heavy duty, (wherever mentioned) ambient temperature compensated type. The selection of bimetal relays shall be based on the absorbed horsepower of motor given in the data sheet. Proper co-ordination shall be ensured between bimetal relay and the back-up HRC fuse provided. The bimetal relay shall be of hand reset type preferably with facility to change to self-reset at site, if necessary. The bimetal relay shall be provided with changeover contact for alarm indication. It shall be possible to reset the relay only after opening the compartment door, if so specified. BMRs shall be with built in single phasing protection. Equipment like fans, blowers, etc., shall be provided with suitable saturable CT operated BMR. For saturable CT operated BMR, Single Phasing Protection Relay shall be separate, if specified.

- SINGLE PHASING PREVENTER RELAY (SPPR)
  1. If specified Single Phasing Protections shall be provided in all motor starter modules with contactor rating of 200 Amps and above. The Single Phasing Protection shall be of the current operated type and shall operate on the principle of sensing negative sequence of current.
  2. In case of single phasing, the Single Phasing Protection shall operate after a time delay of 2 to 3 sec. The relay shall be of the hand reset type and visual indication of the relay operation shall be available.
  3. The Single Phasing Protection shall be suitable for protection of the non-reversible and reversible motors.
  4. Current transformer operated Single Phasing Protection Relay shall be provided for feeders, if specified.
  5. Thermal overload relays shall be provided with minimum 1NO + 1NC contacts with a rating of 5 Amps at 240V, 1 phase, 50 Hz AC and 1.3 Amps at 110 V DC (inductive load).

## **Indicating Instruments & Meters**

- All indicating instruments and meters shall be capable of carrying continuously their full load currents and full voltage across their pressure coils. They shall not be damaged by the passage of fault currents or the existence of over pressure on the primary side of their instrument transformers for the maximum permitted duration of fault conditions, which may occur during normal operation. All instruments and meters shall be back connected.
- For incoming feeders, measuring instruments shall be of 96 x 96 mm square pattern, flush mounting type, 72 x 72 mm instruments shall be used for outgoing feeders. Instruments shall be provided wherever indicated in specific requirements. All auxiliary equipment such as shunts, transducers, CTs, VTs that are required shall be included in the supply of the switchboard.
- All AC ammeters, voltmeters, KW meters shall be of moving iron type for AC and permanent magnet type for DC. Accuracy class shall be 1.0 for KW / KWH meters and 1.5 for ammeters and voltmeters as per IS: 1248. The range shall be as indicated in the SLD. Ammeters for motor feeders shall have non-linear compressed scale at the end to indicate motor starting current. Voltmeter shall be suitable for direct line connection.
- KWH meters and KVARH meters shall be of registering type and shall be installed inside unit but readable without opening doors. KWH meters shall be with maximum demand indicator in KVA.
- KW, KWH and power factor meters shall be suitable for 3 phases, 4 wire unbalanced system with voltage coil suitable for 230V AC. The current coils shall also be suitable as given in SLD.
- Instruments shall be mounted above 900 mm but below 2000 mm from the base channel of the switchboard.
- They shall be provided with zero adjusting devices for external operation.
- Indicating instruments and protective relay for respective feeder shall be located either in the same panel or in adjoining panel and shall be grouped together.

## **Current Transformer**

- The Current Transformers shall be Resin cast bar primary / wound primary type. The burden ratio shall be minimum as indicated in Specific Requirements. However, current transformers shall have sufficient capacity to operate with the

burden imposed by the devices shown on drawings with their accuracy classification. Separate cores shall be used for metering and protection

- Current transformers for instruments shall have an accuracy class 1.0 and accuracy limit factor less than 5.0. However, accuracy class 3.0 is acceptable for ammeters only. If a metering load is fed from a protection CT, suitable 1/1 or 5/5 ratio saturable interposing CTs shall be used.
- The current transformers shall be capable to withstand dynamic and thermal stresses originated by the fault current.
- The CTs shall be suitably insulated and the mounting of the CTs shall facilitate easy maintenance.
- The CTs shall be mounted in stationary part of switchgear.
- The secondary of the CTs for metering when wired to terminals, shorting links shall be provided. Shorting links shall be of removable type of Wago make.
- For proper relaying, one side of current transformer secondary shall be grounded in the compartment with the meters or relays, which they serve, and each CT group shall be grounded with a separate identified lead, which may be disconnected for testing.

#### **Potential Transformer**

- The potential transformers wherever provided shall be epoxy cast resin type and shall have class of burden minimum as given in the SLD. However, potential transformers shall have sufficient capacity to operate with the burden imposed by the devices shown on the drawing with their accuracy classification.
- The voltage transformers shall have an accuracy class 3.0 from 50% to 110% of normal voltage and class 1.0 from 80% to 120% of normal voltage with burdens varying between 25% to 100% of the rated value at 0.8 PF lagging.
- The primary of the voltage transformers shall be rated for 415 volts and the secondary for 110 volts.
- The PT shall be provided with HRC fuse on the primary side and secondary side.
- The PT shall be mounted in a separate compartment complete with its accessories.

- For proper relaying, one side of PT secondary shall be grounded at the transformer and the ground connection shall be identified and removable for testing.
- Test terminals shall be provided for PT circuits.

#### **Timer**

- For reacceleration duty, timers unless otherwise stated, shall be pneumatic type and shall have adjustable time setting of 0 - 60 secs. The time settings, where specified shall be accurately set before dispatch of the switchboard.
- Timers for auto-transfer schemes shall be of static type with timing ranges suitable for the scheme employed.

#### **Indicating Lamps**

- Indicating lamps shall be filament type with series resistance. The domes of the fittings shall be heat resistant.
- The lamp shall be suitable for the voltage supply as given in SLD.
- It shall be possible to replace the indicating lamp without opening the compartment door.
- Screwed type lamps are preferred to bayonet cap lamps.

#### **Control Switches**

All circuit breaker operating switches shall be of the pistol grip type, spring return to neutral and lockable in that position.

They shall be arranged to close the breaker by being turned clockwise and to trip it by being turned anti-clockwise. The trip, neutral and close positions shall be clearly indicated. The movement shall be such that the switch cannot be operated inadvertently and that it is mechanically interlocked to trip before close. The operating switch shall be located preferably on the centre line at about 1.5 M from the floor level

#### **Wiring Termination & Ferruling**

All control conductors insulating material shall be of the PVC type.



Control, signaling, protection and metering wiring shall be by PVC insulated, 1.1 KV grade copper conductor wires of minimum 1.5 sq mm section, for CT secondary circuit wires of 2.5 sq mm copper conductor minimum shall be used.

Flexible conductor ends shall be fitted with suitable crimped thimble for efficient termination.

All control wires shall be properly bunched, cleated and supported on panel frames.

Where it is necessary to use a large number of conductors in one run, they shall be divided into two or more cable runs in enclosed channels.

Conductors shall only be carried over or bent around sharp corners or edges where this is unavoidable, in which case a suitable insulating strip shall be fixed to the sharp edge.

Sharp bends shall be avoided.

Conductors carried across a hinged portion of a chassis or door shall be flexible stranded copper conductors and the same shall be soldered crimped at ends before connections are made.

Suitable means of protection against abrasion shall be provided.

Sufficient slack shall be left at conductor ends to allow components to which the conductors are attached to be removed for inspection and servicing.

Conductors passing through holes in chassis or screens shall be fully protected by correctly fitted grommets or bushes.

Control and main wiring shall be kept separate as far as practically possible.

Colour coding for wiring shall be used and shall be indicated on the drawing.

Terminal strips for connecting entering control cables shall be Wago make plug in type of adequate size, shall be located conveniently for easy accessibility, without danger of contact with live part, ease of connection, and shall be separated by barriers from power circuits. At least 10% spare terminals shall be provided in terminal strips. Sufficient terminals shall be provided on each terminal strip to ensure that not more than one outgoing wire is connected per terminal.

The wire shall be identified by numbered ferrules at each end all in accordance with the connection diagram. All ferrules shall be made of non-deteriorating materials. The ferrules shall be universal triangular type so that they cannot move freely on the wire.

### **Glands**

It shall be preferable to have all the glands on the removable bottom gland plate. Gland plate shall be 3 mm thick M.S. sheet. Suitable provision for cable clamping shall be given alley for bringing cables to the respective compartments.

### **Panel Space Heaters**

Wherever specified in specific requirements all switchgear shall be provided with space heaters in each vertical units to prevent condensation and the same shall be equipped with differential thermostat to automatically cut in and cut off the heater, so as to maintain interior temperature 5 DEG C above the ambient and shall also have manual disconnect switch and fuse for protection.

### **Label Details**

Labels of 3-ply laminate shall have black lettering on yellow background provided for following:

Main nameplate for the PCC as per description given in SLD in centre on top side on front of the PCC. Name plates for all incomers and outgoing feeders indicating description, rating, equipment no., feeder no., etc.

1. Nameplates for all door mounted components.
  2. Name plates for panel numbers on front and rear.
  3. Warning labels for interlocks.
- Danger labels shall be provided for interlocks.
    1. Danger labels for the PCC as per statutory regulations.
    2. Danger labels for busbar chamber.
    3. Danger labels for cable alley housing live terminals.
  - All components shall be provided with components identification stickers.
  - Every component shall be provided with label on inside of the door indicating following information.
    - Switch / Breaker Rating
    - Fuse Rating
    - BMR Rating
    - Contactor Rating
    - CT Rating
    - Rating of other major components

All nameplates shall be fastened by means of screws to the panel.

### **Limit of Supply**

The supply of switchgear shall include the switchgear itself complete with all normal components and devices required for full and proper

operation of the equipment even though such components or devices may not be shown in detail on drawings.

Switchgear shall be in working order provided with the following auxiliary components necessary for normal and safe maintenance and operation.

- Special tools - Complete set of special tools shall include all necessary devices for lifting, installing, withdrawing, testing and maintaining the circuit breakers, contactors, fuses, relays and other components of the switchgear.
- 2 Nos. handles for removing fuses shall be delivered with each switchgear.
- 6 Nos. lamp grips for removing and replacing of indicating lamps.
- 1 No. test plug for Relays.

#### **Commissioning and Start Up Supervision**

Commissioning and start-up supervision shall be provided by the manufacturer at site, and charges for the same shall be quoted separately

#### **Switchgear and Equipment Certification**

Manufacturer shall state in its bid whether proposed circuit breakers and switchgears have been tested by an independent recognized testing organization. Copy of such test certificates shall be attached to the bid.

#### **Packing**

The switchboard shall be shipped to site packed in wooden crates. They shall be wrapped in polyethylene sheets before being placed in crates to prevent damage to the finish. Crates shall have skid bottoms for handling.

- The packing cases shall be marked as per the details given in the purchase order.
- Each case shall have the reference to the vendor general arrangement drawing and shall normally indicate the sections of the switchgear.
- The packing cases shall contain one set of all the drawings for easy inspection at site.

#### **Statutory Regulation**

The switchgear shall be manufactured as per the requirements of Indian Electricity Rules. The switchgear shall be acceptable to the local statutory authorities such as Electrical Inspectorate and Fire Insurance Council. The switchgear shall have approval of Tariff Advisory Committee and relevant certificates shall be furnished in six sets for records.

### **Spares**

Manufacturer shall quote for recommended spares for 2 years and for spare fuses

### **Testing**

- a) 415V switchgear shall be tested as per relevant Indian Standards and will include the following:
- b) Visual and dimensional inspection as per general arrangement drawing.
- c) Checking for provision of feeders as per general arrangement drawing.
- d) Checking for provision of components as per bill of material.
- e) Operation test.
- f) IR measurement before and after HV test.
- HV test.

The testing will be witnessed by Client's Engineer. Six copies of Test Certificates shall be furnished to Director IITM Pune for approval before dispatch.

### **Bus Bar**

The busbars shall be of electrical grade aluminium flats / channels adequately sized to carry maximum current of maximum site temperature specified. The final temperature of busbars and connectors at joints between connector and busbar should not exceed 100o C when carrying rated currents. Also the final busbar temperature shall not exceed 250o C when short circuit current for specified duration flows through.

- Busbar size per phase shall be suitable for maximum specified continuous rating at maximum specified site hygroscopic temperature.
- Bimetallic strips covering full joint surface shall be provided wherever copper to aluminium connections are envisaged. Busbar clamps shall be provided to maintain the busbars in position. These clamps shall be made out of fully heat treated magnesium silicate aluminium alloy to IS: 5082. The clamp design shall be such that it holds the busbar firmly and also allow sliding movement of busbars without generating internal stresses to accommodate expansion during operation at rated current. For fixing the busbars to the busbar supports, cadmium plated bolts, nuts and washers shall be employed
- Wherever required for long run of bus duct, expansion joints with flexible strips shall be provided to allow for expansion and contraction due to temperature variations arising out of normal continuous current flow and short circuit current flow for specified duration. Minimum one expansion joint shall be provided for each 3000 mm long straight length of bus duct.

#### **Termination at the End of Bus Duct**

- The bus duct shall be provided with flexibles at both ends for connecting it with transformer at one end and 415V switchgear at other end.
- The flexibles shall be made of thin copper strips. The ends of the flexibles shall be clamped by copper plate. The ends of flexibles shall be tin plated

#### **Earth Bus**

One earth bus of 50 mm x 8 mm aluminium shall run on the external side of the bus duct through the whole length of the bus duct and shall be positively connected to the body of the bus duct. At both ends of the earth bus provision shall be made to connect it to main / earthing system

#### **LT CABLES Construction**

All LT power cables shall be 660/1100V grade, with aluminium conductor for size 70Sq.MM and above. Power cables of sizes up to 50 Sq.mm. shall be with copper conductors  
The cables shall be suitable for laying in trays, trenches, ducts, conduits and underground, buried installation with uncontrolled backfill and possibility of flooding by water. For all cables, cable manufacturer shall provide information on correct voltage drop values when the current is less than the full current rating of the cable

### **1. PVC Cables**

All power / control cables for use on medium voltage systems shall be heavy-duty type, 1100V grade with aluminium / copper conductor, PVC insulated, inner-sheathed, armoured and overall PVC sheathed.

- The construction of the conductors shall be solid for aluminium / copper cables upto 6 sq.mm. For 10 sq.mm and above shall be stranded only. Conductors of nominal area less than 25 sq. mm shall be circular only. Conductors of nominal area 25 sq.mm and above may be circular or shaped.
- The core insulation shall be with PVC compound applied over the conductor by extrusion and shall conform to the requirements of Type 'A' compound of IS: 5831. Control cables having 6 cores and above shall be identified with prominent and indelible Arabic numerals on the outer surface of the insulation
- The inner sheath shall be applied over the laid-up cores by extrusion/wrapping and shall be on PVC / un-vulcanised rubber. If PVC compound is used it shall conform to the requirements of Type ST1 PVC compound of IS: 5831
- For multicore cables, if the armouring is specified, the same shall be by single round galvanised steel wires where the calculated diameter below armouring does not exceed 13 mm and galvanised steel wires / strips where this dimension is greater than 13 mm. Requirement and methods of tests for armour material and uniformity of galvanization shall be as per IS: 3975 and IS: 2633. If armouring is specified for single core cables, the same shall be with hard drawn aluminium round wire of 2.5 mm diameter.
- The outer sheath for the cables shall be applied by extrusion and shall be of PVC compound conforming to the requirements of type ST1 compound of IS: 5831. To protect the cables against rodent and termite attack, suitable chemicals shall be added into the PVC compound of the outer sheath.

2.

### **XLPE Cables**

- Power cables shall be with Aluminium / Copper Conductor, XLPE insulated, armoured and overall PVC sheathed. All cables rated above 3.3 KV shall be provided with both conductor screening and insulation screening. The conductors shall be provided with non-metallic extruded semi conducting shielding. The insulation screening shall consist of non-metallic extruded semi-conducting compound in combination with a non-magnetic metallic screening of copper. The insulation screen shall be strippable without application of heat. The copper screen shall be capable of carrying the single line to ground fault current for duration of 1 second. For cables rated above

3.3 KV the conductor screen, XLPE insulation and insulation screen shall all be extruded in one operation by Triple Extrusion process to ensure perfect bonding between the layers. The core identification shall be coloured strips or by printed numerals.

- The construction of the conductors shall be stranded and compacted circular for all cables.
- The core insulation shall be with cross-linked polyethylene unfilled insulating compound. It shall be free from voids and shall withstand all mechanical and thermal stresses under steady state and transient operating conditions
- The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of Type ST 2 compound of IS: 5831.
- For multicore cables, the armouring shall be by galvanised steel wires / strips. If armouring is specified for single core cables the same shall be with hard drawn aluminium round wire of 2.5 mm diameter.
- The outer sheath for the cables shall be supplied by extrusion over the armouring and shall be of PVC compound conforming to the requirements of Type ST 2 compound of IS: 5831. To protect the cable against rodent and termite attack, suitable chemicals shall be added into the PVC compound of the outer sheath.

### **Standards**

The Cables shall conform to the requirements of the following, but not limited, to latest revision of relevant Indian Standards or equivalent British or any other International Standard Specification.

IS: 1554 - PVC insulated (heavy duty) electric (Part I) Cables - Part I for working voltages up to and including 1100V.

IS: 1753 - Aluminium conductors for insulated cables.

IS: 3961 - Recommended current ratings for (Part II) cables: Part-II PVC insulated and PVC sheathed heavy-duty cables.

IS: 3975 - Mild steel wires, formed wires and tapes for armoring of cables.

IS: 5831 - PVC insulation and sheath of electrical cables.

IS: 7098 - Cross-linked Polyethylene insulated (Part-II) PVC sheathed cables: Part-II for working voltages from 3.3 KV upto & including 33 KV.

IS: 8130 - Conductors for insulated electric cables and flexible cords.

IS: 9968 - Elastomer - insulated cables, for (Part I) working voltage upto and including 1100V.

### **Testing & Inspection**

All the cables shall be tested and examined at the manufacturer's works. All the materials employed in the manufacture of the cables shall be subjected, both before and after manufacture of the cable, to examination, and testing by vendor.

All routine and acceptance tests in accordance with the relevant standards shall be conducted in presence of the Client.

Vendor shall furnish Test Certificates for all cables before dispatch for approval.

Vendor to confirm the availability of facilities at their works for the following tests and the standards to which they will conform to.

Accelerated water absorption test for insulation.

- Dielectric retention test.
- Oxygen index test.
- Test for rodent and termite repulsion property.

### **Packing & Forwarding**

1. The cables shall be supplied duly wound on non-returnable wooden drums. The drums shall be fully sealed to protect the cable from mechanical damage during transit. The wood used for construction of the drum shall be properly seasoned and free from defects. Wood preservatives shall be applied to the entire drum.
2. All cables shall be supplied in one length. If cable length exceeds standard drum length then the balance quantity shall be supplied in one length. If required by the Client, the vendor shall supply the cable in lengths as specified / informed to vendor during delivery.
3. On flange of the drum necessary information such as manufacturer's name, type / size / voltage grade and length of cable, drum No, year of manufacture shall be printed. An arrow shall be printed on the rim of the flange to show the direction of rotation of the drum.
4. Cables shall be supplied in drum lengths as follows:  
Medium voltage power cables upto and including 6 sq.mm. - 1000 M.  
Medium Voltage power cables from 10 sq.mm. Upto and including 300 sq.mm - 500 M.  
A tolerance of plus 5% shall be permissible for each drum.
5. The length of cable on each drum shall be determined by the manufacturer considering the transport limitations from manufacturer's works to the site.

### **Laying of Cables**

Transporting the cables from stores to place of installation. The drums under the custody of the contractor shall be neatly arranged in the yard near his site office. The drum shall not be rolled for transportation more than 10m Truck / Trailer shall be used for transportation for distance more than 10m.



- The cables shall be rolled out for equipment and cutting shall be as per site requirement. Cable jacks and cable rollers shall be used during laying of cable.
- Electrical Contractor shall cut all cable length by actual measurement at site as per final route determined. Cable lengths indicated in Cable Schedules shall be used only to get an idea of length involved.
- The cables shall be tested for insulation value before laying. Drum Schedule to be prepared by contractor.
- The Cables shall be laid in trenches, trays, along walls or structural support as per the requirement. The cables shall be neatly laid and clamped. The crossing of cables shall be avoided. The arrangement of cables on the tray / trench shall be decided based on the cable schedule and layout drawings and shall be approved by the CONSULTANT/Client.
- Clamping of cable shall be done by 18 SWG thick aluminium clamps at an interval of 0.5 mtr. for vertical run and 1 mtr. for horizontal run. When cables are cleated on wall / structures, the spacer and saddle shall be used at 300 mm interval or less depending on the location and shall be approved by CONSULTANT/Client.
- The cable terminations shall be done as per standard practice and crimping type of terminations shall be considered.
- The glanding shall be done with suitable arrangement for earthing the gland. Wires / sleeves required for effectively earthing the glands shall be included in the termination materials.
- The unused cores of the multicore cables shall be properly taped.
- The tag carrying the cable number shall be at interval of 20 mtr for underground cable and 30 mtr for above ground cable and at all bends and route changes of the cable run. Material of tag will be aluminium for above ground cables and of lead for buried cables. Sample of tags shall be approved by CONSULTANT/Client.
- The cable numbers shall be painted near the terminal blocks in MCC / Distribution Boards / Switchboards.

- For main power cables loops shall be provided near terminations.
- All cables coming from floor / trench shall be taken through a G.I. Pipe. The length of the pipe shall be decided by the contractor and approved by the CONSULTANT/Client.
- The glands supplied by the contractor shall be suitable for cable sizes mentioned and if necessary reducers shall be provided by the contractor. The contractor shall indicate the requirement of reducers and supply the same after approval of rates by Director IITM Pune.
- The contractor shall supply and install the ferrules for multicore cable connections. The ferrule markings shall be identical to the wires connected to the terminals.
- The Lugs used shall be tinned Copper for Copper Cable and Aluminium Lugs for Aluminium Cable, crimping type of reputed make. The Lugs used for multistrand control cable shall be PVC sleeved crimping type copper lugs.
- The connections between the junction boxes/control panels to components like pressure switches, limit switches shall be through flexible conduits. The length of each of the flexible conduit shall not exceed 120 cm.
- The cables coming from switchboards to the cable tray shall be taken through branch trays and the cables shall be clamped neatly. The arrangement shall be approved by CONSULTANT/Client.
- Main cable runs are to be routed as shown on the contract drawings. Any modifications found necessary due to site conditions must be approved by CONSULTANT. Details of routes not shown on these drawings are to be determined on site by discussion with CONSULTANT/Client.
- PVC insulated and / or served cables shall not run parallel within 100 mm of, or be installed above and in line with, any heated pipes or duct. Where crossing above heated pipes or ducts is unavoidable the cable must be kept at least 150 mm from the outer surface of such pipes or ducts or the insulation thereof.
- On main horizontal cable runs where cables are supported, suitable mild steel saddles, cleats or clips shall be used. Between these fixing points cables shall be laid neatly in position on the intervening racks. On vertical cable runs and horizontal runs other than the main horizontal runs, cables shall be fixed at one meter intervals. Where different sized

cables are together the maximum fixing intervals are to be those required for the smallest cable, unless the smaller cables are bunched with larger cables and supported by them throughout the complete multi-cable run.

**NOTE:** Where the contract drawings indicate that the cables are to be run or fixed other than in accordance with this specification, the drawings shall be deemed to be correct.

- Cable run in RCC trenches are to be run on the floor along the sides on suitable brackets and located 75 mm minimum from floor of trench. Cable ducts in the ground shall be sealed against the ingress of water, foreign matter and vermin, at both ends by means of non-setting compound and / or suitable wood plugs fitted over the cable and into the duct. Where ducts are not in use they shall be sealed in a similar manner.
- Cables laid direct in the ground shall be laid on a bedding of 150 mm of sand and covered by 150 mm layer of sand, on top of sand tiles / bricks covering to be done. The depth of laying shall be such as to provide 750 mm minimum cover for low voltage cables and 1000 mm cover for high voltage cables.
- All non used open entries in equipment and open ends of conduit are to be sealed by means of conduit plugs (or blanking plates if entries are not of standard conduit sizes) at all time.

**NOTE:** This is particularly important where equipment is located in position, but electrical installation is incomplete.

Where cables pass through floors, they shall be protected by metal / PVC pipes or other suitable means. Holes in floors, walls, etc. will be made and reinstalled by the contractor unless otherwise stated.

- All cables laid underground shall be protected with good quality brick and interlocked concrete tiles marked "Electric" or "Telephone" cables.
- Cable joints shall be mechanically and electrically sound and except for buried cables they shall be accessible for inspection. Underground joints shall be specially protected with a double layer of bricks and cast iron joint markers (marked 'Cable-Joint'), shall be installed to indicate the position of the joint.
- Where corrosion of armour or gland might occur, it shall be effectively protected by suitable means

- The contractor shall test all cables for proper insulation before they are transported for laying and shall furnish a certificate of acceptance to this effect. Any damage to the cable subsequently shall be made good by the contractor at his own cost. After the test of insulation, the cut ends of cables shall be sealed properly with waterproof material to prevent ingress of moisture.
- Cable Marking  
**All Cables shall be externally marked at either end with the respective identification numbers by means of non-deteriorating material. Cable Markers shall be approved by CONSULTANT/Client.**  
Where conductors are left to be terminated by another party or left to be connected later, they must be individually identified

## **CABLE GLANDS**

- When preparing cables prior to fitting glands, the gland manufacturer's instruction for cable preparation shall be observed. In all cases where armoured cables are used care shall be taken to ensure that the lay of the armour is maintained after the gland is completely fitted.
- Where compound boxes are used for terminating cables, the compound must penetrate fully and leave no air holes. Where hot pouring of compound is employed, 'topping up' must be carried out as soon as possible after the first filling. The pouring temperature of the compound must not be high enough to damage the cable insulation.
- All terminations of paper insulated cable shall incorporate damp barriers in each conductor. The insulation shall be removed to leave approximately 15 mm to 20 mm of the conductor exposed, and the conductor shall be soldered at this point.
- The preferred method of terminating conductors is by means of solder less compressed connectors. Deviations from the above shall be subject to approval of CONSULTANT/Client
- Connectors shall be of the correct size for the conductor concerned and as manufactured by Dowels or approved equivalent
- All connectors shall be marked with the size reference for identification with the correct compression tool. This

reference shall be located on the palm of the connector and shall be remote from the contact faces where possible.

- The palm of the connector shall be of such shape and size that standard washers to relevant IS applicable to the size of stud for which the connector is designed shall lie flat on both faces of the connector palm when the holes in the washers and the palm are co-incident.
- Compression tools shall be designed and supplied for specific use with the connectors used, and shall be regularly serviced by the maker.

### **DISTRIBUTION BOARDS (Wall Mounted)**

The Board shall be installed on column / structure, as required with necessary frame work at an approximate elevation of 1200 mm from finished floor level.

Balance activity, same as mentioned

### **LIGHTING SYSTEM**

The lighting fixtures in the open areas shall be fed from lighting panel and controlled from local switch. Lighting wiring between JB and lighting fixtures shall be done by PVC insulated 3-core (phase neutral and earth) unarmored cable. Lighting fittings in building shall be fed from lighting panels. Wiring in the building shall be done by means of 3-core Copper Conductor PVC insulated or copper conductor wires in conduit of 1' size / metsec channel, as specified. All joints of conductors in Switch boards / JB's / Fittings shall be made only by means of approved Mechanical connectors (nylon / PVC connectors). Bare or twist joints are not permitted anywhere in the wiring system. Cost towards mechanical connectors is deemed to have been included in wiring.

Methods, type, size, etc. mentioned in the BOQ shall supersede the above requirements.

Socket outlets in production areas shall be approximately 1200 mm above finished grade and 300 mm above FFL in office area. Lighting and power panel shall be mounted such that top of the panel is not more than 2000 mm above finished grade.

Fixtures shall be firmly supported from the structures, support clamps, etc. They may be bolted or welded to the steel work or metal inserts. In case of concrete structures, where metal inserts are not available, fixtures will be fixed to or supported

from concrete surfaces with the help of anchor fastener. In such cases special care shall be taken to see that anchoring is firm.

The lighting layouts furnished by Director IITM Pune shall indicate approximate locations of lighting fixtures. The electrical contractor shall determine, with approval of the Engineer-in-Charge or his authorized representative, the exact locations of each fixture in order to avoid interference with mechanical equipment or any structure and also with a view to obtain as uniform illumination as practicable, and to avoid objectionable shadows. Conduit / cable run shown on drawing are only indicative. These shall be laid out by the contractor to suit field conditions as per directions of the Engineer-in-Charge.

All hardware shall be galvanized or zinc passivated. Circuit cable shall be group cleated to structure by using galvanized strip clamps or run in cable trays wherever they are available. Spacers and cleats shall be of suitable size to accommodate the cables and shall be approved by Engineer-in-Charge before fixing at site. For isolated structures lighting cable may be taken in underground G.I. Pipes. G.I. Saddle to be used will be 22 gauge thick ribbed types and GI Spacer will be of 3 mm thick made out of 25 x 3 mm M.S. Flat.

Main runs of wiring from lighting panels and tapings to individual fixtures shall be in sizes specified on the SLD. Wiring for all outlet sockets shall be done with 3 cores of equal sizes for phase, neutral, & earth.

The cost for cable clamps, metal spacers, anchor bolts, etc. shall be deemed to have been included in the installation of cables

Contractor shall keep a close watch on the lighting MTO sheets issued to him. Any discrepancy noticed between the figure given in MTO and the actual requirement at site, shall be immediately brought to the notice of Engineer-in-Charge by the Contractor.

All fluorescent fixtures shall be with high power factor, low harmonic (THD < 10%), warm start electronic ballast. All other Ballasts shall be low loss Cu. Ballasts.

Fluorescent lamps unless otherwise specified shall be tri-phosphor colour 86 (cool day light).

CFL lamps shall be "Bright white" unless otherwise specified.

MID / High bay fixtures and streetlights shall be integral and floodlights shall be non-integral unless otherwise specified.

All housings shall be cast aluminum only. Sheet metal housing is not acceptable for outdoors luminaries. All outdoor luminaries shall be rated at IP 65.

Fixtures construction shall be suitable for maintenance from bottom unless otherwise specified and shall be screw less press fit as far as possible. Lamp replacement shall be possible without removing fixtures.

Tie arrangement shall be provided for covers, louvers etc which need to be removed for lamp / ballast replacement.

## **CONDUIT SYSTEM**

Surface or concealed conduit system of wiring shall be adopted as specified in the drawings. Suitable pull boxes or inspection type fittings will be used to facilitate drawing of wires. Conduit wiring shall be as per IS-732. Wherever specified, conduits and conduit accessories shall be galvanized and shall conform to IS-2667, 1988.

Only threaded type conduit fitting shall be used. Pin Grip type clamp type fittings are not acceptable. Conduit ends shall be free from sharp edges or burrs. The ends of all conduits shall be reamed and neatly bushed with Bakelite bushings.

In order to minimize condensation of sweating inside the conduit system, all outlets shall be properly drained and ventilated in such manner so as to prevent entry of insects.

The outer surface of the conduit pipes, including all accessories forming part of the conduit system shall be adequately protected against rust, particularly when such system is exposed to weather. In all cases bare threaded portion of conduit pipe shall not be allowed unless such bare threaded portion is treated with anti-corrosive preservative or covered with approved plastic compound.

Conduit connection to outlet boxes shall be by means of screwed hubs or check nuts on either side.

Conduit pipes shall be fixed by 22 gauge ribbed G.I. saddles on 25 x 3 mm G.I. saddle bars in an approved manner at intervals of not more than 50 cms. Saddle shall be fixed on either side of couplers, bends or similar fittings, at a distance of 30 mm from the centre of such fittings. The cost of saddle bars, saddles, clamps, etc. shall be deemed to have been included in the installation of conduits.

Where concealed wiring is to be adopted, conduits shall be laid in time before concreting of the slab. The contractor shall co-

ordinate his work with other agencies involved in the civil works in such a way, that the work of these other agencies is not hampered or delayed because of any section on his part. Vertical conduit runs shall be made either through columns or chases prepared in the walls. Contractor shall fill these chases or any other openings made by him after completing the work and neatly finish the surface. During installation, care shall be taken to see that adequate covers are provided to prevent rusting of conduits.

If required, conduit runs may be concealed in the floor for low level receptacles and exhaust fans. As built conduit layout drawing shall be submitted by contractor.

Wiring for exhaust fans shall be terminated in ceiling roses / receptacles and the connection from ceiling rose / receptacles to the exhaust fan shall be by means of a flexible cord equivalent in size to the main run of wires.

Maximum permissible number of wires that can be passed through a conduit of particular size shall be as per Table indicated below.

After erection, the entire conduit systems shall be tested throughout for mechanical and electrical continuity and shall be permanently connected to earth by means of approved type earthing clamps, in accordance with Indian Electricity Rules.

Installation is inclusive of supply and fixing of all accessories like:

Elbows, grommeters, bends, T-offs, etc.

2" Deep 65 mm dia round conduit junction box (18 SWG) with acrylic cover and 30A rated completely shrouded PVC connectors in JB. The terminals shall be kept loose in Junction Box for easy maintenance and connection.

## **CABLE TRAYS**

All cable Trays upto 300mm shall be perforated type & above 300mm ladder type trays shall be used.

The Trays shall be pre-fabricated hot-dipped galvanized. Cold galvanizing at site is acceptable only for touch-ups.

The Trays shall have suitable provision for clamping at an interval of 500 mm.

The Earthing Strip for the earthing ring shall be run along the side of the Tray.



The connection between individual equipment to the ring shall be by bracing or with lugs.

The bending of trays shall be smooth and the curvature sufficient for each bending of cables in it. Pre-fabricated accessories such as Tees, bends, risers, couplers, reducers, etc. shall be used at all junction & branches. Cutting & welding of trays at site is not permissible. Similarly, the trays shall not be welded on the supports but bolted only.

Electrical Cable Tray routing shall be co-ordinated by Electrical Contractor at site to check fouling with pipes, equipment, light fittings, HVAC, etc. before fixing the trays.

## **EARTHING**

All Electrical Equipment must be efficiently double earthed in accordance with the requirement of IS-3043/IEEE 80 and relevant regulations of Electric Supply Authority.

The earth pits shall be as per IS with proper arrangement for testing.

All earthing conductors shall be hot dip galvanized / electrolytic grade base copper conductor. The main earthing rings shall be done as per practice laid in Indian Standard.

The earthing of individual electrical equipment by two distinct strips/conductors shall be done as per practice laid in Indian Standard.

The sizes and material of conductors for earthing various equipment shall be as per relevant Earthing Drawing / General Notes for Earthing and Earthing Schedule.

All electrical equipment shall be connected to the earth bus at two points except the lighting fittings and junction boxes.

Following earthing resistances shall be measured and recorded in the presence of CONSULTANT/Client during the dry season.

Resistance of each earth electrode with electrode isolated from the system.

Combined earth resistance of the installation measured at the substation, switch room and any other point as directed by the CONSULTANT/Client.

The method of testing shall be as per Clause No. 10.1 and 10.2 of IS-3043. The contractor shall prepare the test report on standard Format. The effective earth resistance of the system shall be  $< 1\Omega$ .

All hardware for bolted joints shall be galvanized and the size of the bolt shall not be more than quarter of the size of earth conductor.

Tinned copper lugs shall be provided where round earthing conductors are used.

The 415V neutral shall be solidly earthed by means of two separate and distinct connections to earth. Each connection shall be connected to an independent earth pit near the transformer. The earth pits shall be interconnected between themselves and the main earthing grid to form an earthing ring. The neutral earthing leads shall be kept away from the transformer tank.

All joints in the main earthing conductors shall be welded.

Terminal joints on the equipment shall be bolted.

The earthing conductors running underground shall be laid approximately 500 mm / 600 mm below the grade level.

Removable test links shall be provided near the earth pits to facilitate testing of earth pits.

Where the earthing terminal diameter provided on equipment is larger than quarter of the size of the earth conductor, connection shall be made using a wider flag welded to the conductor.

The quality of galvanizing shall be subject to test in the presence of CONSULTANT/Client.

Unless otherwise approved by Director IITM Pune/ Consultant, all equipment (Rotary/ Static) shall be earthed at two points.

The equipment to be earthed shall be connected to a common earth grid of power system.

The pipes shall be earthed, if resistance of earth exceeds  $10^6$  ohms.

For equipment earthing, suitable GI bolts with spring and plain washers to suit the thread of earth boss of equipment, etc. shall be provided by Electrical Contractor.

### **Materials for Earthing**

The Sizes and Material of Conductors for earthing various Equipment shall be as per relevant Earthing Drawing / General

Notes for Earthing and Earthing Schedule prepared for particular Project.

### **Earth Pits**

The number of earth pits will depend upon soil resistivity and the voltage of the system. The location of the earth pit will be as shown in the drawing. The earth pit together with the electrode shall be constructed as per IS-3043-1987. The minimum distance between two earth pits shall not be less than twice the length of the electrode. A bolted assembly link shall be provided in the connection between earth electrode and the main earth conductor. GI pipe for watering shall be included in the rate of earth pit.

### **Earth Bus and Earth Wires**

The earth wire may be of solid bars or flats or stranded. Sufficient care should be taken to prevent corrosion and mechanical damage. Interconnections of earth continuity conductors and main and branch earth wires shall be made in one of the following manners:

Riveted connection

- a) Welded connection (mainly applicable in the case of M.S.)
- b) Brazed connection (for copper)
- c) Bolted connection

Framework and other non-current carrying metal work associated with each system e.g. transformer, tanks, switchgear frame work, etc. shall be earthed. Extraneous metal framework not associated with the power system e.g. boundary fence, steel structure, sheaths of communication cables, etc. will have to be earthed.

Each incoming and outgoing cable shall be bonded to the switchboard earth so that the armour and sheathing with feeders and interconnection shall form an earth system. The complete earthing system inside a substation shall be given a coat of black asphaltic varnish, if insisted by CONSULTANT/Client.

**Following also shall be earthed:-**

- **Metallic noncurrent carrying parts of all electrical equipments such as transformer, switchgear, panels, power sockets, lighting fixtures., shall be earthed at one point for and up to 230V and at two points for working voltage of 415 Volts.**
  - **Steel structures / columns**
- **Cable trays, spheres, vessels and other process equipment.**
  - **Fence and gate of electrical equipment (of transformer yard)**
    - **Cable shields and Armour.**
- **Street light poles near to main earth grid shall be earthed by tapping from main earth grid. For remote located street light pole, individual earth electrodes shall be constructed.**
- **Earth strips from Lightning arrester shall be laid and connected to Earth stations directly. Strips shall be of specified size. These shall be connected with plant main grid, whenever specified only below ground.**
- **Equi-potential jumpers for any or all of the above equipment joints / sections intended for earthing.**

#### **Artificial Treatment of Soil**

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, calcium chloride sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions.

#### **Earth Resistance**

Earth resistance of main bus and in turn at connections to equipments shall be less than 1 ohm.

For further Details please refer BOQ. Sizes mentioned in the layout drawing shall supersede the above.

#### **Capacitor**

The capacitor units shall be inspected and insulation value shall be checked and recorded

The aluminium link connections shall be checked and tightened.

The units shall be installed on framework near switchgear.

Before energizing the Capacitors, it shall be ensured by Contractor that Discharge Resistor is fitted across the Capacitor

The units shall be earthed with two distinctive earth strips.

## **UPS**

This shall conform to the requirements of the following but not limited to, latest revision of all relevant Indian Standards or International Standards.

- (a) IS: 3700 : Essential ratings and characteristics of semi-conductor devices.
- (b) IS: 3715 : Letter symbols for semi-conductor devices.
- (c) IS: 4411 : Code of designation of semi-conductor devices.
- (d) IS: 5001 : Guide for preparation of drawings for semi-conductor devices.
- (e) IS: 5469 : Code of practice for the use of semi-conductor junction devices.

## **DESCRIPTION & SYSTEM OPERATION**

- The UPS shall consist of Rectifier / Charger, Battery, Inverter, Static Transfer Switch, Maintenance Bypass Switch, Synchronizing Equipment, Protective Device and other Accessories. An Isolation Transformer shall be provided on input side.
- The UPS shall provide continuous electric power within specified tolerance, without interruption, to the critical loads.
- Normally electric energy from normal plant power source shall be supplied to UPS System.
- The solid-state rectifier / charger shall convert incoming AC power to DC power. The rectifier / charger output shall be fed to solid-state inverter. The inverter shall convert the DC power into AC power, which shall supply the load. Upon failure of AC power, input power for inverter shall automatically be supplied from the battery with no interruption / disturbance in inverter output in excess of limits specified herein (in these specifications). At the same time, UPS shall energize an alarm circuit.
- The duration for which Battery shall supply A/C power to O/P shall be minimum 30 minutes.
- When A/C power is restored, the input power for the inverter and for recharging the battery shall automatically be supplied from rectifier / charger output without interruption/ disturbance in inverter output in excess of limits specified herein (in these specifications).

- If the battery is exhausted before A/C power is restored, the UPS shall shut down automatically.
- The solid-state circuitry used for both Rectifier & Inverter shall be IGBT technology.
- Intelligent RS-232 Communication shall be possible which will Provide UPS status indications, electrical parameters such as Input & Output Voltage, Load levels etc and unattended shutdown.
- User-friendly LCD Display to indicate all important UPS parameters such as Input Voltage, Output Voltage, Battery Level and Load Level shall be provided.
- The UPS Module Cabinet shall consist of a rectifier / charger, a three-phase inverter, static transfer switch, maintenance bypass switch, and associated transformers, logic, synchronizing equipment, protective devices, and accessories as required for proper operation.
- The rectifier / charger unit shall be solid state and shall provide direct current to the inverter unit and for battery charging.
- A dry type power transformer shall be used for the rectifier unit if specified in the attached SLD.
- It shall be copper wiring exclusively and have one 5% tap below rated voltage. The transformer's hottest spot winding temperature shall not exceed the temperature limit of the transformer insulation class of material when operating full load at maximum ambient temperature of the transformer location within the rectifier / charger unit.
- An input AC filter shall be incorporated into the rectifier / charger unit. The filter is not to be add-on in front of the rectifier / charger. This filter is to reduce the current harmonics feedback into the input AC line to no more than 10%. The filter is to also improve the input power factor so that it is no more lagging than 0.95.
- The rectifier / charger unit shall provide for input current limiting whereby the maximum input current shall be limited to 125% of the full input current rating. This current limit shall be in effect, no matter whether the load is connected to the UPS module or the static transfer switch. That is, if the static transfer switch is supplying full rated load, then the rectifier / charger must limit the battery recharging to 25%.

- Furthermore, if the load is connected to the maintenance bypass line, the rectifier / charger input current must automatically reduce to 25%.
- The rectifier / charger unit shall provide features whereby when the AC power is returned after the UPS has been operating on battery power or has been de-energized, the total initial power requirement at the input terminals will not exceed 20% of rated load, and the power will gradually increase to 100% of full rating over the 15 second time interval. The unit shall be provided with an internal switch so that walk-in time can be changed from 2 seconds to 15 seconds.
- IGBTs in the rectifier / charger shall be fused with fast acting fuses, so that loss of any one power semiconductor will not cause cascading failures. All fuses shall be provided with a blown fuse indicator with an alarm indicator on the control panel.
- The rectifier / charger unit shall have an output filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 2% RMS. The filter shall be adequate to insure that the DC output of the rectifier/ charger will meet the input requirements of the inverter.
- The rectifier unit shall be designed to boost charge the completely discharged batteries in 10 to 14 hours. The changeover between boost charger mode and float charge mode shall be affected manually. Necessary alarms to indicate battery discharged and D.C. over voltage conditions shall be provided. Selector switch shall be provided for selecting the float charge or boost charge mode.
- There shall be DC overvoltage protection so that if the DC voltage rises to the pre-set limit, the UPS module is to shut down automatically and the load is to be transferred to the static bypass line uninterrupted.
- To prevent battery damage from over-discharging at light load, the rectifier / charger is to automatically raise the shutdown voltage set point as the load is reduced. The shutdown set point is to increase linearly from minimum to 1.75 volts per cell as the discharge time increases from 15 minutes to one hour.

#### **Inverter Unit**

- Advanced PWM Inverter with Precision Control Circuitry using High Performance IGBT Power Stage. The output

shall be Pure Sine-wave output with less than 3% THD. Exceptional reliability, superior performance, Quite operation with very high reliability and efficiency shall be the key characteristics

- The inverter unit shall be a solid state device capable of accepting the output of the rectifier / charger or the unregulated voltage of the battery and provide regulated rated AC output within specified limits.
- The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall be temperature compensated and be adjustable  $\pm 5\%$  of rated frequency. The oscillator shall hold the inverter output frequency to  $\pm 0.1\%$  for both steady state and transient conditions. Drift shall not exceed  $\pm 0.1\%$  during a 24 hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed  $\pm 0.1\%$  from the rated frequency.
- The inverter output shall stay synchronized with the static bypass line provided the static bypass line remains within  $\pm 3$  Hz of the nominal frequency. If the line frequency goes outside these limits, the inverter is to break sync with the line and run on its internal frequency. When the line frequency returns, within limits, the inverter output is to automatically re-synchronize with the line. The rate of change of frequency is not to exceed 0.1 Hz per second. The unit shall be provided with an internal switch so that the synchronizing frequency range can be changed from  $\pm 3$  Hz to  $\pm 1$  Hz or to  $\pm 0.5$  Hz.
- The inverter shall be able to sustain an overload across its output terminals up to 150% load, while supplying any load within its rating, without reducing the output voltage. Loads greater than 150% shall be transferred to the static bypass line.
- The inverter, with the static bypass line disabled, shall current limit at 150% rated current at reduced voltage for any loading over 150% rated load. The inverter shall be capable of at least 300% current for short circuit conditions. If the short circuit is sustained, the inverter shall shut down and disconnect automatically from the critical load bus.
- The inverter unit shall be designed to operate from the rectifier output without use of battery smoothing effect. With the battery connected to the UPS system, a filter shall be provided at the input of inverter unit to reduce the



A.C. Feedback from the inverter to the battery to a maximum of 2% of the battery AH capacity.

- The inverter unit shall be designed to operate with 93V to 145V DC or 186V to 290V DC at the terminals of inverter input filter. The output inverter voltage shall be stabilized to within +2% of the nominal output voltage with a load variation of 0 - 100% at 0.6 power factor (lagging).
- During step loading of 100%. The system voltage dip shall not exceed 15% and output voltage shall recover to within + 3% of the nominal output voltage within 10 cycles (200 m sec.)
- The inverter voltage regulator is to regulate each phase so that an unbalance loading will not cause the output voltage to go outside the specified voltage unbalance or phase displacement.
- An output AC filter shall be incorporated in the inverter unit. The filter shall reduce the inverter output voltage harmonics to 5% RMS total and single harmonics to 3% RMS for linear loads.
- Power semi-conductors in the inverter unit shall be fused with fast acting fuses, so that loss of any one power semiconductor will not cause cascading failures. All fuses shall be provided with a blown fuse indicator with an alarm indicator on the control panel.

### **Static Transfer Switch**

- The Static Transfer Switch, using solid state devices, shall be provided to transfer the load between the UPS module and the static bypass line uninterrupted. Automatic static load transfers are to be initiated when a system overload is greater than specified here, a branch load circuit faults or a fault within the UPS module occurs.
- If the static transfer was caused by an overload or branch fault and this condition was rectified, then the static transfer switch is to automatically re-transfer the load to the UPS module.
- The static transfer switch shall be sized to provide 125% rated load continuously. The switch shall also have an overload rating of 2000% rated load for two cycles.
- Any time the load is on the static bypass line, the control panel shall indicate so. The audible alarm is to sound only after a ten-second delay. If the transfer was due to a

momentary overload and automatically re-transferred back to the UPS module after the overload was removed, the alarm and indicator are to automatically reset.

### **Maintenance by Pass Switch**

- A manually operated maintenance bypass switch is to be incorporated into the UPS module cabinet that will connect the load to the input AC power source bypassing the rectifier / charger, inverter, and static transfer switch.
- All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation.
- While the load is on the maintenance bypass line, it shall be possible to check out the operation of the rectifier / charger, inverter, and static transfer switch. It shall also be possible to check the battery operation.

### **Battery**

A Battery system shall be furnished for the UPS with sufficient capacity to maintain UPS output at the specified load for a duration of minimum 30 minutes. The type of battery shall Maintenance-free, Valve-regulated type. A minimum of 10 years warranty for performance of declared parameters within permissible limits shall be provided.

### **Cabinet**

All the cells making up the Battery shall be installed in a free-standing cabinet, that is, of the same constructions as the UPS module cabinet. The cabinets shall be of the same height and depth.

Each cell is to be held in place to prevent movement during seismic motion. Connectors are to be used so that the battery can be disconnected in no more than 42 volt sections.

### **Battery Disconnect Circuit Breaker**

The UPS Module shall have a Battery Circuit Breaker. This circuit breaker is to be mounted in the battery cabinet. When open, there shall be no battery voltage present in the UPS module cabinet. The UPS module shall be automatically disconnected when the battery reaches the minimum discharge voltage level or when signaled by other control functions.

### **MIMIC Panel**

The Mimic Panel is to depict a single line diagram of the UPS. Indicating Lights shall be integrated with the single line diagram to illustrate the status of the UPS power paths. The functions whose status is to be displayed shall include, but not be limited to, the following:

- a) Input power available
- b) Output power available
- c) Normal operation
- d) Bypass operation

### **INSTRUMENT INDICATION & ANNUNCIATION**

Following Instruments shall be provided on the system

#### **Charger Panel**

- a) AC Line Voltage (with a selector switch)
- b) AC Line Current (with a selector switch)
- c) Charger Output Voltage (each)
- d) Charger Output Current
- e) Battery Current (charging / discharging current)

#### **Inverter Panel**

- a) DC Input Current
- b) Standby Transformer Secondary Voltage
- c) UPS Output Voltage
- d) UPS Current
- e) Power Factor Meter
- f) Frequency Meter

Following indications lamps shall be provided.

#### **Charger Panel**

- a) AC mains ON (3 Lamps)
- b) Battery on Float
- c) Battery on Boost

#### **Inverter Panel**

- a) Battery Output ON
- b) Inverter - I Feeding
- c) Inverter - II Feeding (Only for redundant system)
- d) Standby Supply ON
- e) Load on Bypass
- f) Mains Synchronized

**Audio-Visual Alarm shall be provided for the following complete with 'ACCEPT', 'RESET' and 'TEST' facilities.**

**Charger Panel**

- a) Mains Under voltage / Single Phasing
- b) Charger Failure / SCR Fuse Failure
- c) Reverse Polarity on DC Bus
- d) Cooling Fan Tripped (common for all fans)
- e) Battery Discharged
- f) DC Over-Voltage
- g) Battery Earth Fault

**Inverter Panel**

- a) DC Input Failure
- b) Inverter - I Output Trouble

**Construction**

- Rectifier / Charger and Inverter sections shall be housed in separate panels and shall be complete with all interconnections. The panels shall be fabricated with 1.6/2 mm thick cold rolled sheet steel and structural steel. The panels shall be free-standing. Vermin proof fitted with suitable louvers for ventilation and cooling fan. Hinged doors shall be provided at the front and back where required, with dust tight gaskets. Interpanel sheet steel barriers shall be used. The enclosure shall be IP-51 (NEMA-1A).
- Power cables shall be with aluminium / copper conductor as specified in SLD. Control cables shall be with copper conductors. All Cable connections shall be from bottom and from the front of the panel. At the bottom of the panels, a removable bolted gland plate shall be provided with double compression type cable glands fitted to it for external cable connections. Clamp type terminals shall be used for connection of all wires upto 10 mm<sup>2</sup> and terminals for larger size shall be bolted type suitable for cable lugs.
- Busbars shall be colour coded and live parts shall be properly shrouded to ensure complete safety to personnel intending routine inspection by opening the panel doors. All equipment inside the panel and on door shall have suitable nameplates and device number as per the schematic diagram.
- All fuses shall be link type with HRC links and mounted inside the panel. All power and control switches shall be mounted on the door operable externally and shall be rotary type. Space heaters and 100W incandescent lamps shall be provided in each panel. All instruments shall be switchboard type, back connected, 96 x 96 mm square of reputed make. Scale shall have a red mark indicating maximum permissible

operating rating. Test terminals shall be provided on a separate rail for measuring and testing of equipment to check the performance.

- A suitably sized earth bus shall be provided at the bottom of the panels with provision for earth connection at both ends to purchaser's main earth grid. Suitable earthing of potential-free metallic parts of various equipment shall be done to ensure safety.
- All metal parts shall be treated so as to ensure efficient anti-corrosive protection. Hardware shall be zinc passivated or electro galvanised. Panel enclosure and structure supports shall be thoroughly cleaned and degreased to remove mill scale and rust, etc. External surface shall be prepared for final painting with Manufacturer's standard colour code.

## Equipments Details

All materials and parts comprising the UPS shall be new, of current manufacture, of a high grade and free from all defects and imperfections and shall not have been in prior service, except as required during factory testing.

All active electronic devices shall be solid state. All semiconductor devices shall be hermetically sealed. All relays shall be dust tight.

The maximum working voltage, current and di/dt of all solid state power components and electronic devices, shall not exceed 75% of the ratings established by their manufacturer. The operating temperature of solid state component cases shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 90% of their voltage rating.

## Wiring

Access holes with cover plates are to be provided on top and bottom of the UPS and battery cabinets for inter-cabinet wiring and customer installation wiring.

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards.

All bolted connections of bus bars, lugs and cables shall be in accordance with requirements of the National Electric Code and other applicable standards. All electrical power connections are to be torqued to the required value and marked.

## Ventilation

Adequate ventilation shall be provided to insure that all components are operated within their environmental ratings. All fans are to be equipped with wind vane sensors connected to an alarm on the module control panel.

Temperature sensors shall be provided to monitor temperature of critical components. Upon detection of temperatures in excess of component manufacturer's recommended

ambient working temperature, the sensors shall cause audible and visual alarms to be sounded on the module control panel.

Forced ventilation if provided by means of fans shall have 100% redundancy. If redundancy is not provided then it shall be possible to run the system at rated load for half hour and at reduced load (about 75%) continuously without any damage to the system.

## **Spares**

Vendor shall recommend and provide spare parts needed for start-up and two years operation. Recommended spares should take into account related factors like equipment reliability, effect of equipment downtime upon production and safety, cost of and availability of equipment service facilities.

All spare parts furnished by vendor shall be wrapped and packed so that they will be presented in original as new condition under the normal conditions of storage to be anticipated and shall be properly taped and coded so that later identification as to intended equipment usage will be facilitated. They shall be packaged separately, clearly marked as spare parts and shipped at the same time as the equipment. Packing list shall be furnished so that the parts can be handled without uncrating, if desired.

## **Inspection and Testing**

The Battery shall be subject to inspection by Client's representative. Manufacturer shall furnish to inspectors all requested information concerning the supply.

Battery shall be tested as per relevant IS and test certificates shall be furnished before dispatch.

The UPS System will be tested in the presence of Client's representative. The following tests shall apply:

Full load heat run for eight hours (unit rate to be furnished separately).

Current forcing test.

Recording of time for mains to inverter changeover and vice-versa.

Recording of 1/2 load change transient.

Recording of full load change transient.

Functional Tests.

Detailed inspection will be performed to ascertain that the data sheet and other contractual aspect are complied with the earthing system must be inspected for robustness and continuity.

## **Lightning Protection**

The plant and structures shall be protected against lightning in accordance with requirements of IS-2309.

Air terminal rods shall be provided at the top most points of all buildings and structures. Roof conductors shall be run at not more than 18 meters from each other on top of the buildings and interconnected at intervals of not more than 18 meters. Hot dip galvanized 25 x 3 mm G.I. strips shall be used for horizontal air termination. Whenever specified in the BOQ or layout drawing, early streamer type lightning protection of reputed make & type subject to Director IITM Pune/ consultant approval shall be used. Installation procedures shall be approved by Director IITM Pune/ Consultant prior to the stand of work.

Down comers shall be installed at every 30 meters of the periphery of the buildings and structures and connected to separate earthing pits. Each down comer shall be provided with one earthing pit. Each down comer shall be provided with a test link for testing the installation. Portion at the conductor below ground shall be painted with bituminous paint.

The sizes and material of lightning conductors shall be as follows unless otherwise specified in Specific Requirements.

	<u>Roof Conductors</u>	<u>down</u>
<u>Comers</u>		
a) Copper mm	25 x 3 mm	32 x 6
b) G I mm	25 x 3 mm	32 x 6

The down comer shall be cleated to the wall or columns at intervals of 300 mm using G.I. clamps. All joints in the conductors shall be welded. Welding joints shall be painted with two coats of Bitumen.

Each air terminal rod shall have 150 mm dia GI or 75 mm dia copper sphere with 5 nos. 150 mm long conical GI / Copper spikes. The spikes shall be screwed and welded / brazed to the sphere. The whole assembly shall be fixed to a GI rod of not less than 50 mm nominal bore by means of flanged connections. The down comer shall be connected to the flange and welded / brazed. The top of the air terminal rod shall be two meters above top most point of structure.

Following also shall be earthed: -

Metallic noncurrent carrying parts of all electrical equipments such as transformer, switchgear, panels, power sockets, lighting fixtures., shall be earthed at one point for and up to 230V and at two points for working voltage of 415 Volts.

#### **Steel structures / columns**

**Cable trays, spheres, vessels and other process equipment.**

**Fence and gate of electrical equipment (of transformer yard)**

**Cable shields and Armour.**

**Street light poles near to main earth grid shall be earthed by tapping from main earth grid. For remote located street light pole, individual earth electrodes shall be constructed.**

**Earth strips from Lightning arrester shall be laid and connected to Earth stations directly. Strips shall be of specified size. These shall be connected with plant main grid, whenever specified only below ground.**

**Equi-potential jumpers for any or all of the above equipment joints / sections intended for earthing.**



**APPROVED LIST OF MATERIAL ELECTRICAL**

Contractor shall supply material of Reputed Make. In case, it is not possible to supply Material of recommended make, equivalent make shall be as approved by AEPPL/Client. Contractor shall fill in this data sheet while submitting the tender.

Contractor shall supply material of Reputed Make which is approved by Maharashtra state Transmission Company (MSETCL) and Maharashtra state Electricity Board (MSEDCL)

SR. NO	ITEM DESCRIPTION	RECOMMENDED MAKES	PROVIDED BY BIDDER
1	22 kV H T XLPE CABLES	Universal / RPG./ Lapp/ KEI /Polycab	
2	22 kV H T DO fuse	Atlas / Pactil/ Kiron	
3	A.C.S.R. conductor	Atlas / Sterlite / equivalent.	
4	Clamps, Termination Kits, Joints	Raychem/ M-SEAL	
5	22 kV HT GOD	Atlas/ Pactil/ Kiron	
6	LT Cables	Universal/Lapp/Finolex /RPG/KEI/Polycab	
7	22 kV H.T. cable terminations	Raychem/ M-SEAL	
8	22 kV Lightning Arrestors	CG/GE/Elpro	
9	ACB	ABB / Schneider Master Pac / Siemens 3WL / L&T	
10	MCCBs	ABB / Schneider MG / Siemens / L&T	
11	SDFs	ABB / Schneider MG / Siemens / L&T	
12	Timers, Temp Controllers etc	Solectron / L&T/ABB	
13	Contactors/Relays	ABB / Schneider MG / Siemens / L&T	
14	Capacitors Banks (APP/MD)	Subdohan / Epcos / ABB / Mehar	
15	Lighting Fixtures	Wipro/ Philips /	
16	1/3 Phase/ Sockets	Legrand / L&T/ Hager/ABB/Schneider	
17	DBs	Hager/Legrand/MG/ABB/ Siemens	

18	Load Managers	L&T Quasar / Socomec / Elmeasure / Rishabh/PAC 3200 / ION 6200	
19	SDF Unit	Siemens / ABB/ Merlin Gerin/L&T	
20	ELCB / RCCB /RCBO / MCB	Legrand / Merlin Gerin/ Siemens/Hager/ABB	
21	Bustrunking / Rising main	Schneider / L & T / C & S	
22	Starters	Siemens/ ABB/Merlin Gerin	
23	Relays (OL & EF)	Alstom/ Siemens/ABB	
24	APFC Relay	Sycon/Beluk/Ducati(RMI)/ABB	
25	Energy meter	L&T / Enercon / Krycard / AE / Socomec / Elmeasure / Konzerv	
26	Indicating meter(Digital)	Enercon /AE/ Socomec/Elmeasure	
27	Control fuses	EE/Siemens/ Merlin Gerin	
28	Indicating lamps (LED based)	ALTOS/Teknic/Raas, Siemens	
29	Push buttons	Siemens/BCH/ Teknic/	
30	Connectors	WAGO/Phoenix	
31	Current / Voltage transformers	Kappa/ SEGC/AE	
32	Glands	Commet / Braco / Dowels / Siemens / Phoenix	
33	Lugs	Dowel / Jainson / Braco	
34	PVC conduit accessories	Precision/ Circle Arc/ Diamond.	
35	Wires	Finolex / Lapp / RPG / Universal / Polycab	
36	Switches & socket	ABB/Legrand Mosiac / Crabtree / Anchor Roma / MK	
37	MS Conduit & accessories	BEC/VIMCO	
38	Lighting poles	Valmont/Wipro/Bombay poles/Bajaj / Philips	
39	High Mast	Philips / Wipro /Valmont	

40	Ceiling fans	Usha, Orient, Crompton,	
41	Exhaust Fan ( heavy duty )	Almonard/GEC/ Crompton	
42	Exhaust fans ( light duty)	Siracco	
43	Electronic ballasts	Wipro/CG/ Intelux/ Philips / pier light	
44	Light fitting accessories	ATCO/ Vossoloh/ Wipro, Philips/Thorn/ Clipsal / pier light	
45	Incandescent Lamps	Philips/ Osram / Wipro	
46	Telephone tag block	Krone / Legrand	
47	Lan/Data/Telephone cables / wires (Cat6)	Delton/ Finolex/ ITL/ Avaya / Legrand / Polycab	
48	TV cables(RG6)	Airtech/ Komscop/ Sumer/Finolex.	
49	Speaker	Philips / All Wave Radio / Rami / Bosch	
50	Data Networking	Crone,ABB,D-link	
51	Fire alarm / access	Eureka Forbes/Zicom/ Siemens/ Celberus /Honeywell notifier/	
52	Cable Trays	Ashlesha /Indiana OR Equiv.	
53	Cable Tray Support	Hitech / Amtech /	
54	Inverter / UPS	Emerson / APC / Numeric / Microtec / Ador	
55	Early Streamer LA	Indelec	

**SECTION-H****LIST OF IS STANDARD**

IS 10028	Code of practice for installation and maintenance of transformers.
IS 1866	Code of practice for Maintenance of mineral insulating oil.
IS 335	New insulating oil for transformers and switchgears.
IS 2309	Protection of buildings and allied structures against lightning.
IS 3043	Code of practice for earthing.
IS 5216	Safety procedure and practices in Electrical work.
IS 3106	Code of practice for selection, installation and maintenance of fuses ( Voltage not exceeding 650 Volts )
IS 1646	Code of practice for fire safety of buildings (general) Electrical installation.
IS 9921	Alternating Current Disconnectors above 1000 V.
IS 8623	Factory built assemblies of switchgear, and control gear for voltages up to and including 650 V
IS 2147	Degree of protection provided by enclosure for low voltage switchgear and control gear.
IS 2551	Danger notice plates.
IS 1248	Electrical indicating instruments.
IS 722	AC Electric meters.
IS 2705	Current Transformers.
IS 3156	Voltage transformers.

1. Various materials and electrical installation shall confirm to latest editions of the B.I.S./IEC as mentioned in materials and installation specifications column. Additionally and generally following Indian standards shall also be applicable. All other relevant Indian standards shall also be applicable whether specifically mentioned or not.

IS 8828	Miniature air break circuit breakers for AC circuits.
IS 10118	Installation and maintenance of switchgear.
IS 398 IEC 1089-1991	ACSR conductors
IS 7098	Cross linked polyethylene insulated PVC sheathed cables up to 33 KV
IS 12943	Brass glands for PVC cables
IEC 99-4	Gapless Surge Arrestors
IS-900	Code of practice for Installation and Maintenance of Induction Motors
IS-1255 - 1983	Codes of practice for Installation and Maintenance of Power Cables up to and including 33 KV Rating.
IS-732 - 1989	Code of practice for Electrical Wiring Installation. (System Voltage not exceeding 660 Volt).
IS-1913	General and Safety Requirements for Luminaries.
IS-1646	Code of Practice for Fire Safety of Building (General) Electrical Installation.
IS-2713	Specification for Tubular Poles for Overhead Power lines.
IS-6792	Method for determination of Electric Strength of Insulating Oils.
IS-2667	Specification for Fittings for Rigid Steel Conduits for Electrical Wiring.

**DEVIATIONS FROM GENERAL CONDITIONS**

All deviations from General Conditions of Contract shall be filled in hereby the Tenderer

**SECTION**

**CLAUSE NO.**

**DEVIATION**

The Tenderer hereby certifies that the above mentioned are only deviations from general conditions of contract of enquiry.

**DATE:**

**Signature & Seal of Tenderer**

**DEVIATIONS FROM TECHNICAL SPECIFICATIONS**

All deviations from Technical Specifications shall be filled in hereby the Tenderer

<b>SECTION</b>	<b>CLAUSE NO.</b>	<b>DEVIATION</b>
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The Tenderer hereby certifies that the above mentioned are only deviations from Technical Specifications of contract of enquiry.

**DATE:**

**Signature & Seal of Tenderer**

**DETAILS OF CONTRACTOR**

**Organization Name:**

**Address:**

**Telephone/Mob Number:**

**Fax Number:**

**Web Site:**

**E-Mail id:**

**Year of Establishment:**

**Bankers:**

**Key Persons:**

**Organization Profile:**



## **BILL OF QUANTITY (BOQ)**

## BOQ CIVIL WORKS

Project.: Proposed High Altitude Station for IITM at Mahabaleshwar

Sno	Description	Quantity	Unit	Rate	Amount
1	Earthwork open excavation in all soils to full depth as may be directed except hard rock requiring blasting including shoring, strutting and dewatering wherever found necessary, depositing the excavated earth at site of work with initial lead and lift as directed by the departmental officers.				
a	Upto 1.50 m depth	550.00	Cum		
b	Lift from 1.50 - 3.00 m depth	500.00	Cum		
c	Lift from 3.00 - 4.50 m depth	500.00	Cum		
d	Above 4.50 m depth	380.00	Cum		
2	Dismantling clearing away and carefully stacking materials useful for re-use .The item includes transportation,loading & unloading of the material in any unobjectionable place, and getting for approved by Architect/Engineer incharge.				
a	Dismantling Brick/stone masonry in cement mortar walls	125.00	Cum		
b	Dismantling plain cement concrete	50.00	Cum		
c	Dismantling Reinforced cement concrete	40.00	Cum		
d	Dismantling - flooring & cladding	150.00	Sqm		
e	Stripping- internal Plaster	700.00	Sqm		
f	Stripping- External Plaster	350.00	Sqm		
3	Conveyance of Excavated surplus Earth and debris by lorry with an average lead of 12km entirely within city limits including loading and unloading etc. as directed by dept. officers.	1300.00	Cum		
4	Filling with excavated earth in layers not more than 15cm thick well rammed, watered and consolidated etc. complete complying with standard specification and as directed by the departmental officers as per S.I.85	660.00	Cum		
5	Providing and laying damp Proof Course 40 mm thick with cement concrete 1:2:4 ,extra for providing and mixing water proofing material in cement concrete work@1kg per 50kg of cement.	50.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
6	Supplying and filling and compacting soling stones-avg. size 250 x 150 of tough basaltic igneous rock without any fractures or fissures; chiselled to conical shape by hand and laid to total compacted depth of max. 300 mm over ready compacted layer of hard murrum filling below plinth slab. Item to include compaction with wooden hand-rammers as approved by Engineer-in-charge; all men material and lift upto 1.5 mt. above FGL, all tools and tackle, accessories etc. item finished complete. Basic material to be approved by Architect/Engineer-in-Charge.	100.00	Cum		
7	Supplying and filling in foundations and the area wherever specified with approved good quality filling materials in plinths, area development etc. wherever specified in layers of not exceeding 150 mm thick including breaking clods, storing, transportation, double handling, watering, compacting each layer with vibratory compactor and at un-accessible places with wooden/steel rammers to achieve 95% proctor density at optimum moisture content, all leads and lifts, bailing/ pumping out of water to keep site dry while backfilling; cost shall include conveyance of all materials, labour, machinery etc. complete as directed. The rate to includes loading, unloading, hire and fuel charges for tools and plants and other incidental charges etc, complete.				
a	Approved quality river sand	70.00	Cum		
b	With approved quality murrum	130.00	Cum		
8	Providing pre constructional Anti-termite treatment for the construction of building including cost of chemicals labour as per standard specification. Labour for preparing the area for treatment by spreading chemicals and other incidental charges complete. The rate shall be inclusive of giving anti termite treatment to the building for the following four stages including breaking the termite moulds making holes with crow bars at an interval of 12" to a depth of 8" in the periphery of the building including flooring area and pouring chemicals etc., complete as per ISI 6313/1981.	330.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
	<p>Stage.I. spraying anti- termite treatment chemicals solution for foundation concrete surface laying the foundation concrete bottom and sides of the foundation.</p> <p>Stage.II. Spraying anti-termite chemical solution to the grade beam level, spraying for the grade beams, brick, masonry in superstructure in contact with the back fill earth.</p>				
	<p>Stage.III. Spraying anti-termite treatment, chemicals solution on sand for the flooring before laying the flooring zone, Treatment has to be carried out by making crow bar holes at an interval of 12" to a depth of 8" on the sand filling in basement and raft</p> <p>Stage.IV. Spraying anti-termite treatment chemicals solution around the building (out side) by making crow bar holes at an interval of 12" to a depth of 8" in the periphery of building and chemical poured inside the holes and closed after the treatment.</p> <p>Providing and injecting chemical emulsion for anti-termite treatment and creating a chemical barrier under &amp; around the column pits, walls, top surface of masonry filling in plinth and rubble soling, junction foundations, trenches, basement excavation, of wall and floor, along the external perimeter of the building, at expansion joint, surrounding of pipes, conduits etc. complete with Heptachlor emulsified concentrates as per latest IS code complete from approved agency.( Plinth area of the building at ground floor is to be considered)</p>				
9	Providing and laying plain cement concrete M7.5 Grade using coarse graded aggregate of 40 mm and down size for levelling course under footings, steps, walls, platform etc. including form work wherever necessary and well compacted etc. all complete, as directed.	100.00	Cum		
10	Providing and laying Plinth protection to the outer walls of the building including necessary excavation, metalling of 100 mm, laying 100 mm thick PCC 1:4:8 concrete and Laterite stone top finish layer of avg. 175 mm thickness, including formwork, providing joints, laying the concrete to required slope and level as per the drawings, etc.	170.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
11	Providing and laying in position READY MIX CONCRETE M20 Grade using Ordinary Portland Cement with Fly Ash, water cement ratio not exceeding 0.45 including the use of plasticizer of approved make & dosage of required grade at all locations and levels using 20mm size & down graded aggregates in all types of works including hire charges for pump and pumping charges to the required locations, machine vibrating, tamping, curing, providing fixtures like fan clamps, beading as specified, charges for conveyance of RMC from Plant to the site or all as required (excluding cost of reinforcement and fabrication charges, centering and shuttering). Mix design details to be got approved before commencement of the work adopting pour card system by departmental officer etc. complete as per IS 4926 of 1976/1990.	50.00	Cum		
12	Providing and laying in position READY MIX CONCRETE M25 Grade using Ordinary Portland Cement with Fly Ash, water cement ratio not exceeding 0.45 including the use of plasticizer of approved make & dosage of required grade at all locations and levels using 20mm size & down graded aggregates in all types of works including hire charges for pump and pumping charges to the required locations, machine vibrating, tamping, curing, providing fixtures like fan clamps, beading as specified, charges for conveyance of RMC from Plant to the site or all as required (excluding cost of reinforcement and fabrication charges, centering and shuttering). Mix design details to be got approved before commencement of the work adopting pour card system by departmental officer etc. complete as per IS 4926 of 1976/1990.	790.00	Cum		
13	Supplying fabrication and placing in position Ribbed Tor Steel Fe 500 for all reinforced cement concrete works as per the design given including cost of steel, binding wire, etc. complete complying with standard specification.	140.00	MT		

Sno	Description	Quantity	Unit	Rate	Amount
14	Providing fabricating & erecting structural steelwork in hot rolled sections for trusses, purlins, gantry, monorail columns, cable trays, pipe racks, purlins, castellated beams, staircase & other structural members with all bracings, gusset plates etc. as per detailed drawing or as directed at all heights and levels including removing the scales & burrs, cleaning with phosphoric acid, marking, cutting, fabrication, hoisting, erecting & fixing in position, making alignment of members making welded/ bolted /riveted connections etc complete.	2.25	MT		
15	Supplying and erecting centering for sides and soffits including supports and strutting up to 3.30 m height with all cross bracing for plane surfaces as detailed below, using mild steel sheets of 90 X 60 cm 10 gauge stiffened with MS angle of 25 X 25 X 3mm for boarding, laid over adjustable span & jacks and supported by 50mm dia pipes for general pipes scaffolding systems @ a spacing of 1.20m c/c and vertical connected at a height of 2.0m c/c including 'C' & 'U' clamps and base receiver cup at bottom for connecting pipes etc and removable systems etc complete.				
a	For Footing	560.00	Sqm		
b	Columns, (Rectangular/Square/circular) for all floors	650.00	Sqm		
c	Lintels, conventional slab & beams, staircase waist slab & landings, etc for all floors	1900.00	Sqm		
d	Walls (any thickness) including, core walls, shear wall, retaining wall, parapet wall etc. for all floors.	2070.00	Sqm		
16	Construction of laterite stone masonry of size 40x30x15cm in lime mortar 1:4 by using including dressing, carrying materials, curing, cost of all materials and labour charges and as per the standard specification.	240.00	Cum		
17	Fly ash Brick work with minimum compressive strength of 50 Kg per Sq.cm. in cement mortar 1:5 (1cement : 5 coarse sand) for superstructure at all levels complete and as directed by the Architect/Engineer incharge. Item to include, all accessories, men material and lift at all levels., pre-application preparation etc. finished cleaned complete.	15.00	Cum		

Sno	Description	Quantity	Unit	Rate	Amount
18	Providing and constructing 150 mm. thick, masonry wall ,at all levels, with approved Fly ash bricks, with minimum compressive strength of 50 Kg / Sq.cm, in Cement Mortar 1:3 with extra for providing and placing in position 2nos of 8mm dia TMT bars at every third course rate shall include for cost of reinforcements and tying in postion using binding wire made out of 16 gauge G.I. annealed or 18 gauge S.S., form work, scaffolding, raking out joints,curing etc complete and,as directed by the Architect/Engineer incharge.Item to include, all accessories, men material and liftat all levels., pre-application preparation etc. finished cleaned complete.	200.00	Sqm		
19	Providing 6 mm thick cement plaster to R.C walls, slabs, peripheral beams and columns with Cement Mortar 1:3, (1 cement : 3 fine sand) according to the specification.complete complying with standard specification as directed by the Architect / Engineer incharge.Item to include for necessary hacking, staging, scaffolding and curing at all levels and elevations etc., all accessories, men material and lift at all levels., pre-application preparation etc. finished cleaned complete	2040.00	Sqm		
20	Providing internal and External Wall Plastering with cement mortar 1:4 (One cement and 4 sand) maximum 12 mm thick in all floors including curing etc. complete complying with standard specification as directed by the Architect/Engineer incharge.Item to include, all accessories, men material and lift at all levels., pre-application preparation etc. finished cleaned complete.	1300.00	Sqm		
21	Providing and constructing of Plaster band of size 75mm wide to a thickness of 25mm as shown in the drawings Item to include, all accessories, men material and lift at all levels., pre-application preparation etc. finished cleaned complete.	120.00	Rm		
22	Water Proofing-Toilets: Providing and laying polymer based waterproofing treatment to the sunken portion of toilets, WC, etc. all as per detailed specification. Item to be of brand as approved to include all accessories men material and lift., pre-application preparation etc. finished cleaned complete.	65.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
23	Utility Well Water proofing Providing and laying Shahabad stone box-type WP, in 2 layers with staggered joints externally over RCC sunk-slab, laid in rich CM 1:4 with approved polymerous WP additive; of avg. stone thickness 32 mm & avg. planar size 600 x 900. Item to include getting mock-up of avg. 2 sq.mt. approved from Architect/Engineer-in-charge, all men, material and lift to site, all accessories, tolls and tackle, all approved surface preparation, curing etc. as approved and as per IS codal provisions, item cured, cleaned complete. Joints to be staggered by half a tile along horizontal axis.	10.00	Sqm		
24	Terrace water Proofing	550.00	Sqm		
	Water proofing treatment over RCC roof slab laid to slope in terrace and gutter slab covering the following sequence of operation and specifications:				
	a) The roof slab laid in slope / gutter slab shall be thoroughly cleaned by removing the debris and dust, to receive the water proofing treatment.				
	b) Providing and applying water repellant nano technology coating system over well prepared dry surface covering the surface area of 30 sqm per litre by mixing ratio of the component with water in 1:10 by volume i.e. (one litre of ZYCOSIL or ZYDEX make or approved equivalent and 10 litres of water)				
	c) Applying 2 coats of acrylic polymer modified cement based, flexible water proofing slurry like TAPECRETE or approved equivalent make to a thickness of 2mm and cured for 7 days and as per manufacturer's specification.				



Sno	Description	Quantity	Unit	Rate	Amount
	d) Supplying, providing and applying water proofing treatment with Membrane type water proofing methods using polymer modified Bituminous membrane of CICO shield/ Build Wrap/ Deboer or approved equivalent make. The Atactic Poly-Propylene (APP-4mm th)membrane having UV resistant, ground chemical resistant, high melting point more than 110 deg. C, flexible and elastic with high adhesive strength. The membrane shall be reinforced with non woven polyester reinforcement of minimum of 180 g/sqm and reinforced including coating with compatible primer of Bituminous base and torch application with overlap of 100 mm wherever required. The reinforcement provided shall be able to withstand the traffic flow density during & after construction and shall carry a minimum guarantee period of 10 years. Cost to include applying the primer and torching the entire surface and also prefabricated overlap at ends. The membrane surface shall be protected with granules.				
	e) Providing, supplying & laying extruded polystyrene rigid foam panel of size600 x 1200mm-75mm thick of formula R.Metric-FM 50 having a density of 24 kg/cum and compressive strength not less than 250 kpa of ownes corning or approved equivalent make having exeptional mechanical properties like resistance to the diffusion of water vapour, resistance to water absorption, uniform density distribution, dimensional stability, very high compressive strength, aging resistance and also immunity against insects, pets, bacteria, rodent attacks and micro organisms etc., for over deck insulation including necessary skin shiplap joint,anchors,adhesives, primers etc., as required for proper fixing etc., complete all as per the manufacturers specifications & Employer / Architect's approval. The extruded polystyrene panel has closed sealed cells structure linked to one another is produced by a contineous, fully automated extrusion process in accordance with international specification and standard etc. all complete.				
	f) Laying fibre glass cloth over the extruded polystyrene rigid foam panel.				

Sno	Description	Quantity	Unit	Rate	Amount
	g) A layer of 20 mm thick cement mortar 1:4 admixed with CICO NO - 1 (normal setting integral water proofing compound) or other approved equivalent make compound shall be spread over the operation specified in point (f) above and laying brickbat coba over the surface 75mm thickness at drain point and required thickness at ridge (Not more than 140mm) and the top surface of the brickbat coba shall be plastered with cement mortar 1:4, 20 mm thick admixed with CICO NO:1 @ 2% by the weight of cement and add RECRON 3S 225 per bag of cement and draw false line of 300 mm X 300 mm over the finished surface. (The rate shall be quoted for an average thickness of 110 mm by maintaining a slope of 1:100).				
	Rate shall include for preparation of surface by mechanical upgrading to remove all loose mortar and laitance, oil, grease etc. and washing the surface with water to get neat surface, dewatering, finishing, curing, scaffolding, supply and adding water proofing chemicals at the specified proportion as per manufacturer's specifications, all materials, wastages, conveyance, tools and plants, mixing device and gauge, shuttering and also include for conducting leakage test at terrace by storing water on the terrace for about 25 mm depth continuously for a period of 7 days etc.complete, as directed.				
	Brickbat coba in CM 1:4 using well burnt half bricks / bats.				
	SPECIAL NOTE:				
	6.Grouting periphery of spout pipes with water insensitive epoxy, pressure grouting of construction joints and honey comb areas with cement grout, proper preparation of the concrete surface by mechanical means/hydro blasting to ensure a good bond between the topping and the substrate, Testing of the surfaces prior to start the work, after completion and after a period of one month after completion by ponding,grouting or sealing of joints, making vatta at corners/junctions etc are deemed to be included for all items while quoting rates Contractor shall give both material and performance guarantee in the approved format.				

Sno	Description	Quantity	Unit	Rate	Amount
25	Providing and laying Roof tile 20 mm (+/- 1mm) thick avg. size 300 x 300mm heavy duty concrete paver tile of approved Brand as per approved shade & code laid as per design drawing including cleaning of base surface and removal of laitance, rubbing, cleaning and curing etc. with CM 1:3 having thickness of maximum of 20 mm, all complete and pointed with equivalent tilemate (white cement mixed with colouring pigment using 0.40Kg/M2) including neat finishing etc. complete as per standard specification. (The colour and make of the tiles should be got approved before execution from the Architects)	480.00	Sqm		
26	Scope: Designing the Semi unitised structural glazing system as per design intent and as per approved drawings, preparation of shop drawings, supply, fabricate the panel with the specified glass on the child frame at factory, erect the system on erected extruded main frame & Transom fixed on supporting system at site as per approved shop drawings at all floor levels and for all heights. Designing, providing and fixing frame supporting system, the framing system (ie. Main & Child frame) to support Vision panels (Insulated Glass) / Spandrel panels either with Monolithic Glass or Aluminium composite panel/openable Top hung window panels / punched strip windows / decorative capping to any shape & profile, smoke seal, flashing including gaskets, sealants necessary accessories, as part of the system on a continuous framing supported between floors as detailed below and as per the specification for external facade system.	150.00	Sqm		
	Conducting the test for the materials involved in the system, field test on the erected system at site as per the test criteria set out in the specification of External Facade system. Submission of methodology for the Materials and assembly - field test supported by the copy of relevant codes & Standards and the same shall be got approved by the Employer / PMC / Architect prior to testing. Protection of the System and Materials till handing over to the Employer / PMC / Architect, removal of the unwanted materials, broken glass, Screws, bolts, Nuts, Packing Materials, debris etc, regularly and keeping the premises neat and clean at all times.				

Sno	Description	Quantity	Unit	Rate	Amount
	Coordinate the details of the façade cleaning system during the preparation of shop drawing and incorporate such details in the shop drawing submitted for approval of Employer/PMC/Architect. Maintaining the system by means of periodical inspection at site (bi-monthly) and checking the system and Materials involved in the system during Defects liability period (this will not relieve the contractor from the condition laid down in the contract under defects liability period) to ensure that the system and all materials are free from any defects during this period. Providing the Guarantee for the entire External Façade system to the specified period in an approved format supported with Back to back guarantee from the specialized Material supplier like Glass, Aluminium composite panel, Gasket, Sealant, Hardware etc. complete as directed by the Employer / PMC / Architect.				
	I. DESIGN:				
	a. Design: Design pre-assembled aluminium Semi unitised Structurally glazed Panel with continuous framed panels / Strip window / Punched window system with split mullion to any shape and profile to with stand a minimum design wind pressure of 200 Kg/sqm (Test pressure shall be 1.5 times of the design wind pressure) conforming to IS 875-Part 3 and Lateral forces as per IS 1893 (Latest Revision) and fixed at horizontally / vertically / sloped / curved position etc as shown in the approved drawings by using Aluminium extrusions, Glass, Spacer tape, Gasket, Sealant etc. as specified.				
	Contractor shall be responsible to determine the maximum design wind pressure and lateral forces, moments, stresses etc. applicable for the system. Negative / suction pressures if determined as per IS 875 - part - 3 and Lateral forces as per code IS 1893 shall make allowances as described in the code for corner effects on the system. System shall be designed with Air Pressure equalization chamber and concealed continuous gutter vertically and horizontally at all levels as self drainage barrier to achieve water tightness besides providing EPDM Gaskets on the frame and EPDM Gasket / Sealant on the external groove as air and water barrier.				

Sno	Description	Quantity	Unit	Rate	Amount
	b. System: System shall be designed to withstand a design wind pressure specified above with self-bearing modular elements supported between floors in the case of structural glazing and split mullion supported between sill & lintel/beam in the case of punched windows, EPDM Gaskets on the frame and Gasket/sealant on the groove to prevent the system from Air & water penetration, double adhesive spacer tape, backer rod, sealant, supporting brackets (Resistance to design wind pressure), Separator Gaskets for Bi-Metallic Corrosion, Pressure equalization chamber in the system, built-in continuous internal drainage gutter for collection and facility at lowest floor level to drain out penetrated water, in built adjustability to accommodate thermal expansion, thermal movement and movement due to any other forces etc.				
	System shall be designed with Gasket/Sealant on the external groove with colour anodized aluminium holder around the panel to the required width and thickness as per design as Dead load support to the Glass panel. Non Staining sealant between glass & aluminium holder around the panel shall be provided. Glazing the panel with child frame shall be done only at factory at the controlled atmosphere to erect the panel on erected extruded aluminium main member and transom with supporting system at site fixed on the RC surface. Vertical in-situ glazing shall not be carried out during construction / erection stage. System shall be designed in such a way that the outer surface of insulated glass unit, monolithic glass unit and Aluminium Composite Panel shall be in the same plane or as per approved drawing.				

Sno	Description	Quantity	Unit	Rate	Amount
	c. Movement : System shall be designed to accommodate movement due to any force including the movement resulting from the exterior skin temperature ranging from 15 to 85 deg.celsius, Interior skin temperature ranging from 15 to 30 deg.celsius, and also to accommodate the horizontal building movement of 10 mm per panel & vertical movement of 20 mm between floors on the aluminium framing system with support brackets, glass, gaskets and fastening devices. System shall be designed to accommodate the size and shape of the glass panels as per the approved drawings including approved modifications as may be required during execution as well as all other incidental forces and stresses likely to be experienced under service conditions,i.e.Lateral force, Dead weight and Thermal expansion due to building movement both vertical and horizontal etc.				
	<b>II. MATERIALS:</b>				
	a. Frames: Providing and fixing pre - assembled aluminium frame work (Main & Child member) designed to with stand design wind pressure and movements as specified as continuous framing system for Structurally glazed panel and split framing system for structurally glazed punched windows. Horizontals (Transom) shall be made out of specially designed extruded sections matching to the Mullion depth in such a way the Mullion and Transom flush on inside of the facade. Fabricated glazed panel with child frame at factory shall be fixed at all levels and heights as per approved shop drawing on the erected main member and supporting system erected on RCC surface at site.				
	The supporting system shall consists of Brackets / Clamps, fastening straps, nuts, bolts, rivets, washers and other fastening materials etc. Extruded sections shall be designed to accommodate Insulated Glass Unit (IGU) / Monolithic (Single) Glass and Aluminium composite panel as per the approved shop drawings. Extruded aluminium sections shall be 6063 T6 or 63400 (H9) grade conforming to BS 4167 or IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating of approved colour conforming to IS 1868.				

Sno	Description	Quantity	Unit	Rate	Amount
	b. Glass: Providing and fixing approved brand sandwich laminated 6 + 1.52 + 6 toughened tinted float glass as per specification below for both vision and spandrel panel conforming to the minimum spectral parameters as specified. All aluminium sections including cover profiles finished with AC 25 grade electrolytic colour anodic coating of approved colour conforming to IS 1868. Primary sealant shall be Poly-isobutylene (PIB) and Secondary seal shall be structural silicon sealant of DC 995 (one part) or DC 983 (two part) of Dow Corning or approved equivalent.				
	c. Processing of Glass : Details of the processor, and their facilities, should be submitted by the Contractor, to the <i>Employer / Architect</i> , for approval. Laminated glazing unit, shall be processed, only by the approved Processor. All glass panes, used in the glazing, shall be heat strengthened , conforming to the relevant codes and standards. No tong marks, shall be allowed ,in the processed glass. Necessary test certificate, shall be produced by the processor, to confirm the adherence of the parameters, set out in the codes, and standards, for heat strengthened glass. Contractor, shall submit the certificate, of the processor, duly verified and certified by the Glass Manufacturer and submit the same, supported by copy of codes & standards to Employer / PMC / Architect.				
	Glass Manufacturer, shall ensure, that only new substrate glass, is used for coating ,and necessary inspection procedure ,shall be adopted ,to eliminate the incidence of Nickel sulphate (NIS), inclusion on the float glass, used for coating, and to ensure the same, a certificate from glass Manufacturer, shall be obtained by the Contractor and submit the same, to <i>Employer / Architect</i> . The Contractor, shall arrange, for obtaining necessary clearance, from the processor, for the inspections of the glass processing plant, during the progress of glass processing, and to carry out the random test (Minimum 3 nos), at the glass processor lab by <i>Employer / Architect</i> . It shall be the responsibility of the Contractor , to make sure that the glass, shall be processed ,as per specification and it shall be conforming to the criteria, of the respective codes and standards.The Contractor, shall have to submit certificate, from the glass processor, that the glass processing, has been done, as per specification and codal provisions, has been observed, and such copy of codes, shall be made available ,for verification of Employer / PMC / Architect.				

Sno	Description	Quantity	Unit	Rate	Amount
	Processor shall provide removable Safety clips on each corner of glass as a safety measure prior to packing to avoid breakage of glass in the corners during transit and this safety clip shall be retained till the glass is taken for Glazing in to the frame at factory. Glazed panel with broken or Chipped off glass at the edges and with any scratch on the surface of the glass shall not be allowed to use in the Facade and found any such damages in the glazed panel even after glazing / erected in place shall be rejected and shall be replaced with new one after the approval of installation methodology by the concern authority.				
	d.Gaskets: Providing and Fixing, Ethylene Propylene Dinine Monomer (EPDM) Gaskets, as weather strip and barrier ,at minimum 3 stages, to ensure water and air tightness. Weather strip, shall be EPDM Gaskets, with Hardness (5 second) shore A ,with a typical value, not less than 70, ultimate tensile strength of 70 (+/- 10%) Kg/Sq.cm., and ultimate elongation of 250% (+/- 10%). The gaskets shall be, Osaka rubber make or Sai rubber or Anand Reddiflex make or approved equivalent. The Contractor, shall submit the Manufacturer's test certificate, conforming that, the properties of the Gasket, supplied is meeting the specification, codes & standards and copy of such codes, shall be produced by the Contractor, for verification of <i>Employer / Architect</i> . The Contractor ,shall arrange, to carry out the test, to check the properties of EPDM gaskets, on the random sample, selected by <i>Employer / Architect</i> (Min. 3 Nos of each type to a required length) at India ,and the Contractor, shall make sure, that the properties are meeting, the codes and standards, and copy of such codes, shall be				
	produced, by the Contractor, for verification of Employer / PMC / Architect. produced, by the Contractor, for verification of Employer / PMC / Architect.				



Sno	Description	Quantity	Unit	Rate	Amount
	e. Sealing: Design bite and thickness of structural sealant to withstand 3 times of the stress caused by the design wind pressure specified above and to ensure the same, the design calculation of sealant manufacturer shall be submitted along with shop drawing. Necessary materials as proposed in the shop drawing such as Extruded member with finish, glass and any other material required by the Sealant manufacturer shall be supplied to them to carryout the test as per relevant codes & standards in order to validate the bite and thickness designed by them. Contractor shall obtain the test certificate from Sealant manufacturer and submit the same along with shop drawing and supported by the copy of relevant codes and standards. Contractor shall ensure that the bite and thickness of sealant as designed & determined by calculation, verified and tested by Manufacturer's is followed in the shop drawing and the same shall be adopted for the glazing at factory after the approval of shop drawing.				
	Supplying and fixing the Sealant as per specification and Double Adhesive spacer tapes for glazing the panel at factory. Spacer tape shall be open cell polyethylene of code no. Norton V-2100 of Norton Grind well make or approved equivalent. Jointing / Sealing of the glazed panel at factory shall be done with Non structural (weather) sealant / Non staining sealant of DC 991 HP of Dow corning make or approved equivalent with Polyurethane baker rods of Supreme make or approved equivalent. Acetoxy sealant shall not be used for Structural Glazing application. In general, providing and fixing the Structural and non Structural (weather) sealant shall be as follows:				
	Shop / Factory Sealants : i) Structural sealant shall be DC 995 (one part) or DC 983 (Two part) of Dow corning make or SSG 4000 (one part) or SSG 4400 (Two part) of GE Bayer Silicone make or approved equivalent. ii) Non-Structural (weather) sealant shall be DC 991 HP of Dow corning make or approved equivalent.				
	Field Sealants : i) Structural Sealant shall be DC 995 (one part) of Dow corning make or SSG 4000 (one part) of GE Bayer Silicon make or approved equivalent. ii) Non-Structural (weather) sealant shall be DC 991 HP of Dow corning make or approved equivalent.				

Sno	Description	Quantity	Unit	Rate	Amount
	f. System Supports : Providing and fixing the supporting system with Brackets / Clamps including fastening straps, nuts, bolts, rivets, washers etc. as per design requirement and as per approved shop drawing. Brackets / Clamps shall be of hot dip galvanized steel and Fastening materials shall be Non - magnetic Stainless steel 300 series - 304 grade of Hilti make or approved equivalent. Galvanizing thickness shall be in accordance with IS 2629 and 4759. Providing and fixing Serated plates or Serated washer wherever required as per the system requirement and as shown in the approved shop drawing.				
	g. Smoke seal : Providing and fixing Smoke seal / Fire stop using extruded aluminium channel with cap for continuous structurally glazed framing system and in general the thickness of channel and cap shall not be less than 2 mm thick and to a width as required between transoms and sill finish material and it shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating conforming to IS 1868 of approved matching colour to the Mullion & transom. Aluminium colour anodized extruded Channel shall be supported with the help of chromotised finish aluminium bracket as designed and this bracket to be fixed on the wall / RCC surface with necessary SS anchor bolt and fastener of Hilti make or approved equivalent.				
	The channel with cap shall be provided between Sill finish Material (Sill finish material shall be paid seperately) and structural glazing member at sill level and between RCC member face and structural glazing member at soffit level / false ceiling and etc complete. All the Joints between the capped channel and any other finish material at both sill and soffit level shall be sealed with Intumeasant sealant of 3 M make or approved equivalent. Also, close the gap on the vertical surface between the face of column / wall / partition and structural glazed frame / glass by using extruded aluminium channel with cap with chromotised finish aluminium bracket supported on the coloum / wall / partition and in general the thickness of channel and cap shall be 2 mm and to a width as per drawing and it shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating conforming to IS 1868 of approved matching colour to the Mullion & transom.				

Sno	Description	Quantity	Unit	Rate	Amount
	h. Flashing : In addition to the smoke seal as specified above for Horizontal gap between frame and sill finish material, providing and fixing flashing at all floor levels as part of the system (applicable only for continuous structural glazing portion) made to profile as shown in the approved drawings and the profile shall be made out of hot dip galvanized sheet 1.2 mm thick and galvanizing coating thickness shall be in accordance with IS 2629 & 4759. In general, the flashing shall be provided to the entire length of structural glazing portion horizontally at all floor levels and at terrace level with necessary anchoring system with SS fastening devices of Hilti make or approved equivalent.				
	i. Top Hung windows: Providing and fixing the shutter with Multi point locking handle with key - Model no 610 KH at centre of the transom having a size of 110 x 27mm of approved make and shall be made out of aluminium die cast with powder coat finish - 65 microns, matching to the transom profile colour. Rate shall include the shutter frame as designed, EPDM gaskets, all hardware like hinge, stay and handle with key, fastening materials, all other necessary materials etc. Hinge shall have thermoplastic asymmetric end cap to ensure weather tight sealing at the ends. Rate shall not include cost of Glass, but include heavy duty self balancing stainless steel friction hinges with minimum 9 point locking of Model no SPT 26 of Securestyle (UK) or approved make with provision to hold open option to restrict the opening not more than 200 mm, vent locking accessories with Multi point lock cremone with key of Alualpha Model no 610 KH or approved equivalent with multi point locking mechanism with heavy duty spring mechanism to keep the vent weather tight.				

Sno	Description	Quantity	Unit	Rate	Amount
	K.Field Test: Conduct Field test, at site, on the installed glazing system, as per the creteria set out, in the specification of the external facade system, and as per the Methodology described in ASTM 501-2. Test shall be carried out, in the presence of Employer / PMC / Architect . Methodology for carrying out the test, shall be submitted to Architect , for approval, prior to testing. The results shall be recorded, and the reports shall be submitted to theEmployer / Architect, for approval. If Field test fails, contractor, shall submit the rectification methodology, to correct the defects, as per the performance data ,set out in the Specification of external facade system, and as per the methodology described, in the relavant code, for the approval of PMC / Architect .Defects, if any, noticed ,shall be rectified, to the satisfaction of Employer / PMC / Architect.				
	I. General Guideline : System design in total, including Aluminium extruded frames, type & thickness of Glass pane, Aluminium sleeves at connections, inserts, EPDM Gaskets, Adhesive tapes, Sealant, Supporting system / bracket including fastening and anchoring system & Materials specified in the schedule and the system details as shown in the tender drawing are only tentative and is meant to set out a general outline of the Proprietary system and minimum requirements / properties of the system and component parts.				
27	Providing & fixing Structural glazing with specified color anodized aluminium framing as per indicative drawing & approved fully detailed vendor shop drawing, in skylight comprising of triple glass, laminated as (8 mm master point clear float + 1.52 mm PVB film + 6 mm clear float + 1.52 mm PVB film + 6 mm clear float ), all glasses to be cut to perfect size & toughened fixed over the aluminium framing with structural silicon sealants of approved make approved EPDM seals edge flashings of anodized aluminium 3 mm thick all installation all scaffolding fixings to the walls and structural frame cleaning etc. complete assembly to be fully waterproof for rain, tested approved complete. Item to include preparation of shop drawing by the Contractor/Vendor & getting same approved by the Architects. All glazing cuts patterns & support points, and glazing slopes to be as per drawing or as approved. Item fully secure installed, cleaned complete.	40.00	Sqm		
	FLOORING WORKS				

Sno	Description	Quantity	Unit	Rate	Amount
28	Providing and laying vinyl tiles avg. 300 x 300 x 2 mm thick unless otherwise specified the flooring an approved colour (to be specified by the Engineer/Department's representative). Vinyl floor tiles or sheets shall be laid with an adhesive recommended by the manufacturer. All the preparation and work in connection with the laying and fixing of the specified flooring and vinyl skirtings shall be done and to the satisfaction of the Engineer/Department's representative The flooring shall where necessary, be cut and neatly fitted against adjoining floors thresholds, etc. including preparation and cleaning of base surface removal of laitance, rubbing, cleaning, tools & labour lift at all levels. etc. all complete as per Particular Specification and making mock-up for approval of Architect/Engineer incharge.	100.00	Sqm		
29	Providing the floor with polished Granite slabs of approved colour and size of 1200x600mm, 25 mm thick of Approved Make as per approved shade & code laid as per Design Drawing blemishless and clear without any spots or marks, laid on CM Bed Mortar 1:3 with thickness of 20 mm as approved with mortar overlay of White cement, levelled, aligned as per flooring layout drawing, fixed complete. Item to include getting dry mock-up approved from the Architects/Engineer incharge. Flooring area to include separate door threshold piece lined on both sides at flooring slab joints inserted flush with finished floor level, levelled complete. Item to include all Tools & Tackle, lift for all men, materials & implements to floors at all levels., masking neighbouring installations, cleaning complete with protective tarpaulin cover on finished installation till handover.	280.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
30	Providing and fixing avg. 20 mm(+/- 2mm) thk. Pre-polished Engineered Marble flooring installed size 1500 x 1500 of Approved Make as per approved shade & code laid as per Design Drawing blemishless and clear without any spots or marks, laid on CM Bed Mortar 1:3 with thickness of 20 mm as approved with mortar overlay of White cement, levelled, aligned as per flooring layout drawing, fixed complete. Item to include getting dry mock-up approved from the Architects/Engineer incharge. Flooring area to include separate door threshold piece lined on both sides at flooring slab joints inserted flush with finished floor level, levelled complete. Item to include all Tools & Tackle, lift for all men, materials & implements to floors at all levels., masking neighbouring installations, cleaning complete with protective tarpaulin cover on finished installation till handover.	500.00	Sqm		
31	Paving the floor with avg. 8 mm (+/- 1mm) thk. Pre-polished Vitrified tiles avg. 600 mm x 600 mm planar size as per approved shade/pattern, of approved Brand of best approved quality set in cement mortar 1:3 with 20 mm thickness (One cement and three sand) and pointed with equivalent tilemate (white cement mixed with colouring pigment using 0.40 Kg / M <sup>2</sup> ) including cutting for raceways junction boxes conduits etc., and neat finishing etc. complete as per standard specification. cleaning, making mock-up for approval of Architect/Engineer incharge, Item to include all Tools & Tackle, lift for all men, materials & implements to floors, protecting finished installation with POP layer till handover, with all cleaning complete etc.	300.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
32	Providing and fixing avg. 20 mm(+/- 2mm) thk. Pre-polished Engineered Marble flooring - For Toilet installed size 1500 x 1500 of approved Make as per approved shade & code laid as per Design Drawing, blemishless and clear without any spots or marks, laid on CM Bed Mortar 1:3 with thickness of 20 mm as approved with mortar overlay of White cement, levelled, aligned as per flooring layout drawing, fixed complete. Item to include getting dry mock-up approved from the Architects/Engineer incharge. Flooring area to include separate door threshold piece lined on both sides at flooring slab joints inserted flush with finished floor level, levelled complete. Item to include all Tools & Tackle, lift for all men, materials & implements to floors at all levels., masking neighbouring installations, cleaning complete; with protective tarpaulin cover to finished installation till handover.	35.00	Sqm		
33	Providing and fixing Vitrified tiles in skirting and dado of avg .size 300 x 200 mm (avg. 8 mm thk.) / finish/ shade and approved make over 12mm average thickness of cement mortar 1:3 (1cement : 3 coarse sand) with thickness of 12mm and pointing with specialised joint filler compound as approved ,all complete as per Particular Specification and as per direction of Engineer-in-charge / Architect, including all tools and tackle, men material lift upto all levels etc. finished and cleaned complete.	130.00	Sqm		
34	Providing and laying avg. 20 mm thick IPS finish Flooring proportion of 1:2:4 without any pattern marking on surface finished to line, level and plumb.complete as per Specifications and as directed. Unevenness in floor finish shall not exceed +2mm in one square metre area. including cleaning of base surface and removal of laitance, rubbing, cleaning,lead , lift at all levels, placing, and curing etc. all complete as per Particular Specification and as directed by Architect / Engineer incharge , Item to include all accessories, tools & labour, with all cleaning complete etc.	120.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
35	Providing & fixing 300mm high False Floor over existing RCC slab/flooring of support ,inclusive of support framework- avg. 600 x 600 sandwich cement tiles flooring encased in precoated MS sheeting of egg-crate type closed profile on the bottom & antistatic vinyl skin of approved micron thickness over flat precoated MS top sheet. Edge-to-edge flush tiles to be fixed on anti-corrosive MS Alloy pipe studs min. 25 mm dia. with receiving brackets, tie-members & bottom pressure pads of the same alloy material, bolted & fixed complete. support studs to be have height adjustable mechanism to an approvable range. Item to include trap door,all fabrication for steps or ramps in same material including treads and risers, all hardware, all accessories, tools, labour,lift at all levels. with all cleaning complete etc, installed complete as per standard specification. making mock-up for approval of Architect/Engineer incharge.	12.00	Sqm		
36	Granite cladding /sill piece- Cladding the vertical and cill portion of door and window avg. 450 mm wide pre-polished Natural Granite slab of approved colour/pattern avg. 20mm (+/- 2mm) thick of best approved quality and free from all defects and set in cement mortar 1:2 (One cement and two sand) avg. 15 mm thick, with GI holdfasts as approved. The joints shall be flush with faces of granite slabs and in line. The joints shall be pointed neatly with same colour pigment mixed with white cement of 1.80 kg/m2. The tiles so laid shall be supported with suitable arrangements for a period of 2 hours. The Granite slabs shall be got approved by the Architect/Engineer-in-charge before use in the work, etc., complete. The rate is including labour, all materials, scaffolding charges, hire charges for granite cutting machine, power consumption etc., all material lift at all levels., tools and tackle, item finished complete.Item to include getting mock-up approved by Architect/Engineer incharge.	110.00	Sqm		



Sno	Description	Quantity	Unit	Rate	Amount
37	Providing & laying Pre-polished artificial engineered quartzite marble platform for counter top basins of avg 750 mm wide,avg 20 mm thick(+/-2mm) with granite supports of avg 25 mm thick for vertical and kadappa of avg 25 mm thick below granite with necessary approved sealant as required as per the detail drawing etc., including avg. 32 mm fascia pattis and rounding or polishing the exposed edges as per drawing, cutting for for basin opening, sealing all crevices with silicon sealant, etc. complete.Item to include getting mock-up for approval by Architect /engineer incharge..(measurement shall be of top only for the complete item), Item include all men materials and lift at all levels and tackle/accessories etc. complete.	3.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
	INTERNAL AND EXTERNAL FINISHES				
38	Applying White washing three coats to ceilings to give an even shade conforming to IS-712 all as per Specification and as directed.item include all men materials and lift at all levels and tackle/accessories etc. complete.	600.00	Sqm		
39	Providing & applying approved brand & make Premium Acrylic putty over the substrate surface in min. 2 coats to build up thickness avg. 3-4 mm application on white cement surface coat over all before applying putty final thickness to achieve surface line level and plumb, all skilled labour, scaffolding, cleaning & providing mock-up for approval of the Architect, men material and lift at all levels., all required masking with min. avg. 8 mm wide masking tape, cleaned complete.	2700.00	Sqm		
40	Providing Two coats of 'Premier Acrylic Emulsion Paint' of approved make & colour/shade over a coat of water based primer including preparation of surface by thorough cleaning as per manufacturer's specification fully to give an even shade as approved and curing as per manufacturers specifications and as directed. Item to include all accessories, tools & labour, men material & Lift at all levels, scaffolding with all cleaning, depropping, clearing complete. Item to include getting mock-up for 2 sqm area approved by Architect/Engineer incharge.	2700.00	Sqm		
41	Providing Two coats of 'Premier Acrylic Exterior Emulsion Paint' of approved make & colour/shade over a coat of water based primer including preparation of surface by thorough cleaning as per manufacturer's specification fully to give an even shade as approved and curing as per manufacturers specifications and as directed. Item to include all accessories, tools & labour, men material & Lift at all levels, scaffolding with all cleaning, depropping, clearing complete. Item to include getting mock-up for 2 sqm area approved by Architect/Engineer incharge.	500.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
42	Providing & fixing Seamless ceiling with calcium silicate board of avg 10 mm thk. (finished thickness) using 8 mm thk. boarding material, fixed to the underside of the suspended grid formed of GI perimeter channel of avg. size 20x27x30mm fixed along the wall by TW Rawl plugs and Metal (Galvanised steel expansion) anchor bolts. The GI intermediate channel of avg. size 45x15x0.90 mm shall be fixed to the suspended strap hanger /GI ceiling angle at intervals not more than 1220mm. The suspended GI ceiling angle / strap hanger is to be connected with GI soffit cleat of size Avg. 37x27x25x1.6mm and it should be fixed on the roof slab/beam by using metal expansion fasteners (Wt.Type) of 12.5mm dia to a length of 35mm with 6mm dia.bolt / screw at top ends .	470.00	Sqm		
	The GI ceiling section of avg. size 80x26x0.5mm is to be provided across the intermediate channel at intervals not more than 600mm centres at bottom and the same shall be fixed by GI connection clips 2.64mm dia at the intercection points.The ends of ceiling section channel by adopting an overlap length of minimum 150mm connected with intermetiate channel shall be fixed to perimeter channel in insertion. Work to include making and finishing of recesses for lighting fixture, one coat of primer, two coats of Gypsum putty, three coats of acrylic emulsion paint, trap door of size avg. 600 mm x 600 mm Ready-made hard Gypsum board in Powder coated MS frame Type for service access, Al. powder coated HVAC grills as per approval by Architect Consultant, necessary coves, recesses as per design drawing, sealing the joints with Air Drying Jointing Compound or equivalent sealing materials, with flush bonded/ screwed securing of the hatch using a clip-lock mechanism that is integrated in the frame and concealed. Item to include all accessories, fitments, men & material & lift at all levels., correct installation procedure, necessary cutting in False ceiling strictly with unit templete and finishing, necessary scaffolding, cleaning etc complete. Item to include approval of mock-up by Architect/Engineer incharge.				

Sno	Description	Quantity	Unit	Rate	Amount
43	Providing and fixing Handrail with stainless steel pipe for staircase /ramp/ Entrance Step etc, at levels fabricated with 32mm dia - 1.63mm thick SS pipe as verticals bent to the shape and profile fixed to the required height as specified in the drawing at once in alternate steps.Top horizontal hand railing with S.S.pipe of 50 mm dia - 2.0 mm thick and 3 rows of horizontal intermediate pipe of 25mm dia - 1.63mm thick to be fixed to the verticals as shown in the drawing etc complete, as directed.Rate shall include for making pockets in existing RC / Masonry surfaces, fixing verticals with 185x75mm M.S.plate with 12mm dia Lugs so as to fix into the steps and grouting the pockets with CC 1:2:4 and make the surface to the original position, and necessary tools & Plants, Painting with 2 coats of Synthetic enamel paint over a coat of Zinc chromate primer for M.S. works. S.S.pipe shall be brushed finish and AISI 304 grade steel etc complete, as directed. Rate shall include necessary tools & Plants, Welding with consumables & buffing charges etc. complete as directed.	90.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
	JOINERY WORKS				
44	Colour anodised Aluminium Framed glazed doors	5.00	Sqm		
	Providing & fixing in position approved make glazed Door with Al. framing on all sides (stiles & rails) avg. 38 mm x 90 mm typ. section as approved & toughened clear float glass 6 mm x 2 nos. double glazed panels with sandwich clear lamination film 1.52 mm PVB film as approved. Al frame of artificially aged extruded profiles aluminium Material of grade EN AW 6063 T66 having tensile Strength 245 N/mm2, Surface Quality P6 C0 and variation in Straightness should not be more than 0.7 mm for 1 Mtr length as per detailed drawing or as directed. Item includes floor lock provision in shutter patch fitting as per drawing, & standard chrome plated top cover mechanical floor spring assembly mounted flush to floor of approved brand. All accessories, installation, testing and lift at all levels etc complete .Height made up of all matching sections S80 X 40 profile . All Mullions to travel above False Ceiling to fix & anchor with RCC slab.Upto 3 mtr.height made up of all sections S80 X 40 profile .				
	Hard Ware				
	Spindle and cover plate. The floor spring with backcheck and adjustable closing speed from 175°. Non-hold open. Finish: Satin stainless steel. = 2 Nos				
	Centre hung accessories for double action door Top centre two peices, bottom strap , for Aluminium door. Non handed. Mill finish = 2 Nos				
	Lever action flush bolt with 19mm projecting bolt L=172mm for Metal Doors in satin Chrome Finich = 2 Nos				
	Socket with 16mm dia hole, fully morticed on the floor. Satin stainless steel = 1 No				
	Narrow stile bolt lock with 30mm backset, 24mm sq. forend, prepared for euro profile cylinder including strike plate in satin stainless steel. - 1 No				
	S C type Pull Handle of Length 300mm, 25mm Diameter Suitable for Narrow Profile Doors with adjustable fixing for glass & aluminium Doors. Finish : SSS - = 2 Nos				
	Floor stop half dome with 45mm dia with fixing accessories, in satin stainless steel - = 2 Nos				

Sno	Description	Quantity	Unit	Rate	Amount
45	Solid core flush door with vision panel Providing and fixing approved quality factory made solid core flush door in single leaf / double leaf 38mm thick BWR anti termite treated type plywood with polished natural veneer surface on both sides , TW lipping on all edges of the door shutter 4mmthick, with 25mm thick ply panel core, BWR and anti termite treated. The door frame of 75 x 100 TW type to be fixed and integrated into Gyp-partition/local partition support frame by approved screws min. 90 mm long (TW Frame-GI Box stud joint). The TW frame top rail (at lintel level) to have avg. 100 mm horn projection on either side to anchor firmly on the local partition. including vision Panel of size avg. 300 x 600 (H) for doors using 6mm thick toughened clear float glass fixed to the door with rectangular section teak wood lipping as per the drawing inclusive of all walling holdfasts & horns, fixing implements, accessories installed finished and lift upto all levels etc complete.	35.00	Sqm		
	Hard Ware				
	2 bearing butt hinges size 4" x 3" x 3mm = 3 Nos / 6 nos				
	Lever handle , escutheion and spindle in satin stainless steel. Complete set including sash lock and EPC with both sides Key opeartion & fixing accessoreis.- 1 No				
	Cam action door closer with G-N slide channel arm for pull side fixing. Silver finish.- 1 No / 2 Nos				
	Floor stop half dome with 45mm dia with fixing accessories, in satin stainless steel- 1 No / 2 Nos				
46	Providing and fixing approved quality factory made solid core flush door in single leaf / double leaf 38mm thick BWP anti-termite treated type plywood with 1.5 mm thk. approved laminate surface on both sides, PVC edge binding on all edges of the door shutter 4mm thick, with 25mm thick ply panelcore, BWR and anti-termite treated. Item inclusive of all walling holdfasts & horns, fixing implements, accessories, men material and lift at all levels., installed finished complete.	60.00	Sqm		
	Hard Ware				
	2 bearing butt hinges size 4" x 3" x 3mm, - 3 Nos / 6 nos				
	Dead lock - 55mm backset, 20mm square forend prepared for euro profile cylinder including strike plate. and EPC 60mm Length both side key operation & Escutcheons in SSS Finish-1 No				

Sno	Description	Quantity	Unit	Rate	Amount
	Pull Handle back to back with adjustable fixing for glass, wood and metal doors in satin stainless steel. The pull handles should have supporting washer with raised bevelling on the outer surface. Length =300mm, 22mm dia, - 1 No / 2 Nos				
	Concealed cam action door closer slide channel arm with standard spindle, including cushioned limit stay. Silver finish. Non-handed version- 1 No / 2 Nos				
	Floor stop half dome with 45mm dia with fixing accessories, in satin stainless steel - 1 No / 2 Nos				
47	Providing and fixing aluminium fixed cum Casement windows with part openability fabricated as per drawing and fixed at all levels, elevations and heights having a main frame work of vertical and horizontals, out of specially designed approved extruded sections to withstand the designed wind pressure of 150 Kg/Sqm and loads. All aluminium sections shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating conforming to IS 1868 of approved colour. Rate shall include to fix the main frames into masonry wall / RC concrete surface with necessary clamps, fastening straps, nuts, bolts, rivets, washers and other fastening materials shall be in stainless steel or aluminium as approved by Architect. The section unit weight per running metre is subjected to tolerance on the wall thickness as per IS 6977/ Equivalent BS. The sizes and dimensions are subject to slight variations and for which no extra payment will be paid. Window shutter shall be provided with 5+8+5 mm DGU with desiccant filled 8 mm thick non-corrosive micro-perforated spacer sandwiched between 2 toughened float glass panes each 5 mm thk. thick toughened glass using tinted glass as approved. Clear float Glass of approved make, as per design for all panels and with snap fit aluminium colour anodized beading with special water proof cascades, Neoprene etc. complete, as directed. Necessary silicone-based weather sealant as per approved make shall be provided at the junctions between wall and main frames. Item finished complete with all integrated handles, stays, clip-locking mechanisms etc. as approved, men material etc. lift upto 11 mts from FGL, item finished cleaned complete ensuring all requisite air-tight behaviour of system in closed/shut position.	145.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
	Design features to ensure:- Avg. shutter Stile depth to be 60 mm, avg. frame depth upto 90 mm. Resistance to driving rain- class 5A as per DIN EN 12208. The outer frames to be mitred, openable vent frames to be square cut, and all frame connections to be made with precision corner cleats. Units to have a continuous Al. based drip mould outside on top. Outer frames on cill piece to have enclosed hollow chamber within extruded profile to optimise water drainage. Glazing fitment in frame/shutter stiles & braces to be through hidden 'u' type glazing gasketssitting within extruded housing. To provide 2-point locking and internal Al. window handles as approved. Item to include making a mock-up for one complete window opening in wall, using Al. extrusions approved by Architect and as per approved make list.				
48	Providing and fixing aluminium glazed ventilators with fixed glass louvers with suitable mechanical system to operate the Louvers and fabricated as per drawing and fixed at all levels, elevations and heights having a main frame work of vertical and horizontals, out of specially designed approved extruded sections to withstand the designed wind pressure of 200 Kg/Sqm and loads. All aluminium sections shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating conforming to IS 1868 of approved colour.Rate shall include to fix the main frames into masonry wall / RC concrete surface with necessary clamps, fastening straps, nuts, bolts, rivets, washers and other fastening materials shall be in stainless steel or aluminium.The section unit weight per running metre is subjected to tolerance on the wall thickness as per IS 6977/ Equivalent BS. The sizes and dimensions also are subject to slight variations and for which no extra payment will be paid.	30.00	Sqm		
	MISCELLANEOUS WORKS				



Sno	Description	Quantity	Unit	Rate	Amount
49	FRP Vapour Barrier- Providing and laying with approval of Site-in-charge/Architect avg. min. 0.8 mm thk. plain & flat-surfaced Fibre-glass barrier sheet in and along RCC wall with epoxy resin adhesive pasting of sheet-to-sheet overlaps, each lap min. 150 mm on both axes. Item to be inclusive of all accessories, cover-blocks/GI Stays, binding wire, recommended epoxy resin for any surface mount, surface cleaning of FRP sheet with alkali/detergents, all men, material, lift to specified site and height upto 11 mts. from site ground level, item casted complete.	1000.00	Sqm		
50	Providing and fixing, in position single component, SS Wall holdfasts of 316 grd., avg. 2.5 mm thk. 32 mm wide 100 mm long strips embedded in and spanning inner wall-to-outer wall, twisted at the centre to form drip mould within the drain gap. Installation of holdfast units to be 5 nos./sq.mt. in equal dimensional distribution; end arms of holdfast to be embedded in concrete on one side and the bed mortar of the stone masonry frog on other side. Item to be inclusive of all accessories, men material and lift upto 11 mts. from site ground level, item casted/anchored complete.	880.00	Nos		
51	Making Core Cutting in slabs / beams / retaining walls and any other R.C members to any dia & depth by using 'HILTI' make diamond drilling machine with tolerance for any type of inserts, anchor fasteners etc. rate shall include for all charge, preparation of surface, cutting of reinforcement, cleaning the surface, staging, scaffolding application of necessary chemical / foil (HAV) as per manufactures specification with necessary tools and equipments water and power, removal of debris from the site, staging scaffolding etc complete, as directed.				
a	100 mm Depth	30.00	Nos		
b	150 mm Depth	30.00	Nos		
c	200 mm Depth	30.00	Nos		
	PLUMBING AND SANITARY WORKS				
52	Providing fixing Offwhite/ Ivory Constalation type glazed earthenware europion Water closet pan of Approved make Offwhite/ Ivory Colour PVC seat and cover of Commander make, PVC flush tank of max. 5 litres providing & fixing hidden flat oil painted MS bracket, cutting, grooving making good the walls, providing and fixing of Grab rails with necessary fittings etc complete. as approved by Architect / Engineer - in - charge, men material and installed complete.	10.00	Nos		

Sno	Description	Quantity	Unit	Rate	Amount
53	Providing & fixing first quality white vitreous china oval / round / square wash basin (size as per architectural drawing) for under counter mounting, specially fabricated CI / MS brackets, painted with two or three coats of enamel paint of approved shade over a coat of primer, 32 mm CP brass waste and CP brass cast bottle trap and pipe to wall with CP brass flange and rubber adopter for waste connection complete including filling gap between counter and wash basin with approved type poly sulphide sealant, cutting and making good the walls wherever required. Item to include getting for approved by Architect/Engineer incharge. Item to include all fixing accessories, men material and installed complete.	10.00	Nos		
54	Providing & fixing C.P. Stainless grating (Nirali) with Nahani trap either round or square including frame with fixing on tiles/granite etc. complete as approved by Architect / Engineer-in-charge. Item to include all fixing accessories, men material and lift all levels., installed complete.	10.00	Nos		
55	Providing and constructing S.W. Gully traps of size 150mm x 100mm in cement concrete 1:4:8 outside the building including heavy C.I. grating over the gully trap weight of cover to be 7 kg & constructing B.B. Masonry chamber, 300 x 300mm nicely finished with 1:3 C.M. from inside & outside C.I. hinged cover of size 300 x 300 with frame etc. complete as approved by Architect/Engineer-in-charge. Item to include all fixing accessories, men material and lift all levels., installed complete.	10.00	Nos		
56	Providing and constructing B.B. Masonry chamber of suitable size with cement concrete bedding 150 mm thick in cement mortar outside the B.B. masonry (230 mm) in cement mortar 1:6 and benching from inside with 1:2:4 C.C. and plastering with cement mortar 1:3 from inside and outside and fixing air tight RCC covers of following sizes Pratibha make including curing etc. complete as per direction of the Architect. Weight of cover to be 100 kg. suitable for following sizes of inspection chambers.				
a	600 mm x 600 mm	5.00	Nos		
b	600 mm x 900 mm	5.00	Nos		

Sno	Description	Quantity	Unit	Rate	Amount
57	Providing and lowering , laying including supply of materials and labour for RCC NP2 class spun (HUME) pipe of standard make including jointing with collars with hemp yarn, hot bitumen, sand, cement mortar (1:1) etc. complete including giving satisfactory hydraulic test and works to be executed as per ISS complete as per the direction of project engineer including excavation in all types of soil / hard rock and refilling of trenches in 150 mm layers with proper compaction and dewatering if required etc. including PCC bedding of 150mm thick below pipe, encasing of pipe etc complete.				
a	150 mm dia.	250.00	Rmt		
b	300 mm dia.	250.00	Rmt		
58	Providing and fixing CPVC (Chlorinated Poly Vinyl Chloride) water supply pipes with pipe as per CTS SDR 11 (operating pressure - 7 Bar @ 82 Deg C and 28 Bar @ 23 Deg C) for pipes from 1/2 Inch to 2 Inch. Schedule 40 Pipe to be used from 2-1/2 Inch to 6 Inch. Pipes shall be joined using solvent welded CPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings (connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2846. ASTM F441 with only CPVC solvent cement conforming to ASTM F-493.				
a	20 mm dia.	250.00	Rmt		
b	25 mm dia.	250.00	Rmt		
59	Providing and fixing CPVC (Chlorinated Poly Vinyl Chloride) pipes with pipe as per CTS SDR 11 (operating pressure - 7 Bar @ 82 Deg C and 28 Bar @ 23 Deg C) for pipes from 1/2 Inch to 2 Inch. Schedule 40 Pipe to be used from 2-1/2 Inch to 6 Inch. Pipes shall be joined using solvent welded CPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings (connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2846. ASTM F441 with only CPVC solvent cement conforming to ASTM F-493.				
a	100 mm dia	250.00	Rmt		
b	150 mm dia	250.00	Rmt		

Sno	Description	Quantity	Unit	Rate	Amount
60	Providing and fixing PVC pipe (6 Kg/sqcm) of 110mm dia below and approved make as rain water down take pipe with all specials, accessories and joints with solvent cement solution according to manufacturer's specification.complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.	300.00	Rmt		
61	Providing and fixing C.I. Cowl with lead joints for the following pipes.complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.	4.00	Nos		
62	Providing and fixing Brass Heavy duty Ball cock for UGR / OHT as indicated in the drawings and as per instructions of engineer in charge.complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.				
a	25 mm dia.	8.00	Nos		
b	32 mm dia.	8.00	Nos		
c	40 mm dia.	6.00	Nos		
63	Providing & fixing 15mm dia C.P.Two Way bibcock of approved make with C.P. Wall flange with 15mm C.P. connector pipe for ablution with health facuat of approved make Make etc.complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.	10.00	Nos		
65	Providing & fixing 15mm dia C.P. Sink Cock of approved make with C.P. wall flange with 15mm C.P. inlet connections for sinks etc. complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.	10.00	Nos		
65	Providing & fixing 15mm dia C.P. angle cock of approved make with C.P. wall flange & also 15mm C.P. connector pipes from Angle Stop cock to CP fixture etc. complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.	12.00	Nos		

Sno	Description	Quantity	Unit	Rate	Amount
66	Providing & fixing C.P.Toilet paper holder of approved make continental range as per instructions of engineer in charge etc. complete as approved by Architect/Engineer-in-charge.Item to include all fixing accessories,men material and lift all levels., installed complete.	9.00	Nos		
67	Providing & fixing 15 mm dia C.P. towel Rod 24 for wash hand basin of approved make etc complete.as approved by Architect/Engineer-in-charge,Item to include all fixing accessories,men material and lift at all levels., installed complete.	9.00	Nos		
68	Providing & fixing soap Dispenser of approved make as per instructions of engineer in charge etc. complete,Item to include all fixing accessories,men material and lift at all levels., installed complete.	9.00	Nos		
69	Providing & fixing Hand Drier of approved make as per approved by Architect/Engineer-in-chargecomplete.Item to include all fixing accessories,men material and lift at all levels., installed complete.	9.00	Nos		
70	Providing & fixing CP metal Coat hook of approved make and approved finish as approved by Architect/Engineer-in-charge complete.Item to include all fixing accessories,men material and lift at all levels., installed complete.	9.00	Nos		
71	Mirrors in Toilet- Providing and Fixing Mirrors in toilet, homogenous piece 5 mm thick faultless Float glass mirrors of approved source glass. Mounted with approved 316 grd. SS Studs on 12mm thick Marine grade BWR & AT rated plyboard backing of Century Ply or equi., entire assembly mounted over specified glazed vitrified tile Dado to locations as per drawing and approval. Plyboard edges to be sealed with min. 4 mm thick TW lipping AT treated and clear matt PU finished; and glass edges to be avg. 2.5 mm bevelled & grinded finished smooth. Exposed SS mounting studs on face of glass to be of brushed steel/Butler finish. Item to include all fixing hardware & accessories as approved, and a single unit mock-up for approval of the Architects. Item to be mounted, cleaned finished complete to correct line, surface level and plumb; and inclusive of all men, material finished item suitably protected till handover.	10.00	Sqm		

Sno	Description	Quantity	Unit	Rate	Amount
72	Providing & fixing Stainless steel kitchen sink of approved make, 32 mm bottle trap with 300mm long wall connection pipe of approved make & CP waste coupling over the kitchen platform including providing and fixing G.I. waste pipe of 32mm dia 'C' class Approved make below the sink upto Nahani trap through required fixing arrangement like Jam nut etc. complete as per the direction of the Architect/Engineer in charge. Item to include all fixing accessories, men material installed complete.	1.00	No		
73	Providing & fixing mixer with shower arm with telephonic shower of approved make as per instructions of engineer in charge etc. Item to include all fixing accessories, men material installed complete.	1.00	No		
74	SINTEX tank- .Providing and laying on conc. Pedestals to lift of avg. 11 mts. From FGL on terrace level; HDPE hygienic Water storage tank with tank-hole and cover/cap; of select approval to Brand and brand-specific manufacturer's specifications to be accorded by Architect/engineer-in-charge; tank to be of white finish colour. Item to include all men, material lift upto 11 mts., all installation accessories, cleaned installed complete with all water retention guarantees, item installed complete.	10000.00	Lit		
	TOTAL				

<b>Project : HIGH ALTITUDE LAB,IITM</b>		
<b>CLIENT:-Indian Institute of Tropical Metrology</b>		
<b>WORK:-INTERNAL &amp; EXTERNAL ELCTRICAL WORK OF HIGH ALTITUDE LAB MAHABALESHWAR</b>		
Description	Supply	Installation
	Amount (Rs)	Amount (Rs)
<b>HT Part</b>		
<b>1 SECTION - I : 22 kV HT Work &amp; Substation</b>		
<b>LT Part</b>		
<b>2 SECTION - I : LV Panels &amp; Distribution Boards</b>		
<b>SECTION II : L.V. Cables.</b>		
<b>5 SECTION III : Earthing &amp; Lightning Protection</b>		
<b>SECTION IV : Point Wiring &amp; Fixtures</b>		
<b>8 SECTION V: UPS MAINS / SUBMAINS WIRING &amp; TELEPHONE</b>		
<b>9 SECTION VI : External Lighting</b>		
<b>TOTAL AMOUNT -</b>		
<b>VAT@5%</b>		
<b>VAT@12.5%</b>		
<b>Service Tax @ 10.3%</b>		
<b>Other taxes if any</b>		
<b>FINAL VALUE (Supply + Installation) Without Taxes</b>		-

**Note:-**

HT WORK							
Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
	<b>SECTION - I</b>						
	<b>HT &amp; SUBSTATION</b>						
1	Supply, Installation of 22 kV, 2 pole structure complete with Erection of RSJ 152 x 152 mm 13 mtr long pole, 300 x 300 x 6mm base plate excavation of pole pits along with foundation with M 20 concrete, 300mm high pole coupling above ground level, providing & fixing of necessary support channels ISMC100 for mounting of equipments like 22 kV PIN / post Insulators, 30 kV L.A., GOD, D.O. and receiving cable/ HT overhead line, including clamps (50x6mm MS ) GI / plated nut bolts & hardware, supply, erection of necessary H.T. stay sets, danger board & painting of poles & associated structure with 2 coats of red oxide and 2 coats of silver paint & any other item required to complete the task. Work should be done as per MSEDCL's/ Supply authority requirements/ guidelines. (Spare)	Set	1				
2.0	Supply, Installation, testing, Commissioning of 22 kV equipment on above 2 pole structure with all necessary clamps, plated hardware etc. to complete the task.						
2.1	Supply, Installation, Testing, Commissioning of 22 kV, 400 Amp vertical type 3 stacks per pole GOD set with lockable handle.	Set	1				
2.2	Supply, Installation, Testing, Commissioning of 22 kV, 25 Amp vertical type drop out fuse set, with fuse element of suitable rating.	Set	1				
2.3	Supply, Installation, Testing, Commissioning of 30 kV Lightning Arrestor Station class type (Set includes One LA for Each phase)	Set	1				
2.4	HT Earthing	Set	2				
3.0	Supply, testing, tagging, laying, & commissioning of following 22 kV grade XLPE cable including excavation of in all types of strata upto 1000mm deep except hard rock, sand cushioning of 75mm, laying bricks on both sides of cable & covering with RCC / PCC tiles or half round hume pipe of 200 mm dia. and refilling of cable trench, leveling of cable trench etc. as required. <b>(Note: Quantity is tentative as MSEDCL tap of point is not decided)</b> , (Only Hard rock excavation shall be measured separately).(Round Armour type of Cable)						
3.1	3C X 150 Sq.mm. HT XLPE Cable.	Rmt	180.00				
4.0	Supply, installation, testing & commissioning of heat shrink jointing for 22kV cables of following sizes including necessary accessories, spider supports, plated hardware like lugs / ferrules, insulation tapes etc. complete. Standard make. Scope also includes making suitable cutouts in gland plate & sealing them after connections.						
4.1	3C X 150 Sq.mm. HT XLPE Cable.						
4.2	Straight through Joints	Set	UR				
4.2	Outdoor End Termination.	Set	1.00				
4.3	Indoor End Termination.	Set	7.00				

Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
5.0	Supply, Installation, testing & commissioning of 22kV compact indoor type Metering Kiosk mounted on plinth with necessary supporting structure consisting of 50/5A Class 1 accuracy duly tested CT, PT 22kV/110V Class 1, units with Provision for installation of Electronic Time of Day metering system as per MSEDCL requirements, metering instruments, CT PT units should be duly tested for calibration and Class 1 accuracy of suitable ratio.	Set	2.00				
6.0	Supply, installation, testing & commissioning of MSEDCL approved and duly tested Electronic TVM / TOD meter of appropriate Class and accuracy. (As far as possible the meter should be obtained from MSEDCL)	Set	2.00				
7.0	Supply, installation, testing & commissioning of 22kV, free standing, dust and vermin proof metal enclosed, breaker panel SF6 / VCB with built in control supply arrangement, necessary CT, PT units, Digital meters, indications and protection system consisting of EF & OC relays, Aux. relays, master trip relay, antipumping relay trip circuit supervision relay and any such relays required for protection functions, window annunciation etc. as per specifications.						
7.1	22kV, 630A, 25kA Single VCB Outdoor HT Breaker Panel Non Extensible type including Power Pack as per specifications , Data sheet and SLD (At metering Station )	Set	1.00				
8.0	Supply, Erection, Testing and Commissioning of 1 No. 22kV / 0.422kV, 500 kVA, Dyn 11, 5.0% Impedance, Oil Insulated Transformer with OCTC and all accessories complete on readymade plinth, Scope shall includes unloading shifting from stores to plinth and BDV test & topping up of fresh transformer oil as per requirement to complete the task.If required filtration of oil .	Set	1.00				
9.0	Supply, Loading, Unloading, Erection, Testing and Commissioning of 250kVA, 415V DG Set with AMF cum synchronisation Panel.	Set	1.00				
10.0	Electrical Inspector's approval for above 250kVA DG Set & NOC from Pollution Control Board, Local authorities, etc.	Job	1.00				
11.0	Providing Chainlink Fencing with 10SWG, 1.5" Chainlink jali with 50 x 50 x 6 mm M.S. Angle supports at proper intervals (@2.0m C/C). Fencing height should be 2.4M above Ground Level. The rate shall be inclusive of 1No.3M wide,double leaf gate made out of 40mm dia., 2mm thk. MS pipe with proper channel supports and 1.2M wide single leaf gate same as above gate etc.complete including painting with 2 coats of red oxide primer & 2 coats of silver paint.  ( Total perimeter of fencing 50 mtrsq ). (Spare)	Job	1.00				
12.0	Supply, laying of following different types of Route markers for road crossing for electrical, telephone cables etc. complete as required including excavation of trench in all types of strata except hard rock and refilling, leveling of trench, shifting of extra earth or debris to dump yard complete as required.						
12.1	HT	Nos.	10.00				
12.2	LT	Nos.	10.00				
12.3	Supply and fabrication of M.S. angle / channel supports for trays, frames etc. including necessary painting with 2 coats of primer and 2 coats of enamel black paint.	Kg.	UR				
13.0	Liaison with Electrical Inspector for approval of substation and MSEDCL for load sanction / load release / Commissioning of substation including submission of drawings to the respective authorities, arranging site visit of respective authorities for inspection, etc. complete as required.						
13.1	Load Sanction,Electrical inspectors approvals for drawings, site visit and Charging permission, MSEDCL testing etc.	Job	1.00				
14.0	Supply, installation, material equipment required as per statutory provision & safety.						
14.1	22kV grade Rubber mat 1000 mm width.	Mtr	10.00				
14.2	22kV class Hand gloves.	Nos	4.00				
14.3	22kV Danger boards of appropriate size & marking.	Nos	10.00				
14.4	Fibre Glass Earthing Rod	Nos	3.00				
14.5	First Aid Box	Nos	2.00				
14.6	Laminated First aid chart with frame.	Nos	1.00				
14.7	4.5 Kg fire extinguisher	Nos	2.00				
14.8	9 Kg fire extinguisher	Nos	UR				
14.9	Fire Buckets with stand 04 Nos. of Buckets filled with Fine Sand	Nos	2.00				
<b>TOTAL OF SECTION - I</b>							



Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
	LT WORK						
	SECTION - I : LV Panels & Distribution Boards						
1.0	Supply, Installation, testing & commissioning of LV panel boards compartmental cubicle type freestanding with appropriate cable entries, front operating, front maintained wherever required complete with base frame etc. as required and as per IS 8623 specifications. Panel has to be fabricated out of 14 / 16 SWG CRCA sheet, and surface treated with phosphating seven tank process and duly powder coated with RAL 7032 or any approved color. (Refer Single Line Diagram vide drg. no.1_702_AB_MSLD_00 for Switchgear and other details).						
1.1	Main LT Panel	Set	1.00				
1.2	SLDB (External Lighting)	Set	1.00				
1.3	175 kVAR RTPFC Panel With 7% detuned reactor with thyrister switch	Set	1.00				
2	Supply, installation, testing, tagging, (Circuit numbering) and commissioning of following double door readymade recessed type MCB, DB, fabricated out of CRCA sheet and painted with powdercoating process OR made out of scratch proof polycarbonate body, and concealed in wall or on surface with necessary frame complete as required.						
2.1	12 way SPN DB with 25A, DP RCBO as incomer & 10A SP MCB 10 Nos as outgoing as per SLD (LDB-1,2 & 3)	Nos	3.00				
2.2	12 way SPN DB with 32A, DP MCB as incomer & 10A SP MCB 8 Nos as outgoing as per SLD (ELDB-1,2 & 3)	Nos	3.00				
2.3	8 way TPN DB with 63A, TP MCB as incomer & 16-20A SP MCB 24 Nos as outgoing as per SLD (PDB-2,PDB-4,PDB-5 )	Nos	3.00				
2.3	12 way VTPN DB with 100A, TPN MCCB as incomer & 32A TP MCB 12 Nos as outgoing as per SLD (PDB-3) .	Nos	1.00				
2.4	12 way VTPN DB with 100A, TPN MCCB as incomer & 20A SP MCB 24 nos & 32A TP MCB 4 Nos as outgoing as per SLD (PDB-1).	Nos	1.00				
2.5	4 way VTPN DB with 63A, TP MCB as incomer & 32A TP MCB 4 Nos as outgoing as per SLD (UPSDB) .	No	1.00				
2.6	4 way TPN DB with 63A, TP MCB as incomer & 20-25A SP MCB 12 Nos as outgoing as per SLD (MAIN INVERTER DB)	No	1.00				
2.7	4 way tpn DB with 40A FP 100mA RCBO as incomer & 20A SP MCB as outgoing. As per SLD ( AC DB)	No	1.00				
3	Supply, fixing, testing, of good quality industrial sockets with MCB's or MCB isolators of different ratings in readymade IP 55 metal enclosure. Box should be suitable to terminate cables / wires easily, complete as required.						
3.1	20A 1Ø, 2P+E, Socket with 20A SP MCB in a Readymade Box.	No.	10.00				
3.2	32A, 3Ø, 3P+N+E, Socket outlet with 32A TPMCB in readymade metal enclosure.	No.	6.00				
3.3	40A TP MCB with enclosure (UPS & Inverter)	Set	4.00				
4	Supply, fixing, testing, of good quality industrial interlocked switched sockets with MCB's of different ratings in readymade IP 65 metal enclosure. Box should be suitable to terminate cables / wires easily, complete as required.						
4.1	20A 1Ø, 2P+E Socket with 20A SP MCB in a Readymade Box IP65 .	No.	5.00				
4.2	32A, 3Ø, 3P+N+E, Socket outlet with 63A TPMCB in readymade metal enclosure IP65.	No.	5.00				
	TOTAL : SECTION - I						
	SECTION II : L.V. Cables.						
1.0	Supply, Installation, Testing and Commissioning of 1100V grade L.T. XLPE/ PVC insulated multistrand Al./ Cu. conductor cables on provided prefabricated trays/ pipe/ in trenches with necessary clamps, identification tag. & all other items required to complete the task. (Actual cable lengths shall be measured at site prior to procurement.)						
1.1	3.5C x 300 Sq.mm. A2XFY cable.	Rmtr	UR				
1.2	3.5C x 240 Sq.mm. A2XFY cable.	Rmtr	310				
1.3	3.5C x 185 Sq.mm. A2XFY cable.	Rmtr	UR				
1.4	3.5C x 50 Sq.mm. A2XFY cable.	Rmtr	60				
1.5	3.5C x 35 Sq.mm. A2XFY cable.	Rmtr	UR				
1.6	4C x 25 Sq.mm. AYFY cable.	Rmtr	150				
1.7	4C x 16 Sq.mm. AYFY cable.	Rmtr	60				
1.8	4C x 10 Sq.mm. AYFY cable.	Rmtr	50				
1.9	4C x 6 Sq.mm. YWY cable.	Rmtr	50				
1.10	4C x 4 Sq.mm. YWY cable.	Rmtr	UR				
1.11	4C x 2.5 Sq.mm. YWY cable.	Rmtr	UR				
1.12	3C x 2.5 Sq.mm. YWY cable.	Rmtr	550				
1.13	3C x 4 Sq.mm. YWY cable.	Rmtr	200				
1.14	3C x 2.5 Sq.mm. AYFY cable.	Rmtr	UR				
1.15	1CX 10 Sq.mm. YY Including End Termination	Rmtr	100				

Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
2.0	Supply & installation of End termination for cables as above with Brass, heavy duty, Single compression glands, Al/ Cu lugs, other consumable like insulation adhesive tape, crimping, gland hole drilling, ferrulling, marking, etc.						
2.1	3.5C x 300 Sq.mm. A2XFY cable.	Nos.	UR				
2.2	3.5C x 240 Sq.mm. A2XFY cable.	Nos.	30				
2.3	3.5C x 185 Sq.mm. A2XFY cable.	Nos.	UR				
2.4	3.5C x 50 Sq.mm. A2XFY cable.	Nos.	4				
2.5	3.5C x 35 Sq.mm. A2XFY cable.	Nos.	UR				
2.6	4C x 25 Sq.mm. AYFY cable.	Nos.	6				
2.7	4C x 16 Sq.mm. AYFY cable.	Nos.	4				
2.8	4C x 10 Sq.mm. AYFY cable.	Nos.	4				
2.9	4C x 6 Sq.mm. YWY cable.	Nos.	2				
2.10	4C x 4 Sq.mm. YWY cable.	Nos.	UR				
2.11	4C x 2.5 Sq.mm. YWY cable.	Nos.	UR				
2.12	3C x 2.5 Sq.mm. YWY cable.	Nos.	70				
2.13	3C x 4 Sq.mm. YWY cable.	Nos.	6				
2.14	3C x 2.5 Sq.mm. AYFY cable.	Nos.	UR				
3.0	Supply & installation of readymade hot dip GI. perforated type tray, including readymade accessories e.g. vertical & horizontal bends, reducers,couplers,Tee's, right angles etc.(Ref Layout)						
	Supplying and installing following size of perforated pre-painted M.S. cable trays with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with M.S. suspenders including bolts & nuts, painting suspenders etc as required.						
3.1	50mm, 50x50 perforated tray. (16 SWG)	Rmtr	60				
3.2	100mm, 50x50 perforated tray. (16 SWG)	Rmtr	30				
3.3	150mm, 50x50 perforated tray. (16 SWG)	Rmtr	30				
3.4	200mm, 50x50 perforated tray. (16 SWG)	Rmtr	30				
3.5	300mm, 50x50 perforated tray. (16 SWG)	Rmtr	25				
3.6	450x50x50 MM. LADDER CABLE TRAY	Rmtr	25				
4.0	Supply and installation of readymade hot dip GI tray covers 16/18 SWG including readymade shape of Vertical & Horizontal Bend, Tee's, Right angles etc. to suit tray for all vertical runs.						
4.1	50mm perforated tray.	Rmtr	UR				
4.2	100mm perforated tray.	Rmtr	25				
4.3	150mm, 50x50 perforated tray. (16 SWG)	Rmtr	UR				
4.4	200mm, 50x50 perforated tray. (16 SWG)	Rmtr	UR				
4.5	300mm, 50x50 perforated tray. (16 SWG)	Rmtr	UR				
5.0	Excavation of cable trenches upto a depth of 1200 mm maximum and refilling, reinstating the material after cable laying complete including providing crown and disposing, spreading material within 500 mtrs.						
7.0	Supply and Fabrication of M.S. angle/ Channel/ Square tube of 3mm thick of 50x50mm size including base plates supports as per requirement (Duly approved by AEPPL and Client) for trays, frames etc. including necessary painting with 2 coats of primer and 2 coats of enamel black paint.	Kg.	1000				
<b>TOTAL : SECTION II</b>							

Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
	<b>SECTION III : Earthing &amp; Lightning Protection</b>						
1.0	Supply & making following Earthing station as per IS 3043 by using GI plate / Cu. plate / Pipe earthing as electrode complete with watering pipe, 50 x 6 mm connecting GI strip up to chamber, soil treatment with charcoal & salt / bentonite powder brick inspection chamber of suitable size with 450 x 450 mm, CI cover, disconnecting link complete, including excavation of earth pit in all type of strata, refilling as detailed below.						
1.1	Earthing station as above but using 600 x 600 x 6 mm. GI. Plate as electrode complete.	Nos	14				
1.2	Earthing station as above but using 600 x 600 x 3 mm. Cu. Plate as electrode complete.	Nos	18				
1.3	Earthing as above but using maintenance free earth electrode with chemical treatment 3mtr. long "Ashlok" CAT NO. T39 / Alltec / UES make or equivalent. Including boring of hole upto 6.5 mtrs. in all types of strata as required.	Nos	UR				
2.0	Supply, installation, testing of GI/ Cu. earthing strips & wires in ground at a depth of 600 mm. or in ready made trenches or on ready tray with necessary clamps & bimetallic strips as per specification. (excavation required for this will be ensured separately.) Refer layout & tender spec for various applications						
2.1	50 x 6 mm. GI strip.	Rmtr	250				
	32 x 6 mm. GI strip.	Rmtr	250				
2.2	25 x 6 mm. GI strip.	Rmtr	50				
2.3	25 x 3 mm. Cu. strip. Supported on Porcelain insulator/ J bolt at every 1.5 mtr interval for building L.A.	Rmtr	100				
2.4	25 x 3 mm. Cu strip.	Rmtr	295				
2.5	32 x 6 mm. Cu strip.	Rmtr	150				
2.6	8 SWG GI Wire.	Rmtr	300				
2.7	6.0 sqmm Cu. Cond. PVC insulated.	Rmtr	UR				
2.8	4.0 sqmm Cu. Cond. PVC insulated.	Rmtr	UR				
3	<b>Conventional Lightning Protection system Level - III (15x15 Mtr) As per IEC 62305 Part-III</b>						
	<b>The rate includes necessary connected minor civil works if required and necessary supports as required at site. No extra payment will be made for the same. OBO make or equivalent conventional lightning arrester with the following items</b>						
3.1	Design & Supply of Air Termination Lightning arrester compliance with IEC 62305 / IS 2309/ IS 3043 .The Horizontal air termination has to be connected for a grid size of 15mX15m .The components of the Airterminal System are :						
	8 mm Aluminum Round Conductor with a minimum cross sectional area of 50mm <sup>2</sup> and compliant with IEC 62305 as horizontal air terminal	Rmtr	350				
	Holder for 8 mm Aluminium conductor, suitable for double conductor holding, outer diameter not less than 135mm and height 75 mm.	Nos	85				
	Cross connector to be provided at every crossing of aluminium conductor .	Nos	53				
	Expansion Pieces for equalising temperature-related length changes, necessary on conductor length at every 20 metre .	Nos	7				
	Connector for expansion piece.	Nos	14				
3.2	The down conductor should be clamped to the wall at an interval of maximum 1000mm.						
	Down Conductor Holder for parapet and wall	Nos	308				
	Down Conductor Holder for flat	Nos	45				
3.3	A test clamp should be installed so that the down conductor may be disconnected from the earth termination for regular checks of the earth termination resistance value.						
3.4	Ring Earthing made of 30*3mm GI of 70 micron Zinc coating and comply with IEC 62305						
	30*3 mm GI Flat Conductor	Rmtr	50				
	Connector for GI Flat Conductor	Nos	18				
	Saddle Clamp	Nos	15				
	Interception Rod, made up of aluminium, 2 M long,suitable of withstanding high winds .	Nos	6				
	Stand for fang fix, consists of Fangfix stone with base and clamp. Diameter not less than 370 mm.	Nos	6				
	Corrosion Proofing Band	Nos	4				
	Glue	Nos	4				

Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
	<b>END OF LIGHTNING PROTECTION SYSTEM</b>	SET	1				
4.0	Surge Protection Device (previously called as TVSS) connected in the mains power supply, needed to protect the electrical and electronic equipment, should be able to withstand 100 KA (10/350msec). As per IEC 62305-1, LPL 1 (Lightning Protection Level) maximum expected lightning current is 200 KA. As explained in IEC 62305, 100 KA will be dissipated in earth and the balance 100 KA will reach the electrical supply lines. Power Line SPD's are to be connected at the mains incoming panel and in addition Distribution Boards which are more than 15 meters away from the incoming panel. DB's which are feeding power to critical and sophisticated electronic equipment; SPD's must be installed ignoring the cable distance. Suitable SPD's also to be used in all Telecommunication, Signalling, automation and instrumentation equipment according to the Zonal concept explained in IEC 62305 for a perfect protection of complete electronic installations. All SPDs should be tested and ensure performance requirements according to IEC 61643.	Nos.	UR				
	<b>TOTAL : SECTION III</b>						
	<b>SECTION IV : Point Wiring &amp; Fixtures</b>						
1.0	Surface / concealed point wiring for light / fan/ 5 A points with 3 x 2.5 Sq.mm. multistrand Cu. FRLS wires 1100 V gr. in suitable size FR PVC conduits / flexible conduits wherever required as submains and 2 x 1.5 + 1 x 1.5 Sq.mm. wires for each point complete (submains will not be measured separately) with necessary modular switch board, switch plates and Blanking plates & accessories as required etc. to complete the task.. Primary Point shall mean first point wired from switchboard and Secondary point shall mean successive points next to Primary point.						
	Note:- All conduits in area with false ceiling shall be concealed in wall below false ceiling						
1.1	Primary Light point wiring with necessary 5 A SP switch, ceiling rose / Holders complete. (Maximum 2/3 points controlled by one switch)	Pt.	40				
1.2	Secondary light point wiring with 2x1.5 + 1x1.5 sqmm Cu wires from primary point above including necessary accessories e.g. connectors.	Pt.	60				
1.3	Fan point with modular 5 A SP Switch, 5 step Electronic fan Regulator, switch box plate & fan hook box etc. modular fan box.	Pt.	5				
1.4	5A 3 pin socket outlets independent (Modular).	Pt.	UR				
	Switch,Socket,Unbreakable box						
1.5	5A 3 pin socket outlets for AC/Raw/Power point	Pt.	10				
	Switch,Socket,Unbreakable box						
1.6	Exhaust fan / Wall fan points with modular socket near fan & 5A switch in main switch board of respective area	Pt.	6				
	Point wiring,Switch,Socket,Unbreakable box						
1.7	Point wiring as above but for 5A +15 A socket outlet with 2 x 2.5 Sq.mm. + 1 x 1.5 Sq.mm. wires from DB including socket outlet & switch etc.complete.	Pt.	60				
2.0	Supply, installation, testing and commissioning of lighting fixtures/ fans/Ex. fans etc. including necessary ballast, lamp, accessories, wiring connection, support arrangement like suspension chain, M.S. conduit drop with ball socket. down drops, etc. All FTL fixtures shall be with triphosphor source.						
2.1	4x14W T5 RECESS MOUNTED DIRECT-INDIRECT FIXTURE (EQUI. TO WIPRO WVF53414)	Nos.	10				
2.2	3x36W CFL RECESS MOUNTED Bottom opening CLEAN ROOM FIXTURE (EQUI. TO WIPRO WIP43336)	Nos.	9				
2.3	2x18W CFL RECESS MOUNTED DOWNLIGHTER FIXTURE (EQUI. TO WIPRO WCP27218)	Nos.	14				
2.4	1x28W T5 INDUSTRIAL FIXTURE FIXTURE (EQUI. TO WIPRO WIF 20128)	Nos.	14				
2.5	1x26W CFL DECORATIVE WALL LAMP (EQUI. TO WIPRO FWP 42126)	Nos.	11				
2.6	2x36W CFL RECESS MOUNTED Bottom opening CLEAN ROOM FIXTURE (EQUI. TO WIPRO WIP53236)	Nos.	22				
2.7	2x28W T5 INDUSTRIAL FIXTURE FIXTURE (EQUI. TO WIPRO WIF 20228)	Nos.	16				
2.8	Supply, installation testing of 150mm exhaust fans with mounting frame & louvers.	Nos.	6				
2.9	Supply, installation testing of wall mounted fans with mounting frame & louvers.	Nos.	UR				
3.0	Supply & installation of 2 mm thick FR PVC white/Black conduit of following sizes including all accessories e.g. deep junction box, bends etc. for concealing in slab / wall & spacer, saddles for open on slab / wall.						
3.1	32 mm dia. FRPVC.	Rmt	UR				
3.2	25 mm dia. FRPVC.	Rmt	UR				
	<b>TOTAL : SECTION IV</b>						
	<b>SECTION V: UPS MAINS / SUBMAINS WIRING &amp; TELEPHONE</b>						
1.0							
1.1	Supply, Installation, Testing, Commissioning of 5 kVA UPS with batteries, battery stand, 3 phase I/p & 3 phase o/p with 15 Minutes battery back up.	No.	1				
1.2	Supply, Installation, testing and commissioning of 5 kVA 1ph I/P & 1ph O/P Inverter system with 15 min. battery back-up.	No	1				
2.0	Supply & Installation of power points with 2 x 4.0 + 1 x 2.5 Sqmm Cu wires as above but in FR PVC conduit.	Rmtr	200				

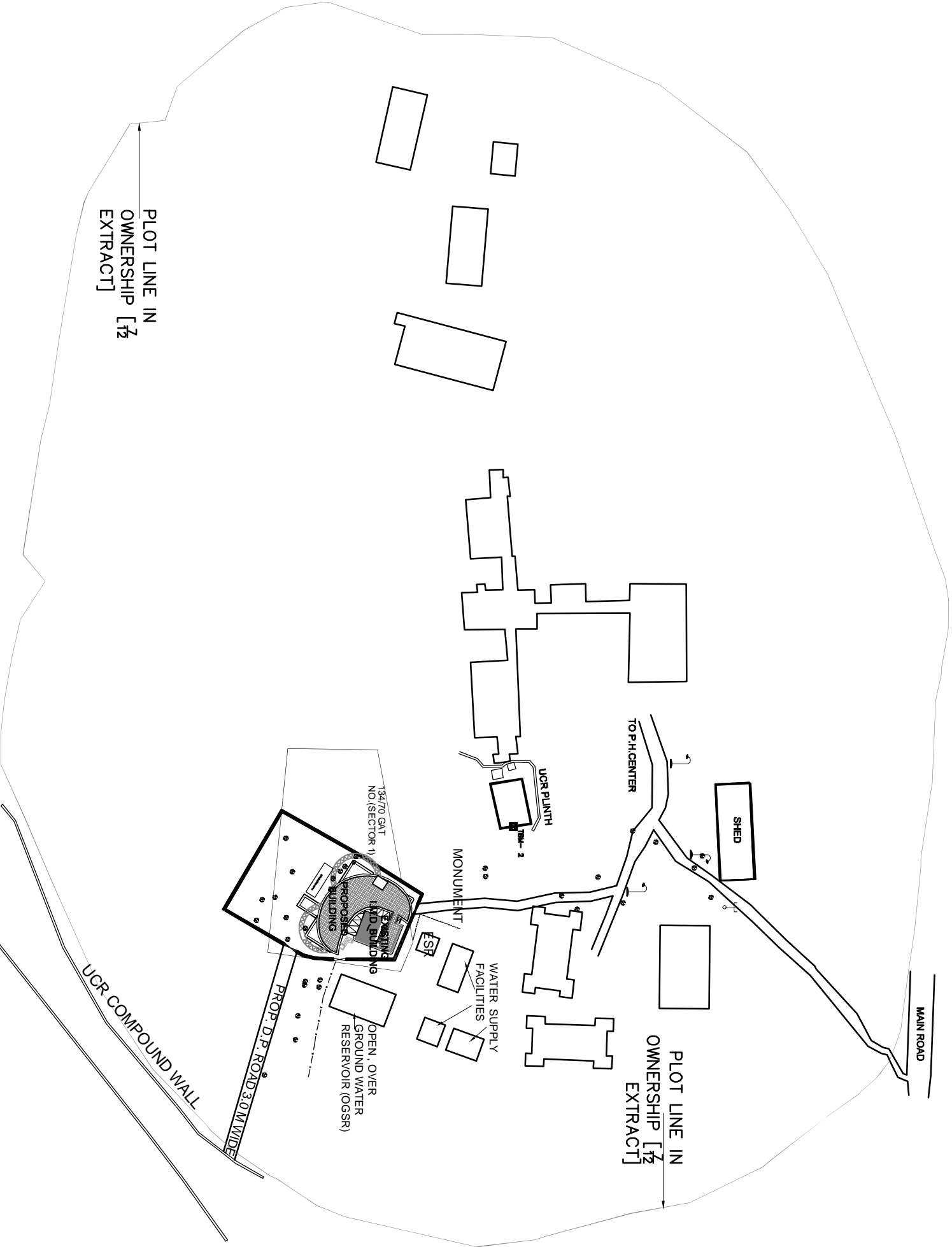
Sr.No.	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
3.0	As above but 2 x 2.5 + 1 x 1.5 Sq.mm. wires. In FR PVC conduit.	Rmtr	1000				
4.0	Supply and installation of main for UPS power points in Admin Area area with 2 x 4 + 1 x 2.5 Sq.mm. wires including 25mm FR PVC Conduits.	Rmtr	50				
	Wires & conduit						
5	As above but 2 x 2.5 + 1 x 1.5 Sq.mm. wires.FR PVC conduit.	Rmtr	UR				
6	Supply ,Installation,Testing & Commissioning of 24 port switch,Patch cord Panel & rquired accessories to complete the job.						
6.1	Supply, installation, testing & comissioing of 24 Port Switch with SFP port	Set	UR				
6.2	Supply, installation, testing & comissioing of Patch Panels for above switch	Set	UR				
7	Supply ,Installation,Testing & Commissioning of Data, Telephone cable & rquired accessories to complete the job.						
7.1	Supply & laying of Cat-6 computer/data cables in provided blank concealed conduits / Floor Truff above.	Rmtr	350				
7.2	RJ 45 socket for above cable		10				
7.3	Supply and laying of RJ11 cables in provided blank concealed conduits / Floor Truff above. 2 pair .0.5 sq mm FR PVC insulated annealed copper conductor, unarmored telephone cable	Rmtr	350				
7.4	Telephone socket & RJ 11 jack for above cable	Set	10				
7.5	Data Cluster Consisting Of:-2No. RJ45 Network Point 1No,RJ11 Telephone Point 2No,2No. 5A Modular Socket Points With 2No. Switch ON UPS POWER	Set	10				
7.6	Data Cluster Consisting Of:-1No. RJ45 Network Points, 1No. RJ11 Telephone Points 1No. 5A Modular Socket Points With 1No. Switch On UPS POWER	Set	5				
8.0	Supply and installation of 2 mm thickness Aluminium extruded raceway for under floor installation including necessary cutting of floor providing couplers and clamps for raceway fixing as details provided making good the surface of floor complete as per sizes provided.						
8.1	80mm x 38mm deep AL. raceways.	Rmt.	UR				
8.2	100mm x 38 mm deep AL. raceways.	Rmt.	UR				
8.3	125mm x 38 mm deep AL. raceways.	Rmt.	UR				
9.0	Supply and installation of good quality floor junction boxes of appropriate sizes for raceways with folded frames including counter sunk screw arrangements such that covers are in level with the floor level. The cover will be M.S, power coated & have 4 Nos. 25 / 32 mm Ø holes with rubber grommets at appropriate location.						
9.1	100mm X 100mm X 50mm deep16SWG junction box with 14 SWG cover.	Nos.	UR				
9.2	125mm X 125mm X 50 mm deep16SWG junction box with 14 SWG cover.	Nos.	UR				
9.3	225mm X 225mm X 50 mm deep 16SWG junction box with 14 SWG cover.	Nos.	UR				
9.4	330mm X 330mm X 50 mm deep 16SWG junction box with 14 SWG cover.	Nos.	UR				
9.5	450mm X 450mm X 50 mm deep 16SWG junction box with 14 SWG cover.	Nos.	UR				
<b>TOTAL : SECTION V</b>							
<b>SECTION - VI</b>							
<b>External Lighting</b>							
1.0	Supply, Installation of Street Light poles complete with excavation, pile foundation of size 1200 x 600 x 600 mm foundation with coupling, muffing & RCC reinforcement, 2Nos. of 40mm dia GI pipes bend to shape 1.5m long for cable entry/exit, cable loop box with 15A 4 way connector, 10A SP MCB per lamp, spring type earthing of pole with 12 SWG wire Wipro/EQVT make.						
1.1	As Above but 7.5 Mtr. Poles with 1200mm suitable bracket long for mounting Flood light fixture.	Nos					
1.2	With Single Bracket	Nos	7				
1.3	With Double Bracket	Nos	1				
1.4	1x 70 WATT HPSV GATE POST LAMP( Wipro Cat No. WPM 27080 or Equiv.)	Nos	2				
1.5	1X 50 WATT HALOGEN PENDENT LIGHT (Wipro Cat No.FFQ 51050 or Equiv.)	Nos	15				
1.6	WFH52250 Floodlight 1x250W	Nos	9				
<b>TOTAL : SECTION VI</b>							

PLAN FOR HIGH ALTITUDE LAB, IITM, MAHABALESHWAR

MAIN ROAD



SCALE :- 1:1000



PLOT LINE IN OWNERSHIP [1/2 EXTRACT]

TO P.H. CENTER

PLOT LINE IN OWNERSHIP [1/2 EXTRACT]

UCR PLINTH

MONUMENT

WATER SUPPLY FACILITIES

OPEN, OVER GROUND WATER RESERVOIR (OGSR)

PROP. D.P. ROAD 3.0M WIDE

UCR COMPOUND WALL

TO PACHGANI

TO S.T. STAND

NORTH LINE:



- NOTES :
- 1) ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
  - 2) READ THIS DRAWING ALONG WITH THE STRUCTURAL ENGINEER'S DRAWING.
  - 3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK.
  - 4) ALL DIMENSIONS ARE IN MM.

ARCHITECT SIGN :

CONSULTANT SIGN

CLIENT : IITM

SITE :

BUILDING : IITM MAHABALESHWAR

TITLE : MASTER PLAN



ARCHIVISTA  
ENGINEERING PROJECTS PVT. L.  
OFFICE NO. 201/202, 11TH FLOOR, SAI EMBRE  
PLOT NO. 100, KOTHRUVA, P.O. (100) KOTHRUVA,  
MYSURU, KARNATAKA

JOB NO.:  
SCALE: 1:1000  
DATE: 24.01.12  
DRAWN BY: KASAPUPE  
CHK. BY: ---  
REV.: 21.02.12 [RD]

NO.	DATE	REMARKS
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134/70 GAT  
NO.(SECTOR 1)

EXISTING

I.M.D. BUILDING

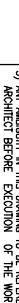

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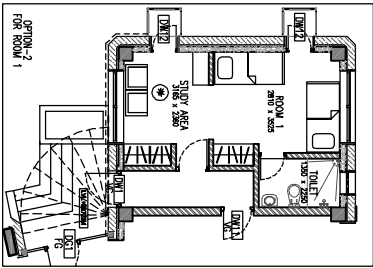
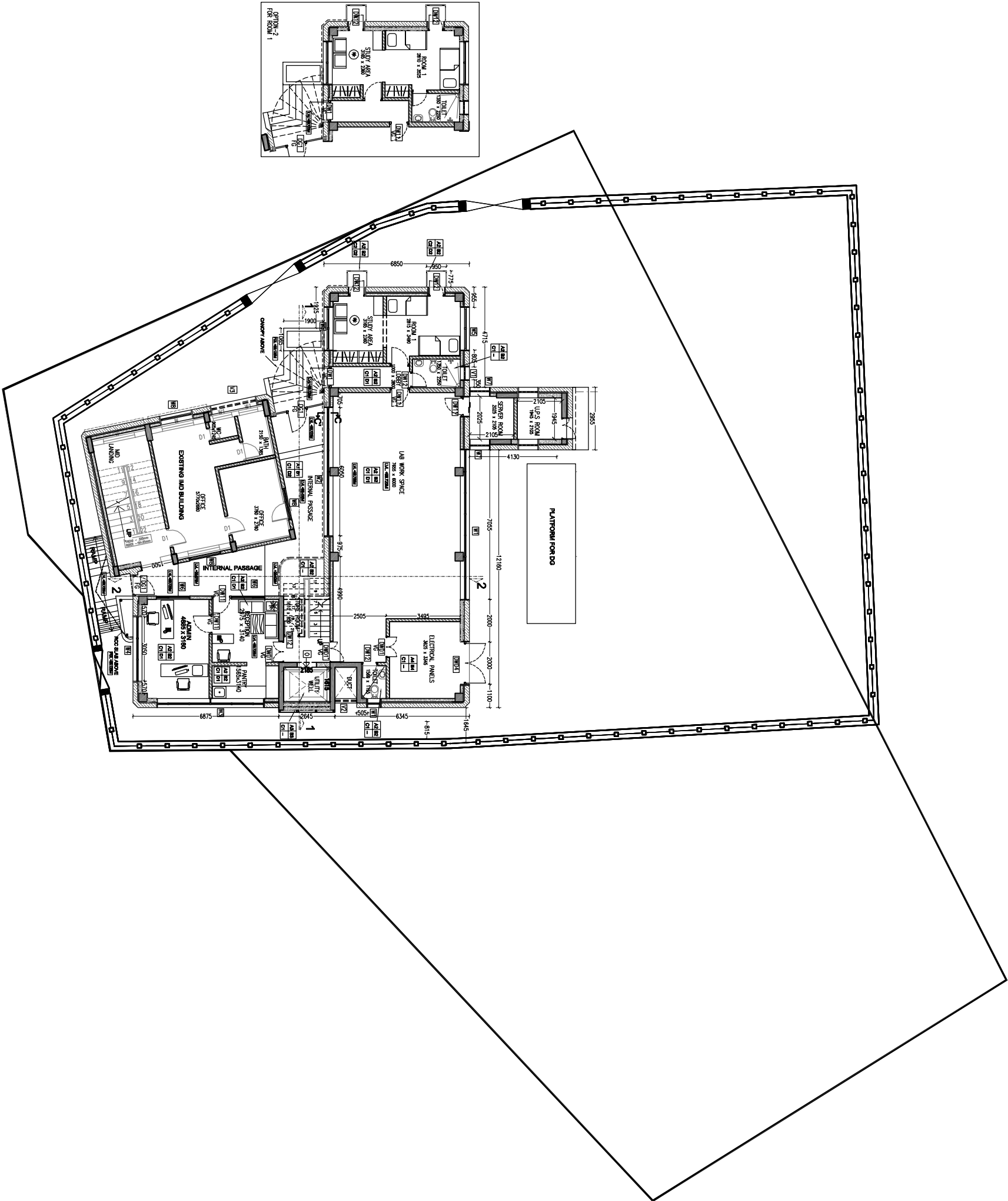
**2.5 M WIDE PAVED PATH**

PR

# SPACE REQUIREMENTS FOR METERING KIOSK

REVISIONS					
NO.	DATE	REMARKS	NO.	DATE	REMARKS
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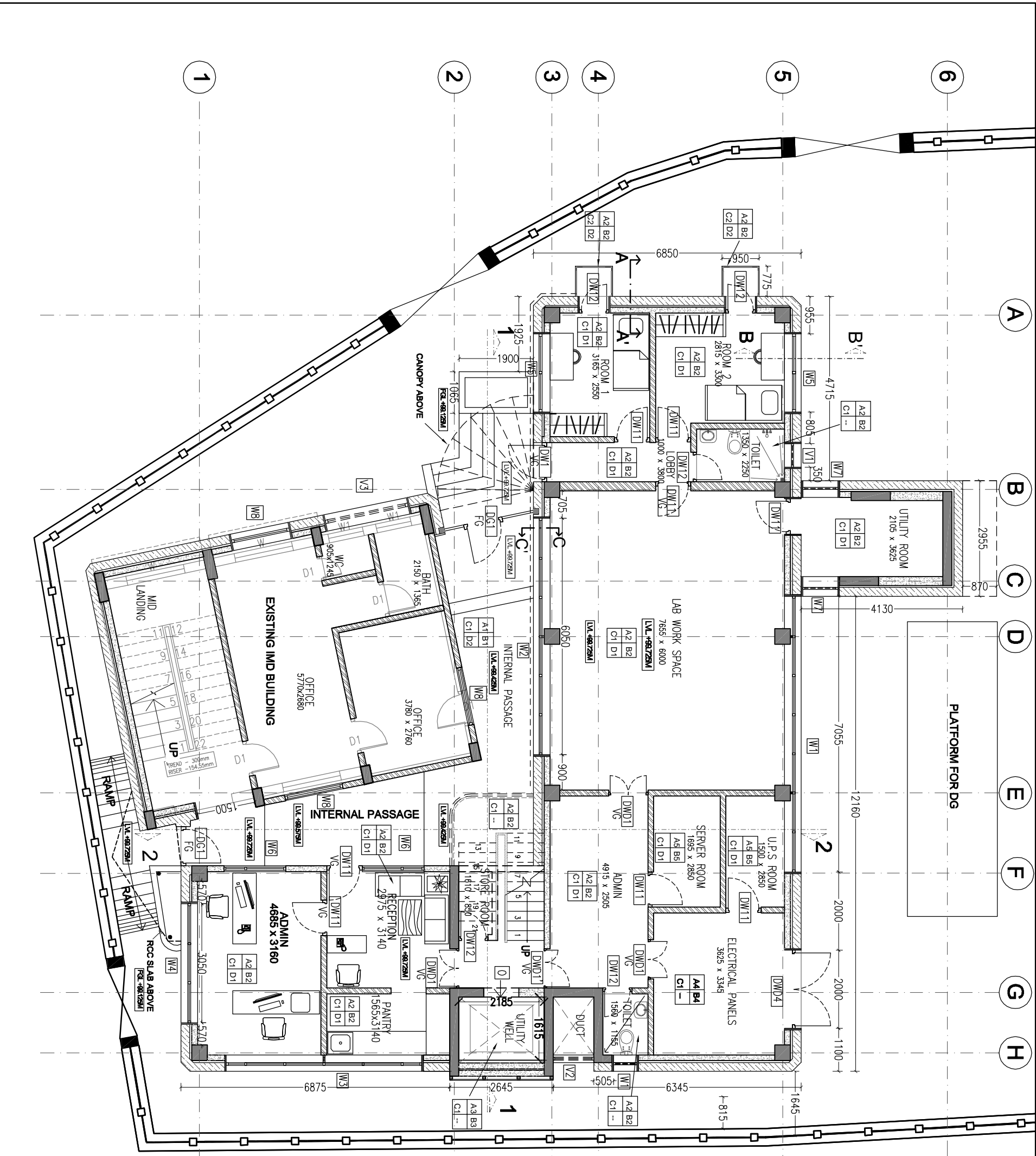
NORTH LINE:		
		
NOTES :		
1) SHUT WRITTEN DIMENSIONS ARE TO BE FOLLOWED.		
2) ALL DIMENSIONS ARE TO BE IN METERS UNLESS OTHERWISE SPECIFIED.		
3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK.		
4) ALL DIMENSIONS ARE IN MM.		
ARCHITECT SIGN :	CONSULTANT SIGN :	CLIENT : IITM
BUILDING : IITM MAHABALESHWAR		TITLE : MASTER PLAN
DESIGN ENGINEERING  ARCHIVISTA		JOB NO: SCALE : 1:100 DATE : 24.01.12 OFFICE NO. 201/202, THIRD FLOOR, SANI BUILDING, BANER, PUNE - 411 045. PH. (020) 6629444, FAX (020) 6629456A, WWW.ARCHIVISTA.COM
ARCHIVISTA ENGINEERING PROJECTS PVT. LTD. PLOT NO. 201/202, THIRD FLOOR, SANI BUILDING, BANER, PUNE - 411 045. CHK BY: _____ REV.: 21.02.12		RD



NOTES :		ARCHITECT SIGN :		CONSULTANT SIGN :		CLIENT : IITM		BUILDING : IITM MAHABALESHWAR	
1) ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.								TITLE : GROUND FLOOR PLANE(REVISED CONCEPT)	
2) READ THIS DRAWING ALONG WITH THE STRUCTURAL ENGINEER'S DRAWING.									
3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK									
4) ALL DIMENSIONS ARE IN MM									

REVISION		NO. DATE		NO. DATE		NO. DATE		NO. DATE	
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SCHEDULE OF OPENINGS (DOORS)		
DESIGNATION	SIZE	TYPE
DG1 - FG	1.00 X 2.10	COLOUR ANODISED ALU. FRAMED GLASS DOOR
DW1 - VG	1.00 X 2.10	FLUSH DOOR WITH VISION PANEL
DWD1 - VG	1.00 X 2.10	FLUSH DOOR WITH VISION PANEL (DOUBLE LEAF)
DWD1 - VG	1.00 X 2.10	FLUSH DOOR WITH VISION PANEL (DOUBLE LEAF)
DW11	.900 X 2.10	FLUSH DOOR TO DETAIL
DW11 - VG	.900 X 2.10	FLUSH DOOR WITH VISION PANEL
DW12	.750 X 2.10	FLUSH DOOR TO DETAIL
DWD4	2.00 X 2.50	FLUSH DOOR TO DETAIL
O	.900 X 2.10	OPENING

WINDOWS		
DESIGNATION	SIZE	TYPE
W	11.05 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W1	7.06 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W2	6.05 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W3	5.00 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W4	3.07 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W5	2.00 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W6	1.58 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W7	0.80 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W8	1.50X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
V1	0.80 X 0.80	ALUMINIUM GLAZED LOUVERED VENTILATOR
V2	1.04 X 7.77	COLOUR ANODISED ALUMINIUM LOUVERED DUCT SCREEN
V3	2.14 X 0.80	ALUMINIUM GLAZED LOUVERED VENTILATOR

A Flooring		B Skirting
A1	Natural Granite.	B1 Natural Granite.
A2	Artificial Granite.	B2 Artificial Granite.
A3	IPS	B3 IPS
A4	Anti - Static Vinyl mat on IPS	B4 Anti - Static Vinyl mat on IPS
A5	Anti-Static composite fixed floor on G.I Studs	B5 Anti-Static composite fixed floor on G.I Studs
C Walls		D Ceiling
C1	Int. Acrylic Emulsion on Premium Acrylic putty	D1 Monolithic calcium silicate Board
C2	Glass wall	D2 Glazed roof on composite AL-MS frame

- NOTES:
1. ALL EXTERNAL WALLS TO BE 425mm THICK R.C.C -LATERITE COMPOSITE WALL
  2. ALL INTERNAL WALLS TO BE 150MM THICK CONCRETE BLOCK MASONRY WALL.
  3. FORMED GROUND LEVEL AT PLOT IS +99.125M

REVISIONS

NO.	DATE	REMARKS
1	24.01.12	ORIGINAL ISSUE

NOTES :

1) ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.  
2) READ THIS DRAWING ALONG WITH THE STRUCTURAL ENGINEER'S DRAWING.  
3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK.  
4) ALL DIMENSIONS ARE IN MM

NORTH LINE:

ARCHITECT SIGN :

CONSULTANT SIGN :

CLIENT : IITM

TITLE : GROUND FLOOR PLAN

SITE :

ARCHIVISTA ENGINEERING PROJECTS PVT. LTD.  
OFFICE NO. 207/202, THIRD FLOOR, 5th EMBRE, CHENNAI - 600 084  
TEL: (080) 66344444 FAX: (080) 66344998  
www.archivistaindia.com

JOB NO.:

SCALE: 1:100

DATE: 24.01.12

DRAWN BY: M328790

CHECKED BY: ---

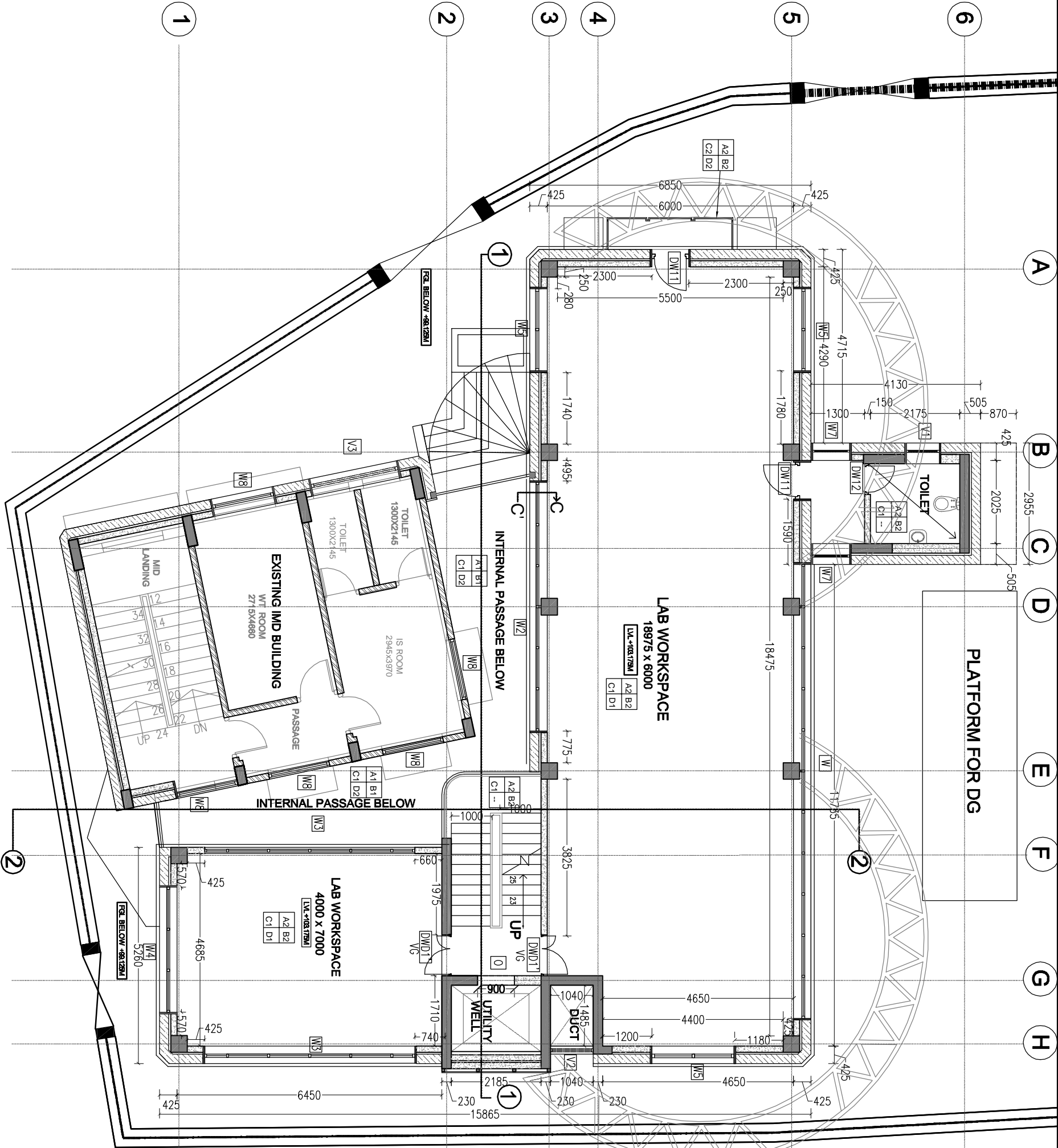
REV.: 21.02.12

SCHEDULE OF OPENINGS (DOORS)		
DESIGNATION	SIZE	TYPE
DG1 - FG	1.00 X 2.10	COLOUR ANODISED ALU. FRAMED GLASS DOOR
DW1 - VG	1.00 X 2.10	FLUSH DOOR WITH VISION PANEL
DWD1 - VG	1.00 X 2.10	FLUSH DOOR WITH VISION PANEL (DOUBLE LEAF)
DWD1' - VG	1.00 X 2.10	FLUSH DOOR WITH VISION PANEL (DOUBLE LEAF)
DW11	.900 X 2.10	FLUSH DOOR TO DETAIL
DW11 - VG	.900 X 2.10	FLUSH DOOR WITH VISION PANEL
DW12	.750 X 2.10	FLUSH DOOR TO DETAIL
DWD4	2.00 X 2.50	FLUSH DOOR TO DETAIL
O	.900 X 2.10	OPENING

WINDOWS		
DESIGNATION	SIZE	TYPE
W	11.05 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W1	7.06 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W2	6.05 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W3	5.00 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W4	3.07 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W5	2.00 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W6	1.58 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W7	0.80 X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
W8	1.50X 1.35	ALUMINIUM GLAZED CASEMENT WINDOW
V1	0.60 X 0.60	ALUMINIUM GLAZED LOUVRED VENTILATOR
V2	1.04 X 7.77	COLOUR ANODISED ALUMINIUM LOUVRED DUCT SCREEN
V3	2.14 X 0.60	ALUMINIUM GLAZED LOUVRED VENTILATOR

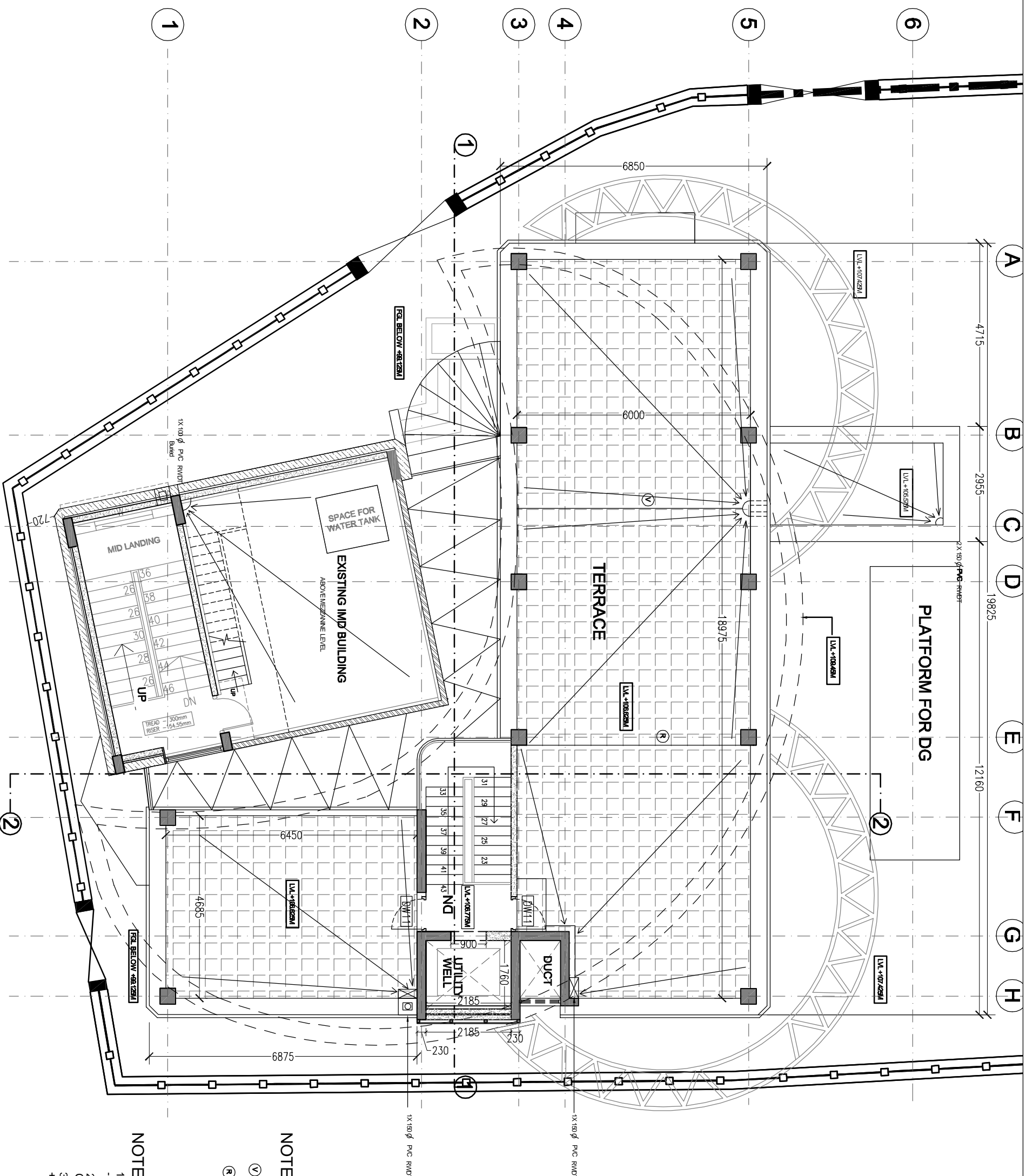
A	Flooring	B	Skirting
A1	Natural Granite.	B1	Natural Granite.
A2	Artificial Granite.	B2	Artificial Granite.
A3	IPS	B3	IPS
A4	Anti - Static Vinyl mat on IPS	B4	Anti - Static Vinyl mat on IPS
A5	Anti-Static composite rised floor on G.I Studs	B5	Anti-Static composite rised floor on G.I Studs
C	Walls	D	Ceiling
C1	Int. Acrylic Emulsion on Premium Acrylic putty	D1	Monolithic calcium silicate Board
C2	Glass wall	D2	Glazed roof on composite AL-MS frame

- NOTES:
1. ALL EXTERNAL WALLS TO BE 425mm THICK R.C.C -LATERITE COMPOSITE WALL
  2. ALL INTERNAL WALLS TO BE 150MM THICK CONCRETE BLOCK MASONRY WALL.
  3. FORMED GROUND LEVEL AT PLOT IS +99.125M



REVISIONS		NO. DATE		REMARKS		NO. DATE		REMARKS		NO. DATE		REMARKS	
1	24.01.12	ORIGINAL ISSUE				1				2			
2						3				4			
3						5				6			
4						7				8			
5						9				10			

NORTH LINE:		NOTES :		ARCHITECT SIGN :		CONSULTANT SIGN :		CLIENT : IITM	
1) ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.		2) READ THIS DRAWING ALONG WITH THE		3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE		4) ALL DIMENSIONS ARE IN MM			
SITE :		BUILDING : IITM MAHABALESHWAR		TITLE : FIRST FLOOR PLAN		DESIGN ENGINEERING		ARCHIVISTA	
ENGINEERING PROJECTS PVT. LTD.		OFFICE NO. 207/202, THIRD FLOOR, 5th EARTH, DDA, NEW DELHI		PHONE NO. 26122222, 26122222, 26122222		FAX NO. 26122222, 26122222, 26122222		WWW.ARCHIVISTA.COM	
SCALE : 1:100		DATE : 24.01.12		DRAWN BY : SHREYA		CHKD BY : ---		REV. : 21.02.12	
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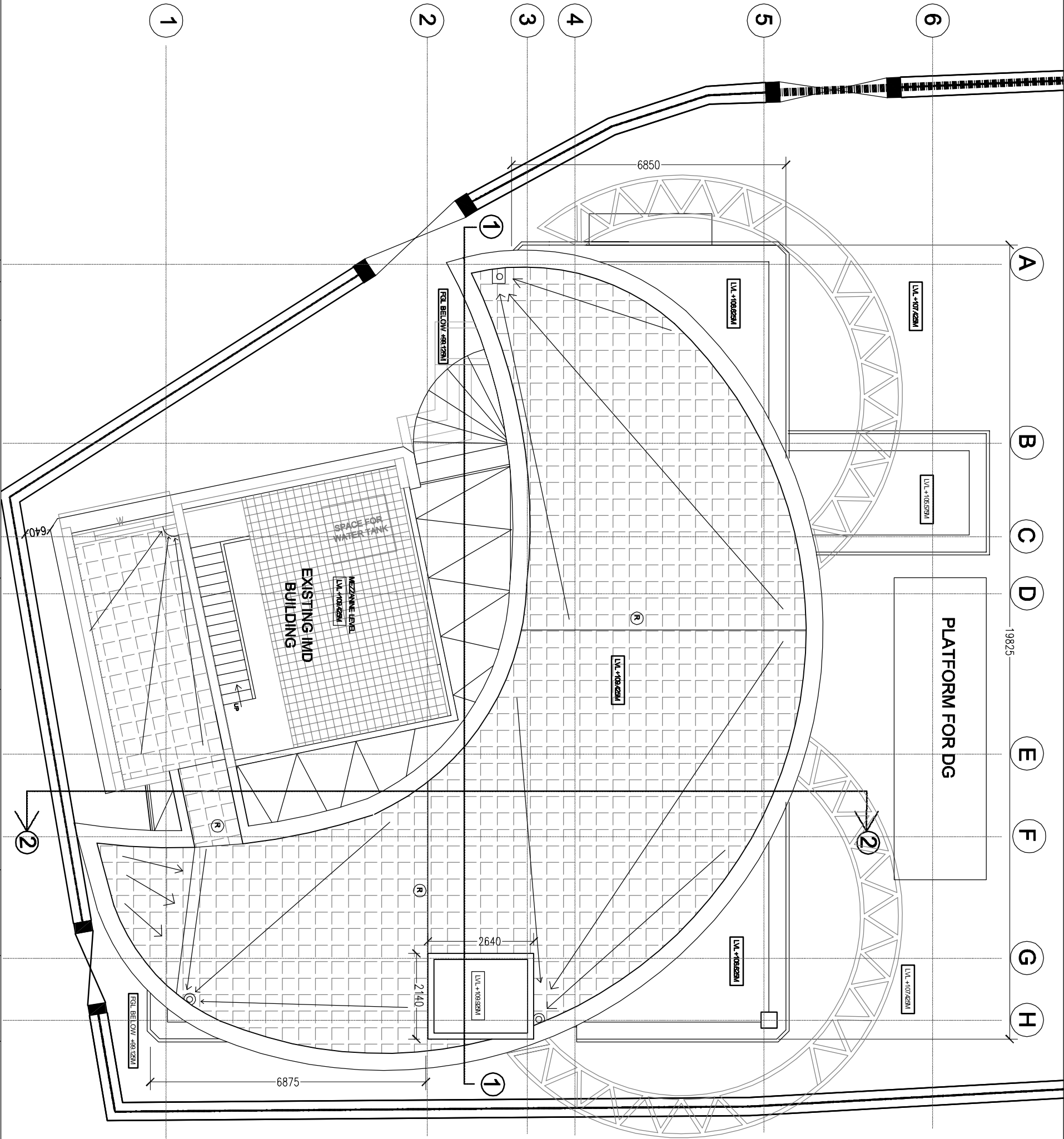
NOTE:

- Ⓢ - VALLEY - LINE IN WP LEVEL
- Ⓡ - RIDGE - IN WP LEVEL

NOTE:

1. ALL EXTERNAL WALLS TO BE 425mm THICK R.C. CEMENT LATERITE COMPOSITE WALL.
2. ALL INTERNAL WALLS TO BE 150MM THICK CONCRETE BLOCK MASONRY WALL.
3. FORMED GROUND LEVEL AT PLOT IS +99.125M

3		2		1		10		9		8		7		6		5		4		3		2		1							
REVISIONS		NO.		DATE		REMARKS		NO.		DATE		REMARKS		NORTH LINE:		NOTES :		ARCHITECT SIGN :		CONSULTANT SIGN :		CLIENT : IITM		BUILDING : IITM MAHABALESHWAR							
RO		24.01.12		ORIGINAL ISSUE												1) ALL WRITTEN DIMENSIONS ARE TO BE FOLLOWED. 2) DIMENSIONS ARE TO BE TAKEN FROM THE STRUCTURAL ENGINEER'S DRAWING. 3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK 4) ALL DIMENSIONS ARE IN MM.								SITE :		TITLE : TERRACE FLOOR PLAN		JOB NO:			
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																										ARCHIVISTA		ENGINEERING PROJECTS PVT		RO	



NOTE:

- - VALLEY -LINE IN WP LEVEL
- - RIDGE -IN WP LEVEL

NOTES:

1. ALL EXTERNAL WALLS TO BE 425mm THICK R.C.C -LATERITE COMPOSITE WALL
2. ALL INTERNAL WALLS TO BE 150MM THICK CONCRETE BLOCK MASONRY WALL.
3. FORMED GROUND LEVEL AT PLOT IS +99.125M

REVISIONS										BUILDING : IITM MAHALESHWAR	
NO.	DATE	REMARKS	NO.	DATE	REMARKS	CLIENT : IITM		TITLE : ROOF PLAN			
R0	24.01.12	ORIGINAL ISSUE				SITE :		DESIGN ENGINEERING			
1			2			ARCHITECT SIGN :		ARCHIVISTA			
3			4			CONSULTANT SIGN		ENGINEERING PROJECTS PVT. LTD.			
5			6			CLIENT : IITM		OFFICE NO. 207/208, THIRD FLOOR, SAU BUILDING, BANER, PUNE - 411 046.			
7			8			CONSULTANT SIGN		MR. (020) 9888200			

- LIST OF EQUIPMENTS & THEIR CODE NUMBERS
2. Cloud droplet probe

3. Cloud combination probe with aspirator

4. LWC sensor

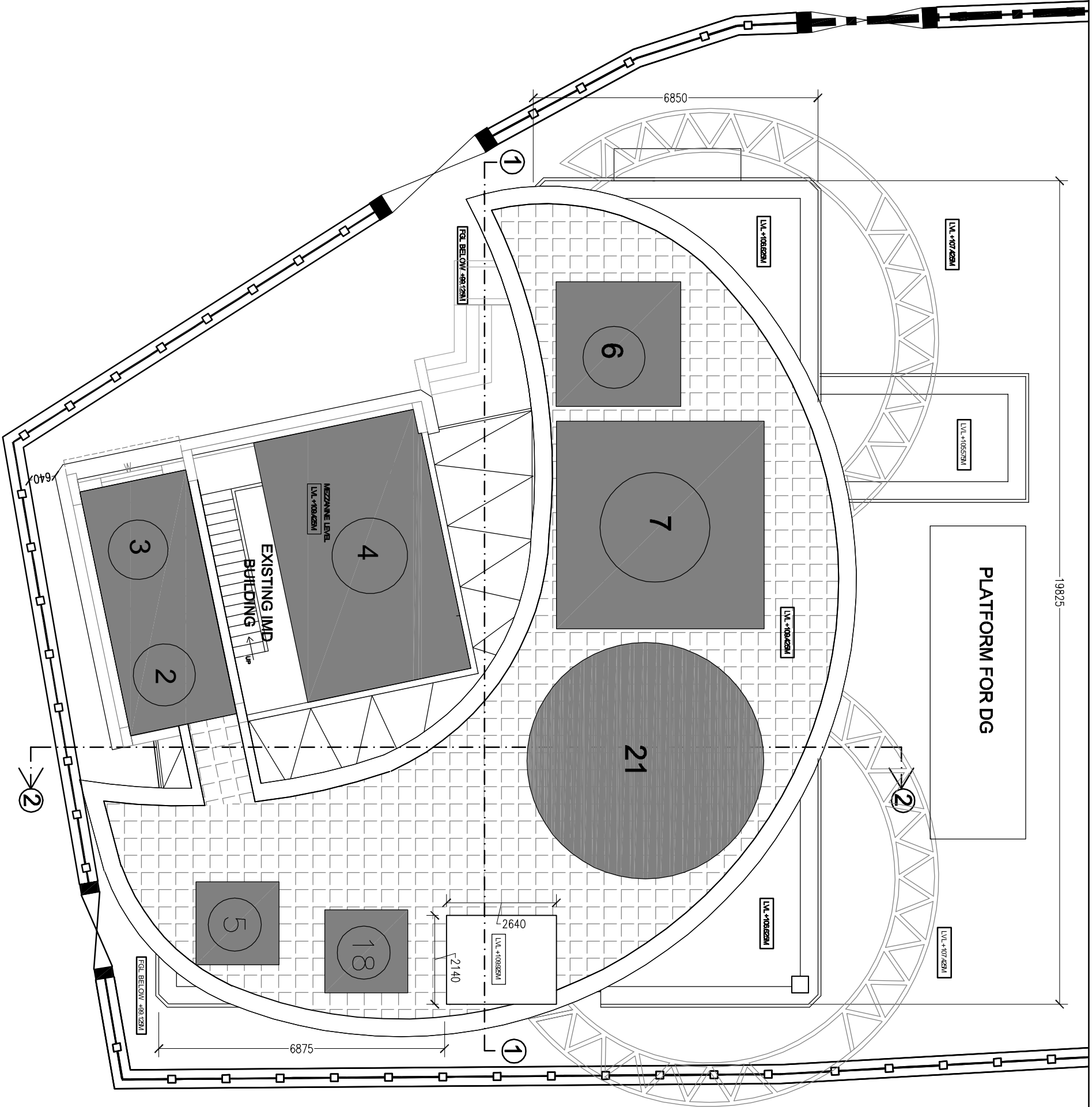
5. Whole sky imager

6. Micorain radar – it will be installed on a mast

7. Microwave radiometric Profiler – It will be installed in a TRIPOD, space (3x3 feet), view should be clear

18. Automatic weather station (wind, temperature, RH and rainfall)

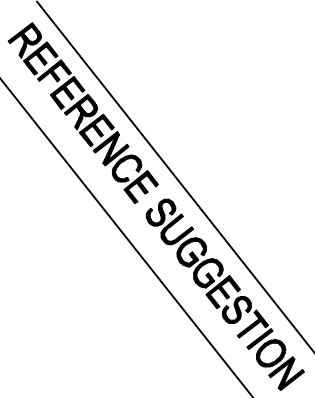
21. GPS Radio sounding antenna.

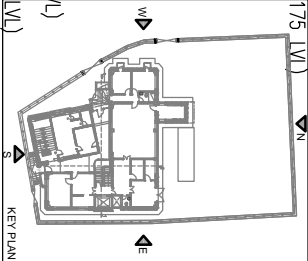
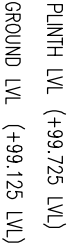


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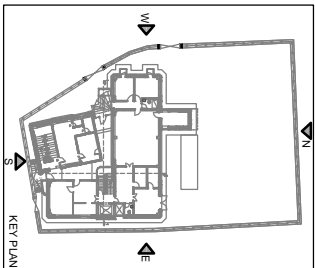




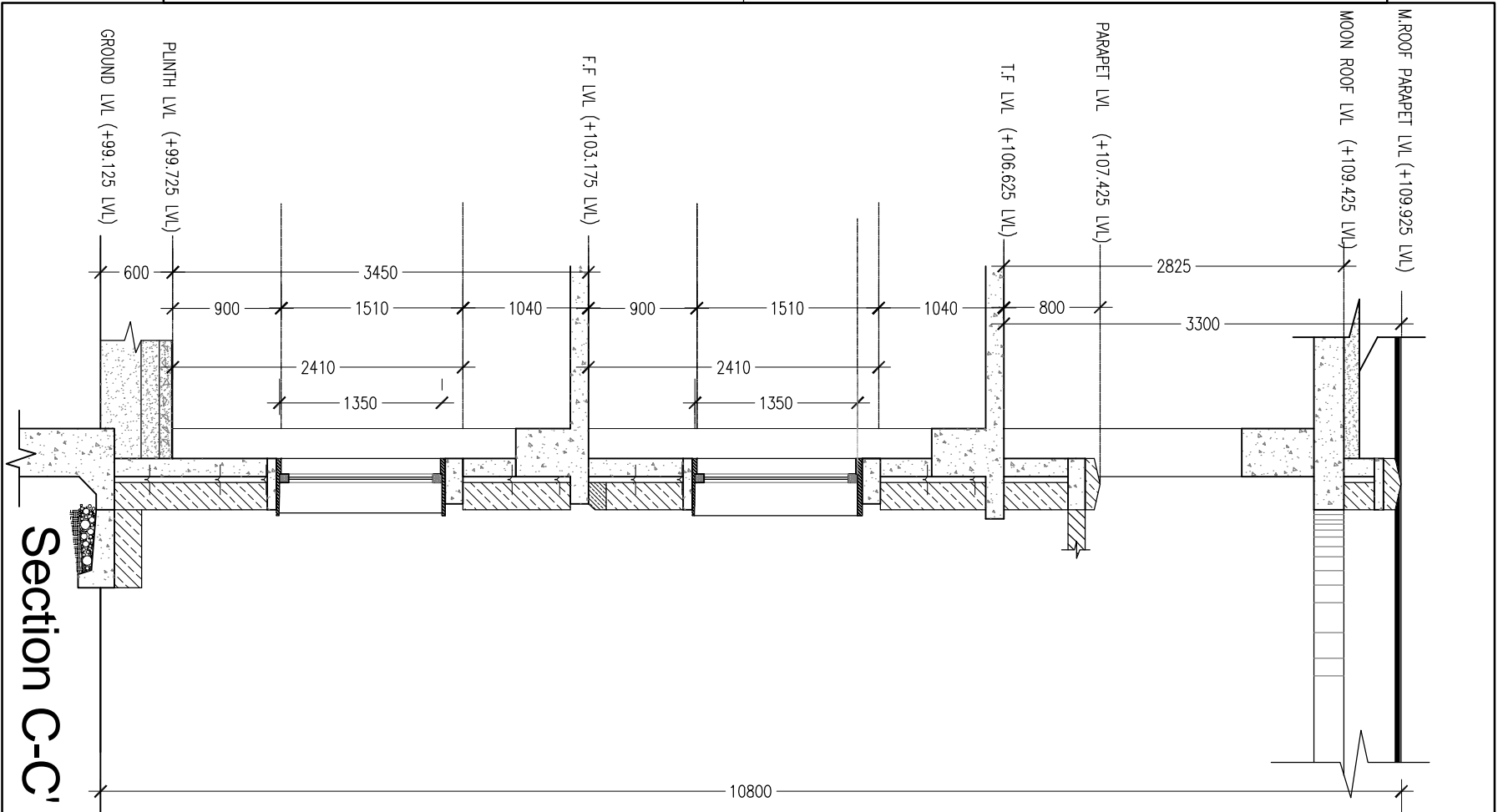
WEST SIDE ELEVATION



## SOUTH SIDE ELEVATION

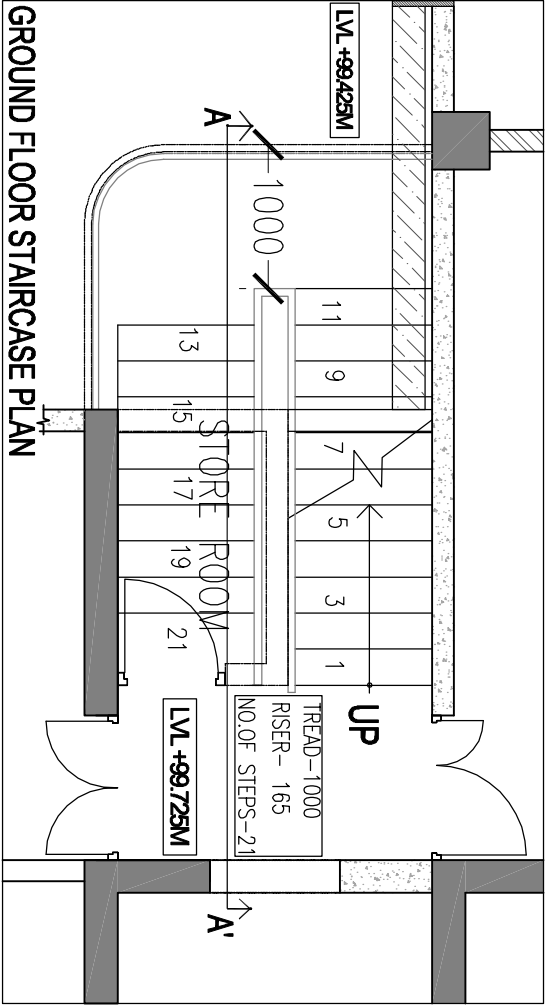


## REVISIONS

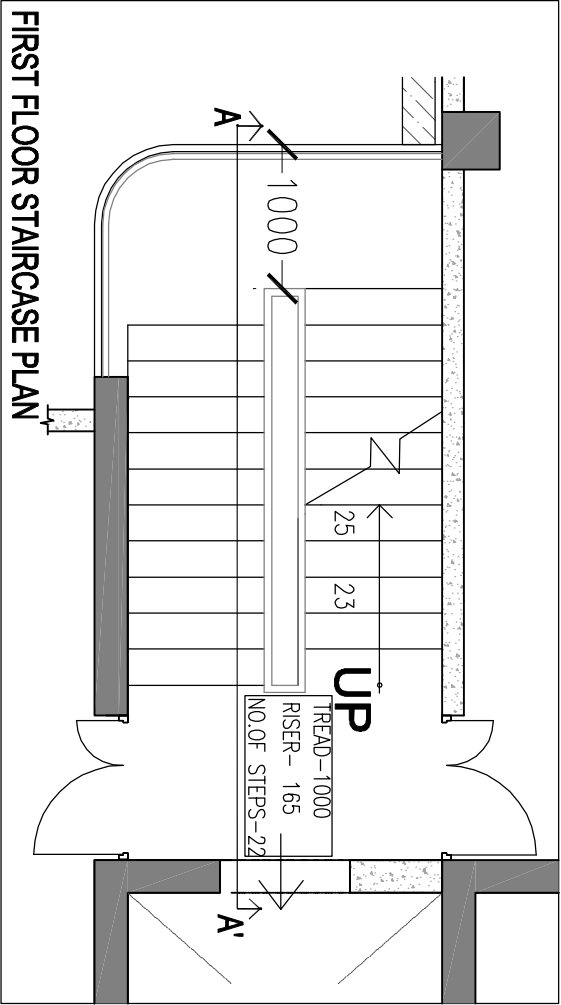


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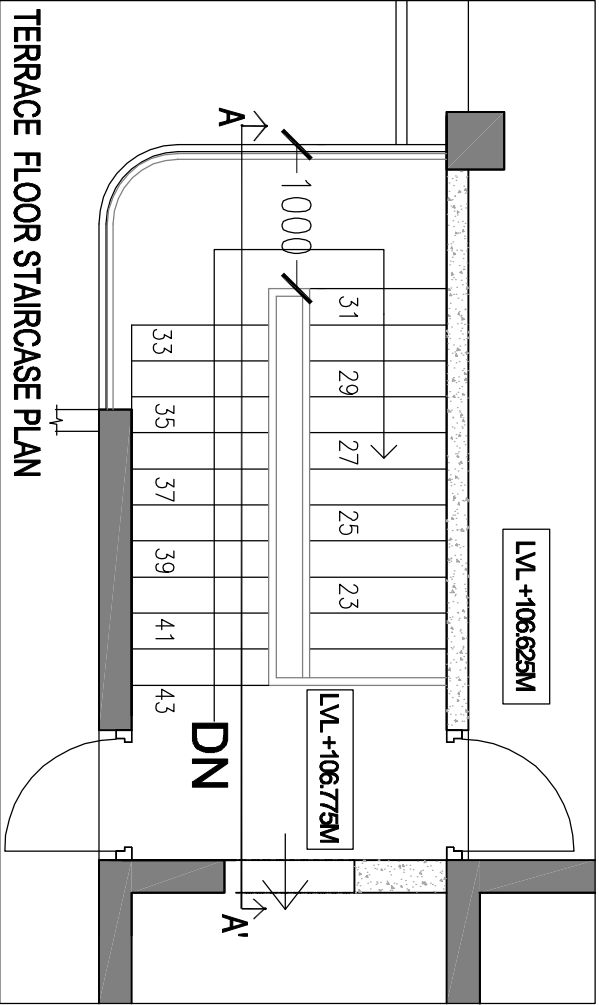
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		1) ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED 2) READ THIS DRAWING ALONG WITH THE STRUCTURAL ENGINEER'S DRAWING. 3) ANY ALTERATION IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT FOR THE APPROVAL OF THE WORK 4) ALL DIMENSIONS ARE IN MM						SITE :		TITLE : WALL SECTION DETAIL	
								DESIGN ENGINEERING		ARCHIVISTA	
								ARCHIVISTA		ARCHIVISTA	
								ENGINEERING PROJECTS PVT. LTD.		SCALE : 1:50	
								OFFICE NO. 207/202, THIRD FLOOR, 5th EMBRE		DATE: 24.01.12	
								CHAK. BY: M. SURESH		JOB NO.:	
								CHAK. BY: ———		JOB NO.:	
								REV: 22.02.12		JOB NO.:	



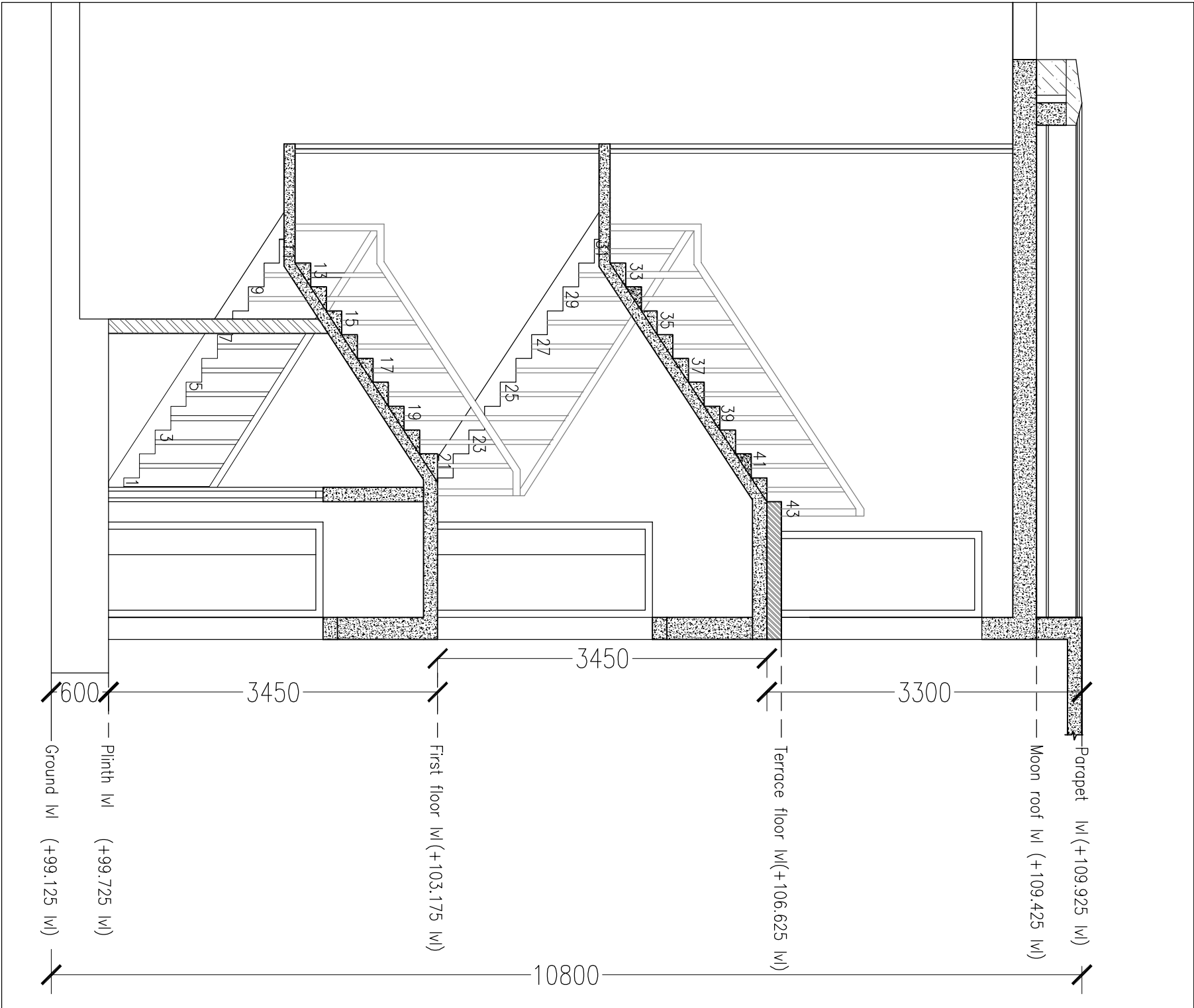
GROUND FLOOR STAIRCASE PLAN




FIRST FLOOR STAIRCASE PLAN

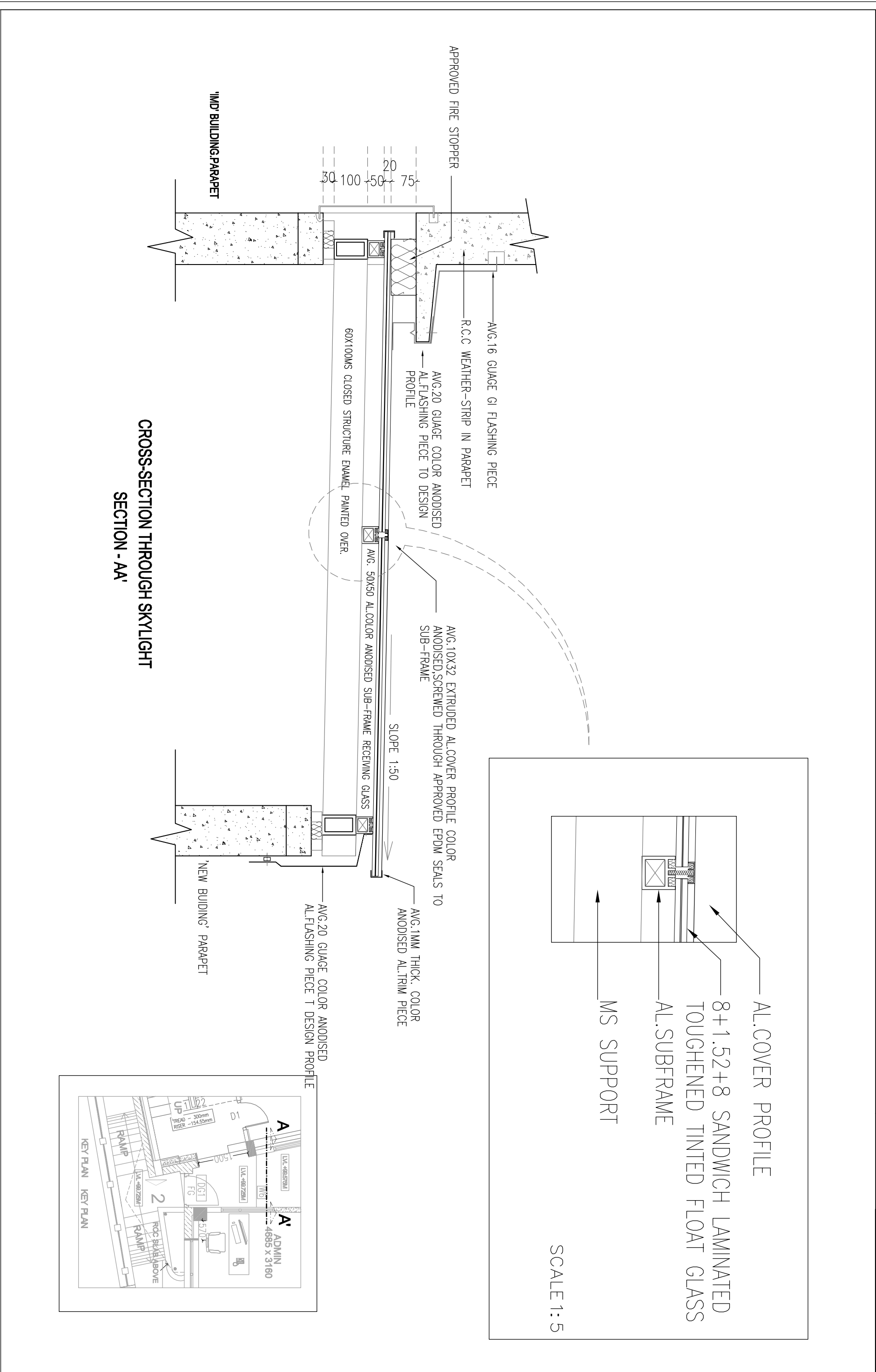


TERRACE FLOOR STAIRCASE PLAN

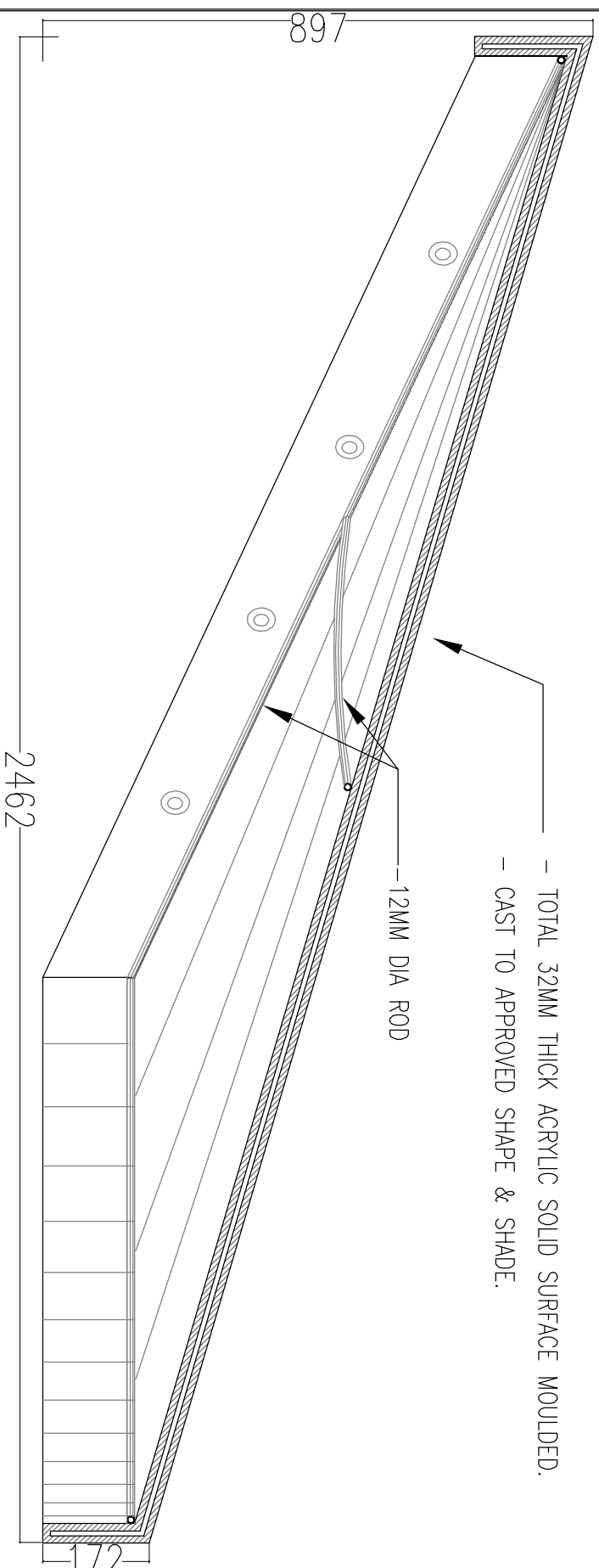


SECTION A-A'

REVISIONS										BUILDING : IITM MAHABALESHWAR									
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										NOTES : 1) ONLY MENTION DIMENSIONS ARE TO BE FOLLOWED. 2) READ THIS DRAWING ALONG WITH THE 3) ANY AMBIGUITY IN THIS DRAWING TO BE DECIDED TO THE 4) ALL DIMENSIONS ARE IN MM									
										ARCHITECT SIGN :									
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										ENGINEERING PROJECTS PVT									
										OFFICE NO. 201/202, THIRD FLOOR, 5th EMBRE									
										BAKER, PUNE - 411 005									
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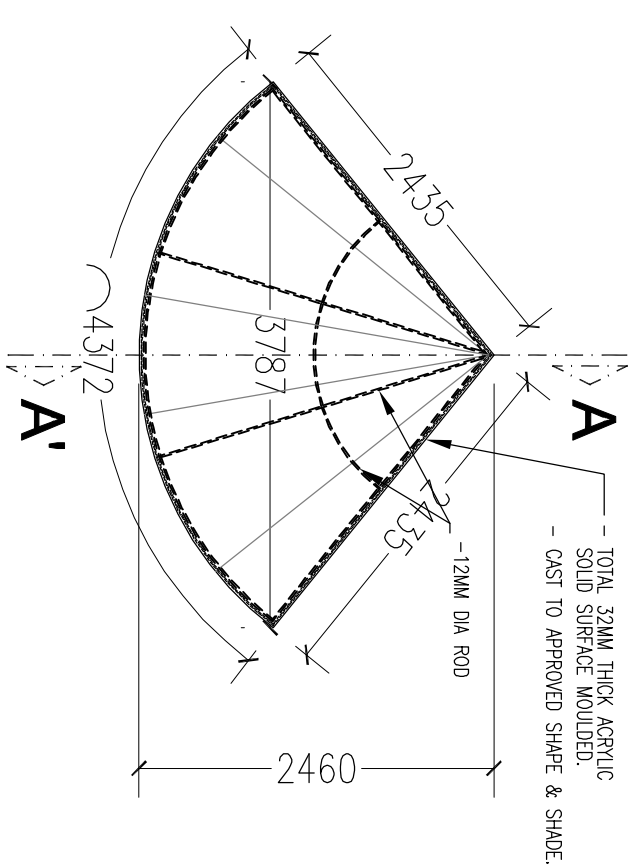


5					BUILDING : IITM MAHABALESWAR	
4					TITLE : DETAIL – CROSS SECTION THROUGH SKYLIGHT	
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2					ENGINEERING PROJECTS PVT. OFFICE NO. 207/202, THIRD FLOOR, SAI DAPUR, BAKER, PUNE – 411 045, PH. (020) 6624444, FAX (020) 6624404, ARCHIVISTA	
1					DATE : 24.01.12 DRN BY: MARRONI CHK BY: ——— REV.: 22.02.12	
REVISIONS						
NO.						
DATE						
REMARKS						
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5					NORTH LINE:	
6					NOTES : 1) PAID WRITTEN DIMENSIONS ARE TO BE FOLLOWED. 2) ALL DIMENSIONS ARE TO BE IN MM. 3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK. 4) ALL DIMENSIONS ARE IN MM.	
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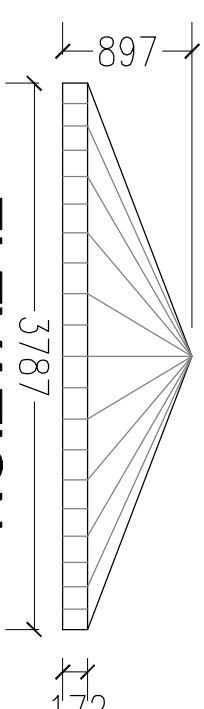


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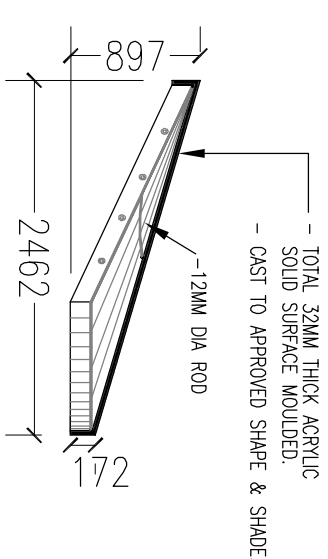
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# PLAN

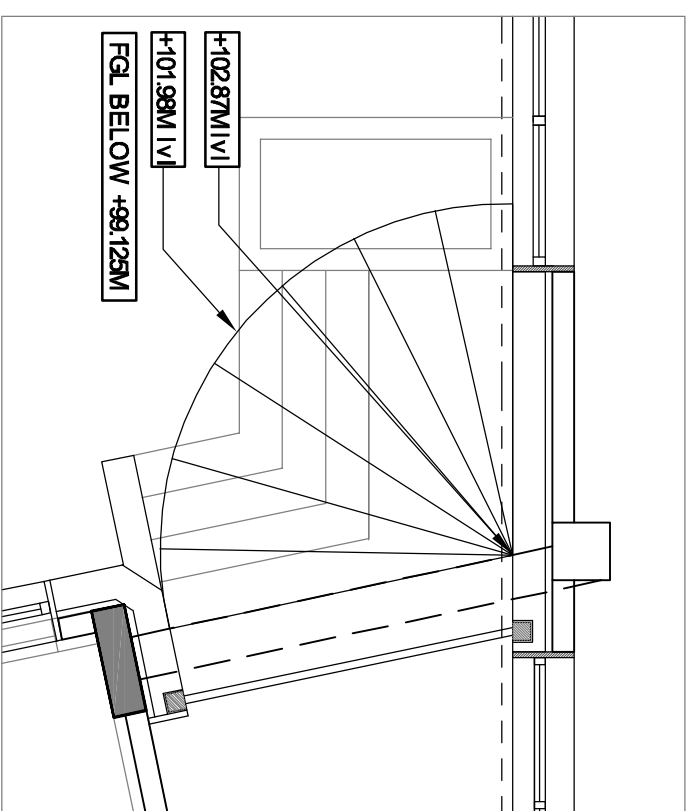


# ELEVATION



# SECTION AA'

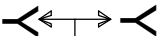
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## KEY PLAN

**SCALE 1:50**

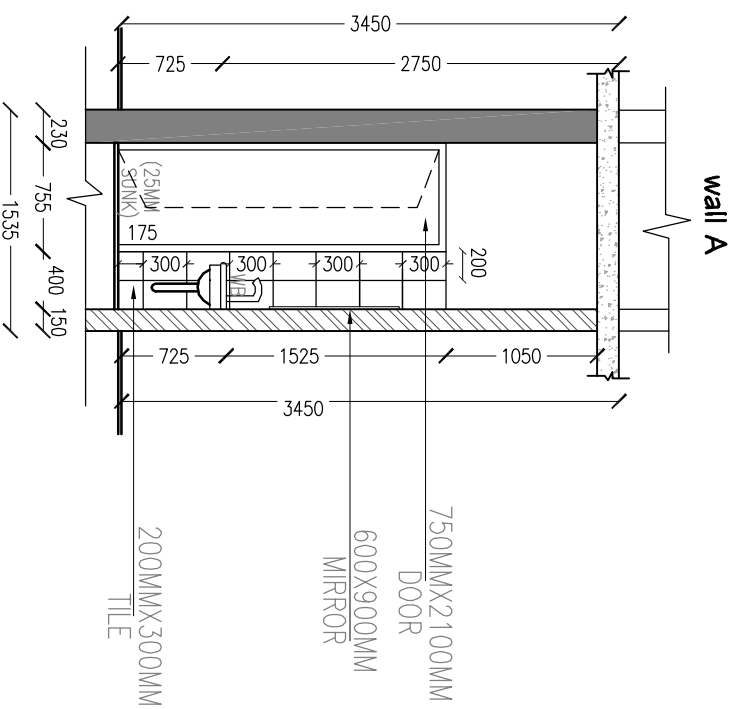
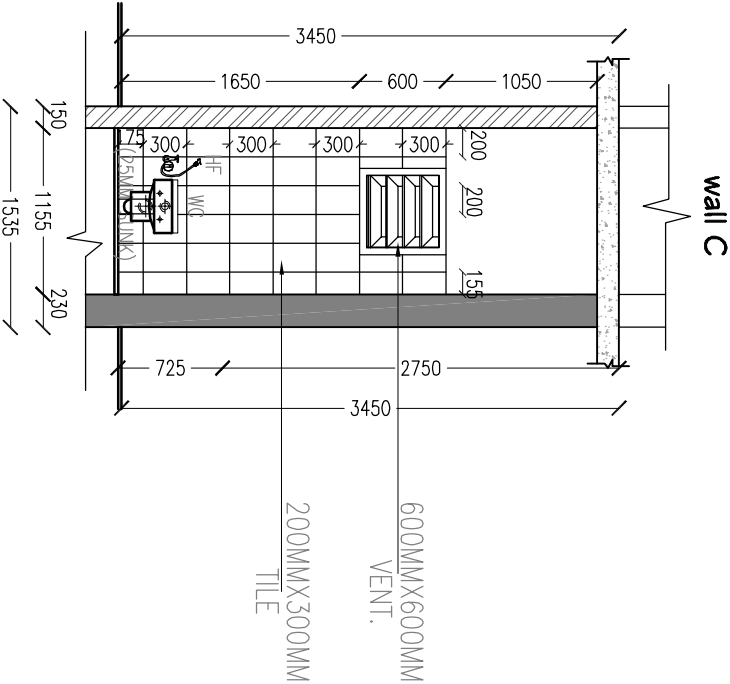
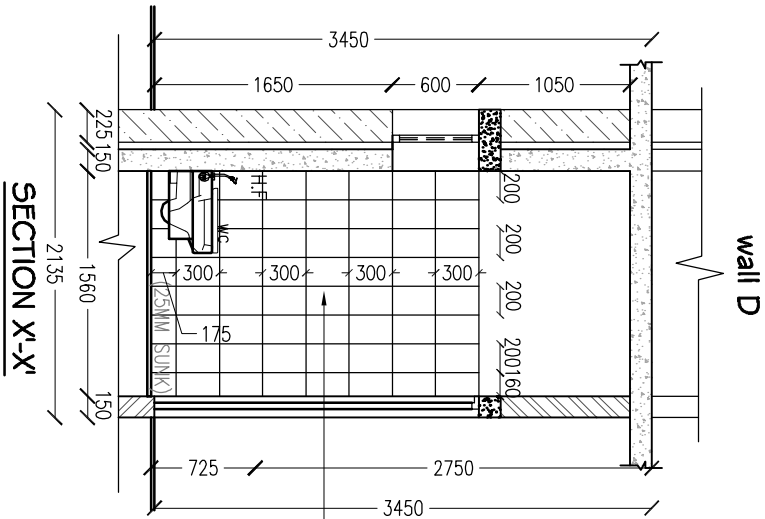
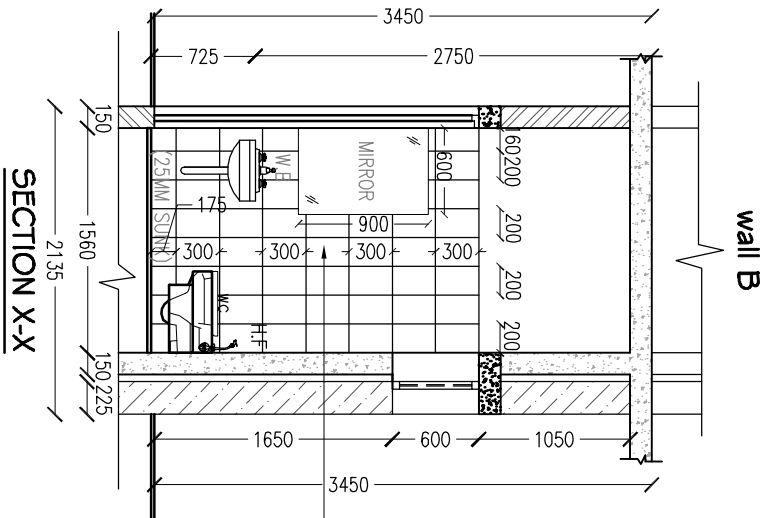
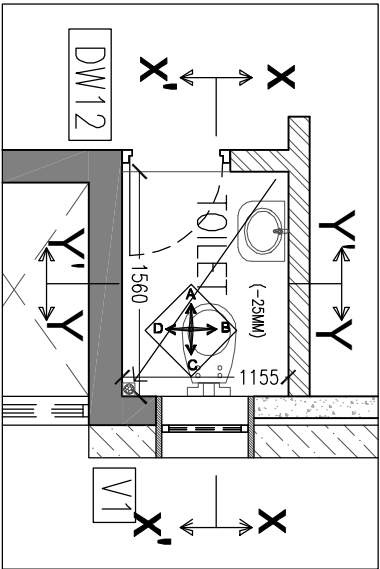
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**SECTION X-X**

NORTH SIDE TOILET  
AT FIRST FLOOR

[illegible]



EAST SIDE TOILET  
AT GROUND FLOOR


NOTES :		ARCHITECT SIGN :		CONSULTANT SIGN :		CLIENT : IITM		BUILDING : IITM MAHABALESHWAR	
1) ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.								TITLE : TOILET DETAIL	
2) READ THIS DRAWING ALONG WITH THE STRUCTURAL ENGINEER'S DRAWING.								DESIGN ENGINEERING	
3) ANY AMBIGUITY IN THIS DRAWING TO BE REFERRED TO THE ARCHITECT BEFORE EXECUTION OF THE WORK								ARCHIVISTA	
4) ALL DIMENSIONS ARE IN MM								ENGINEERING PROJECTS PVT. LTD.	
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								PH. (080) 86344444, FAX. (080) 86344444	
								WWW.ARCHIVISTA.COM	
								JOB NO.	
								SCALE : 1:100	
								DATE : 24.01.12	
								DRAWN BY: K.Srinivas	
								CHK. BY: ---	
								REV. : 21.02.12	
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SECTION Y-Y

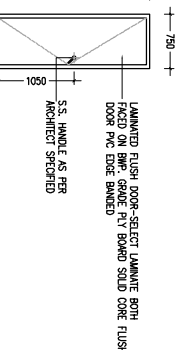
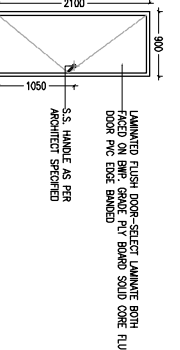
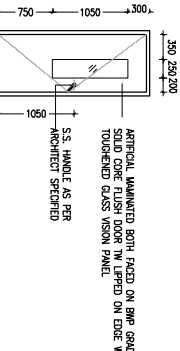
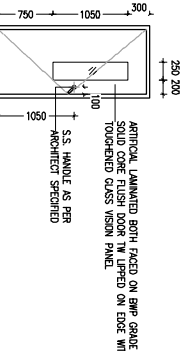
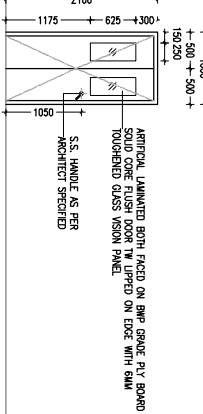
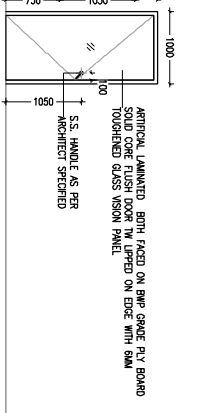
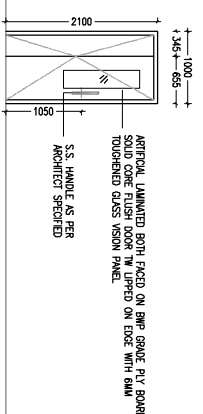
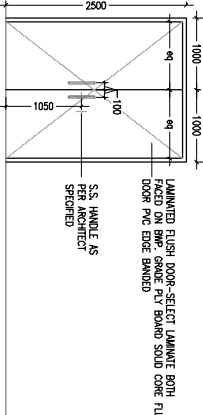
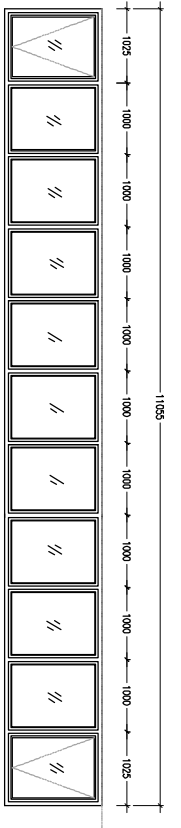
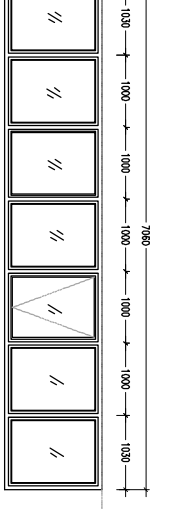
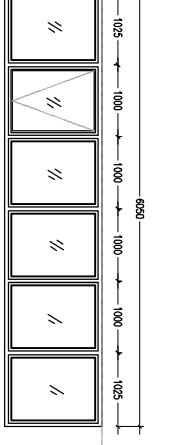
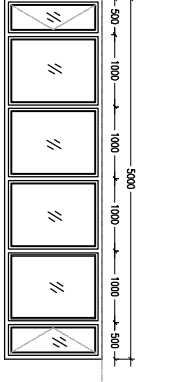
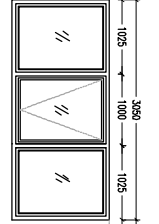
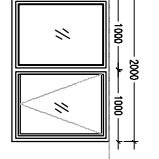
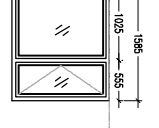
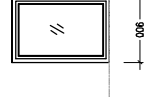
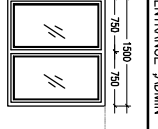

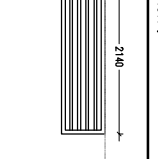
## SECTION Y-Y

NORTH WEST TOILET  
AT GROUND FLOOR

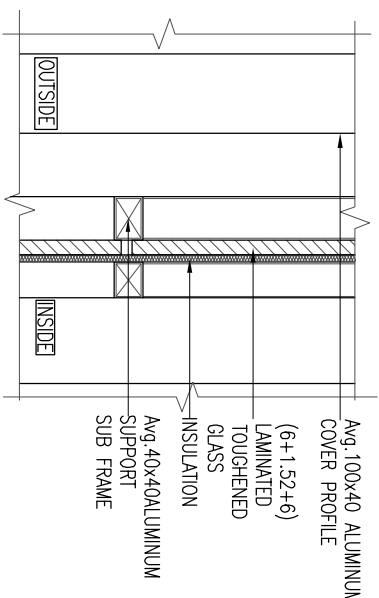
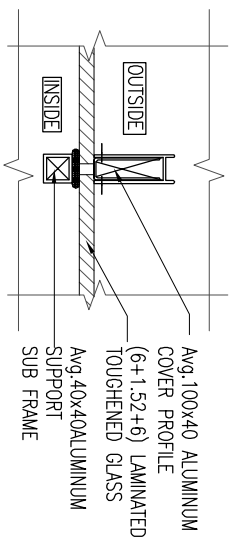
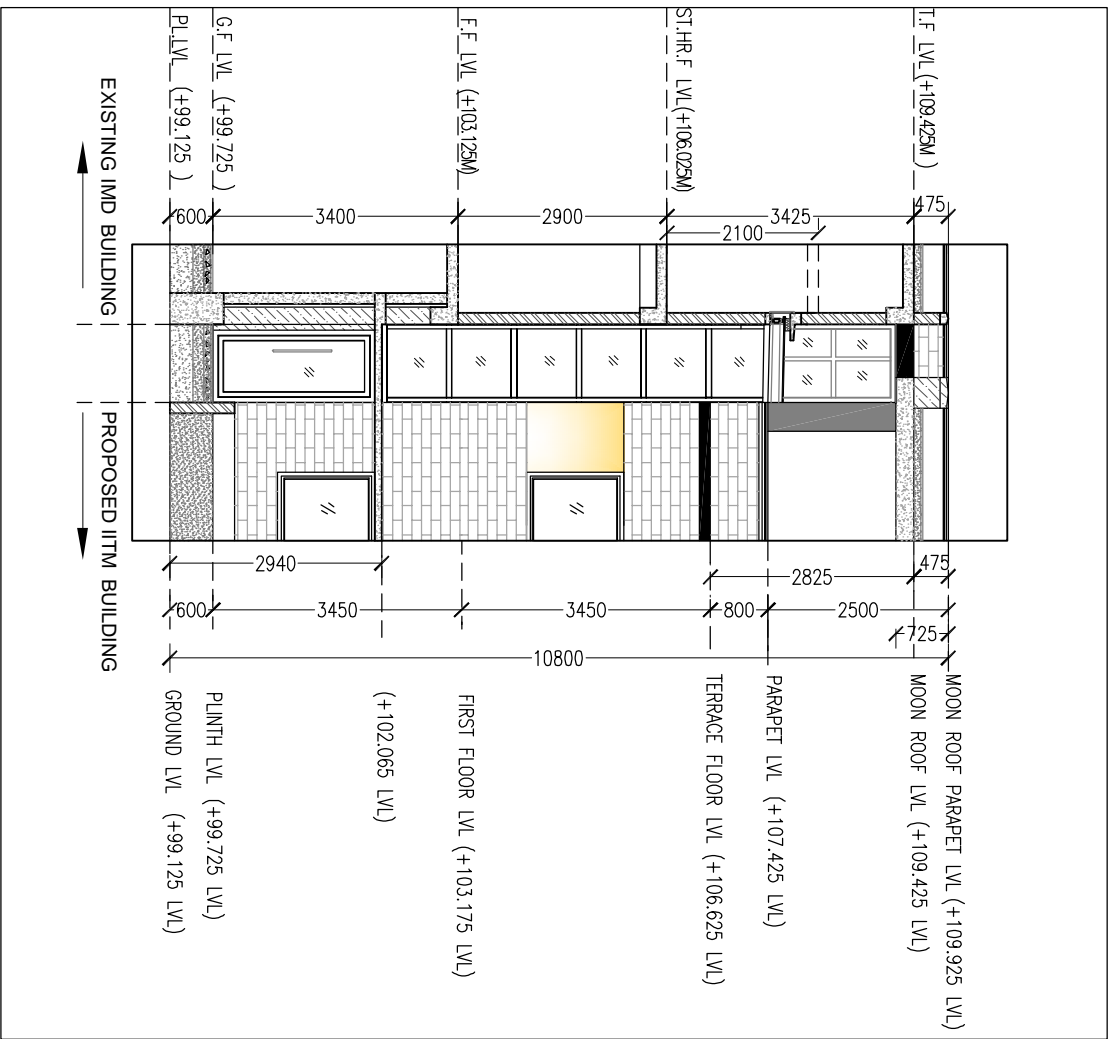
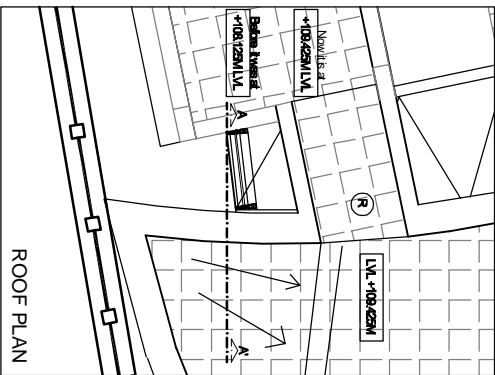
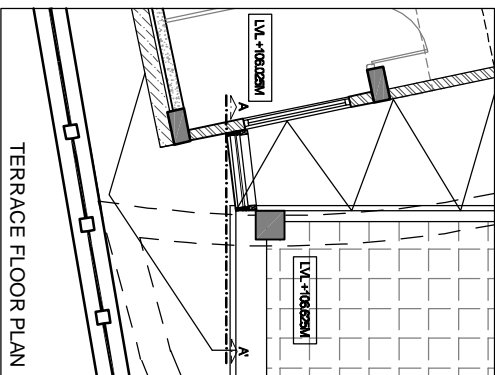
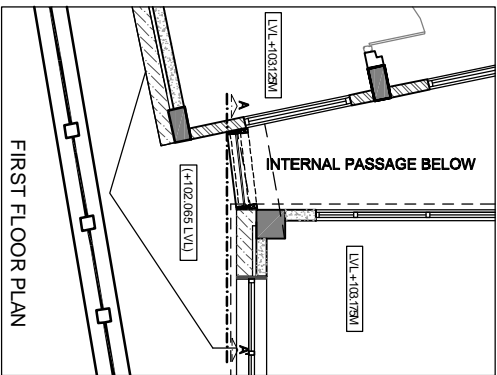
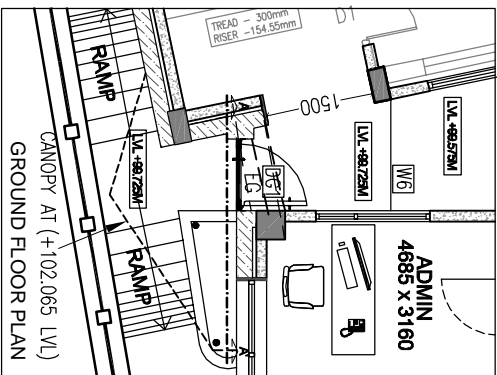
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<div style="display: flex; justify-content: space-between;"> <div> <p>SITE :</p> </div> <div> <p>CLIENT : IITM</p> </div> </div>												<div style="display: flex; justify-content: space-between;"> <div> <p>TITLE : TOILET DETAIL PLAN</p> </div> <div> <p>ARCHIVISTA</p> <p>ENGINEERING PROJECTS PVT. LTD.</p> <p>OFFICE NO. 201/202, THIRD FLOOR, 5th EMBRE BANKER, PUNE - 411 005.</p> <p>PH. (020) 6624444, FAX. (020) 6624404</p> <p>WWW.ARCHIVISTA.COM</p> </div> </div>											
<div style="display: flex; justify-content: space-between;"> <div> <p>DESIGN ENGINEERING</p> </div> <div> <p>ARCHIVISTA</p> </div> </div>												<div style="display: flex; justify-content: space-between;"> <div> <p>JOB NO.:</p> <p>SCALE : 1:100</p> <p>DATE : 24.01.12</p> <p>DRN.BY: H.S.KRISHNA</p> <p>CHK.BY: ———</p> <p>REV.: 21.02.12</p> </div> <div> <p>REV.: 21.02.12</p> </div> </div>											



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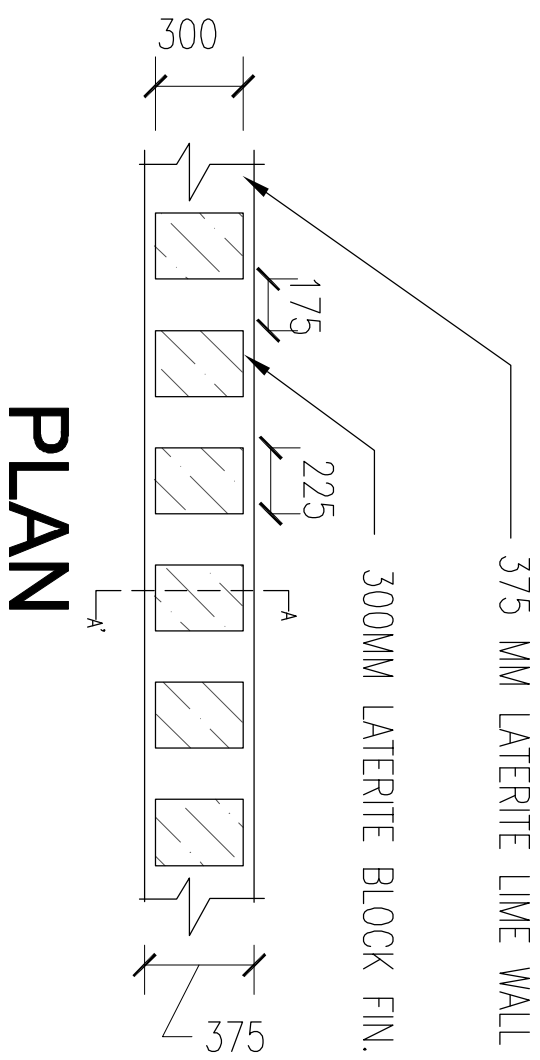
							
TYPE DW12 FLUSH DOOR TO DETAIL TOILET 1&2,FIRST FLOOR TOILET,GROUND FLOOR GLASS BALCONY 1&2,8 STORE ROOM		TYPE DW11 FLUSH DOOR TO DETAIL ROOM 1&2 DOOR, UPS ROOM ,SERVER ROOM, UTILITY ROOM, FIRST FLOOR TOILET LOBBY & GLASS BALCONY		TYPE DW11 - VG LAMINATED FLUSH DOOR WITH VISION PANEL RECEPTION,ADMIN & LAB WORK AREA		TYPE DW1 FLUSH DOOR WITH VISION PANEL	
							
TYPE DW1-VG FLUSH DOOR WITH VISION PANEL (DOUBLE LEAF) RECEPTION, ELECTRICAL PANEL ROOM,LAB WORK AREA		TYPE DW1-FG COLOUR ANODISED ALU. FRAMED GLASS DOOR ENTRANCE 1 & 2		TYPE DW12 -VG FLUSH DOOR WITH VISION PANEL (DOUBLE LEAF) ADMIN , LAB WORK AREA		TYPE DW12 FLUSH DOOR TO DETAIL ELECTRICAL PANEL ROOM BACK SIDE DOORS	
							
W 11.05 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW LAB WORKSPACE FIRST FLOOR		W1 7.06 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW LAB WORK SPACE ,U.P.P.S ROOM		W2 6.05 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW LAB WORK SPACE ,INTERNAL PASSAGE		W3 5.00 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW PANTRY ,ADMIN	
							
W4 3.07 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW ENTRANCE ,ADMIN		W5 2.00 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW ROOM 1&2 ,FIRST FLOOR LAB		W6 1.52 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW RECEPTION ,ADMIN		W7 0.90 X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW UTILITY ROOM ,TOILET LOBBY	
							
W8 1.50X 1.35 ALUMINIUM GLAZED CASEMENT WINDOW EXISTING BUILDING		V1 0.60 X 0.60 ALUMINIUM GLAZED LOUVERED VENTILIATOR TOILET		V3 2.14 X 0.60 ALUMINIUM GLAZED CASEMENT WINDOW EXISTING BUILDING			

REVISIONS										BUILDING : IITM, MAHABALESHWAR											
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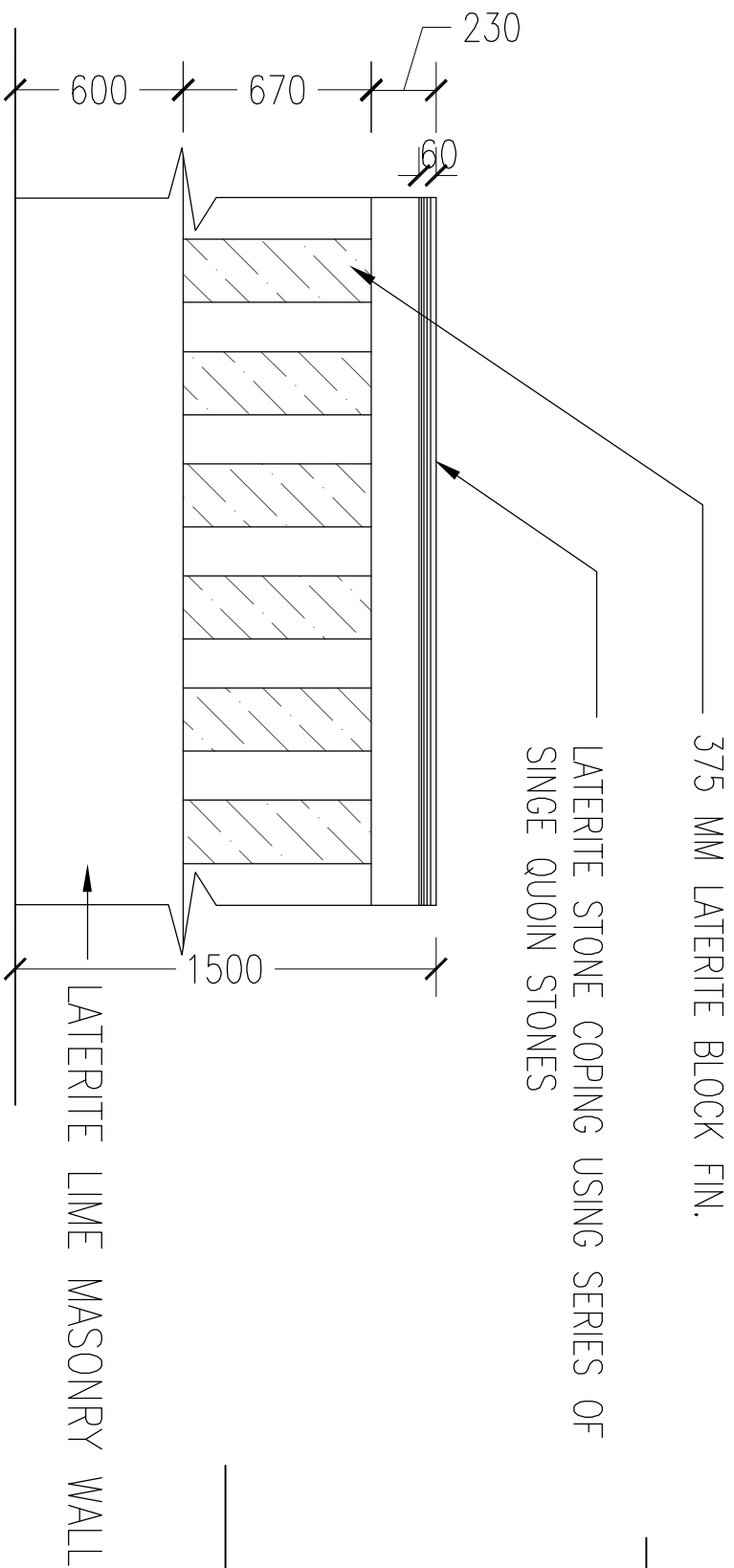


SCALE 1:10

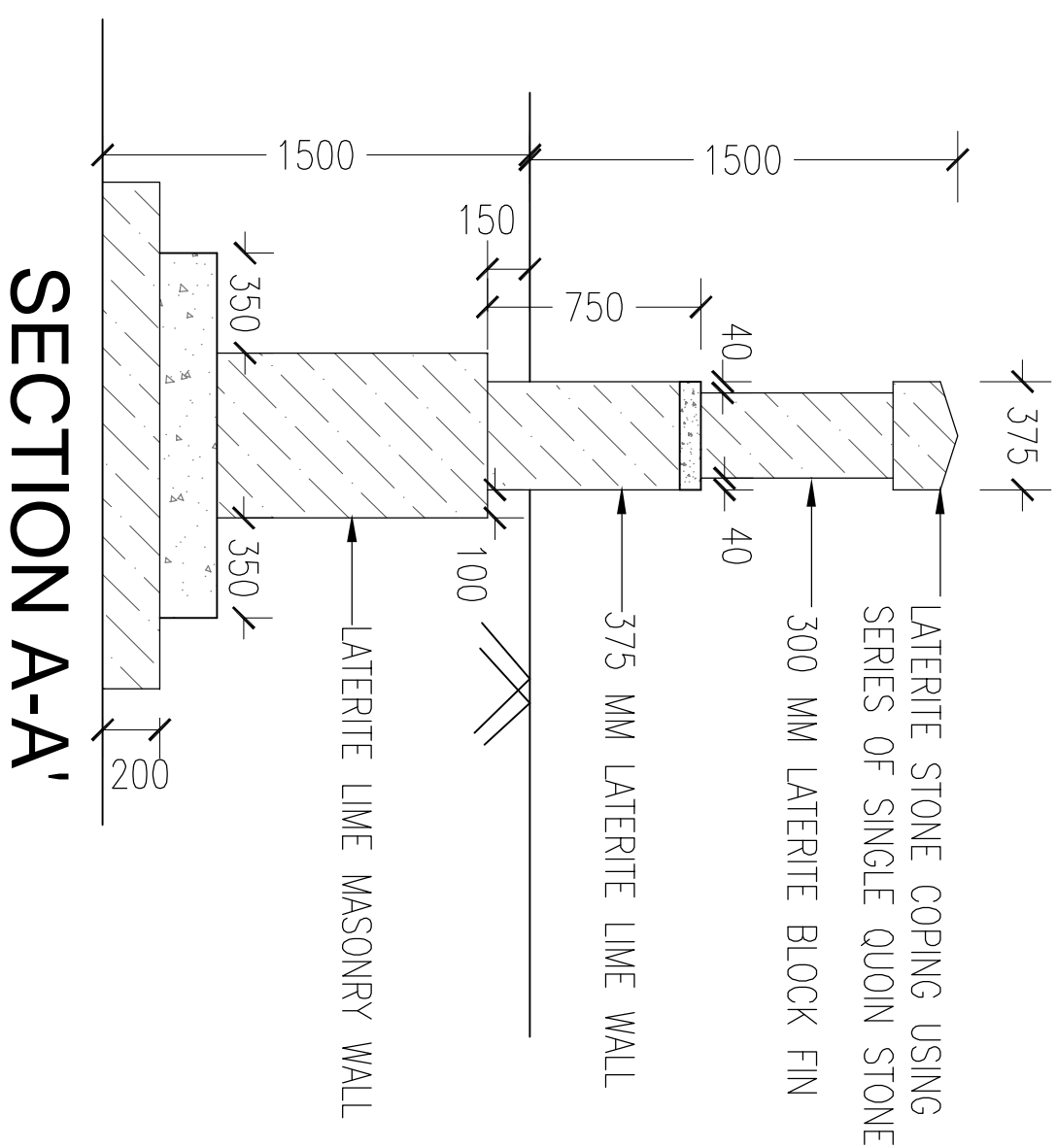
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ARCHIVISTA		ENGINEERING PROJECTS PVT. LTD.		OFFICE NO. 201/202, THIRD FLOOR, SAI EMPORIUM		BANKER, PUNE - 411 005.		M. (020) 26004600		www.archivista.com									
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# PLAN



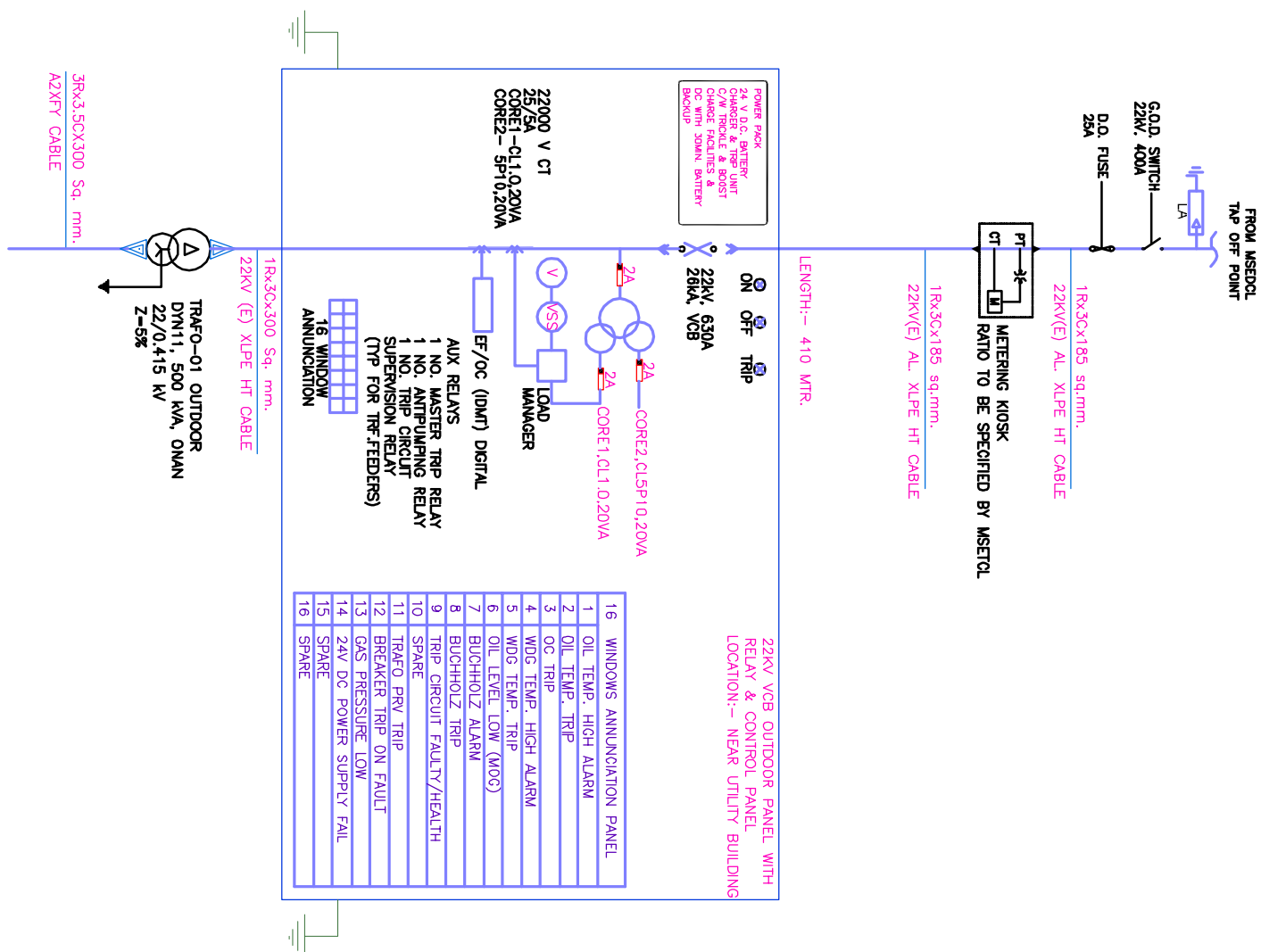
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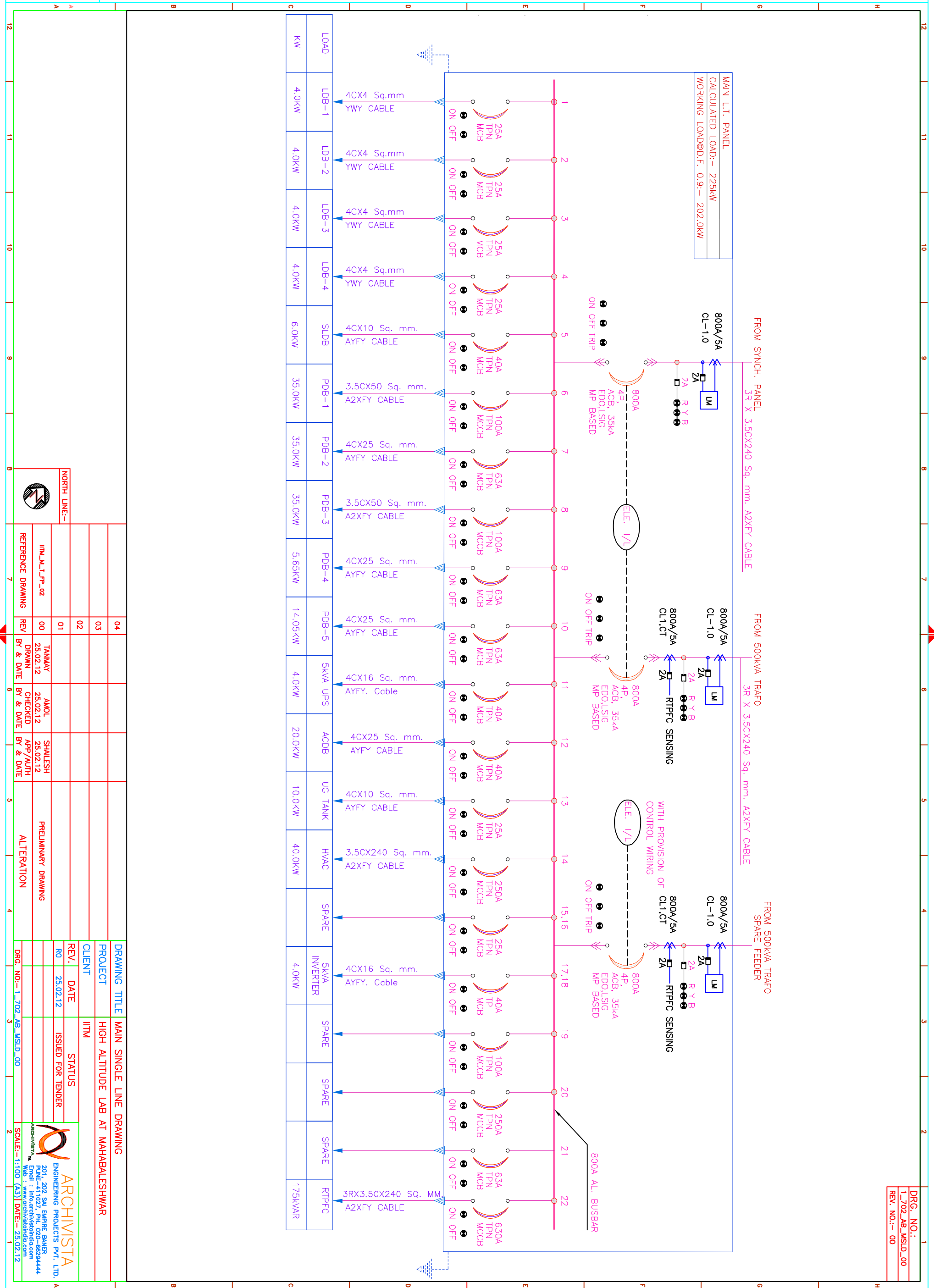


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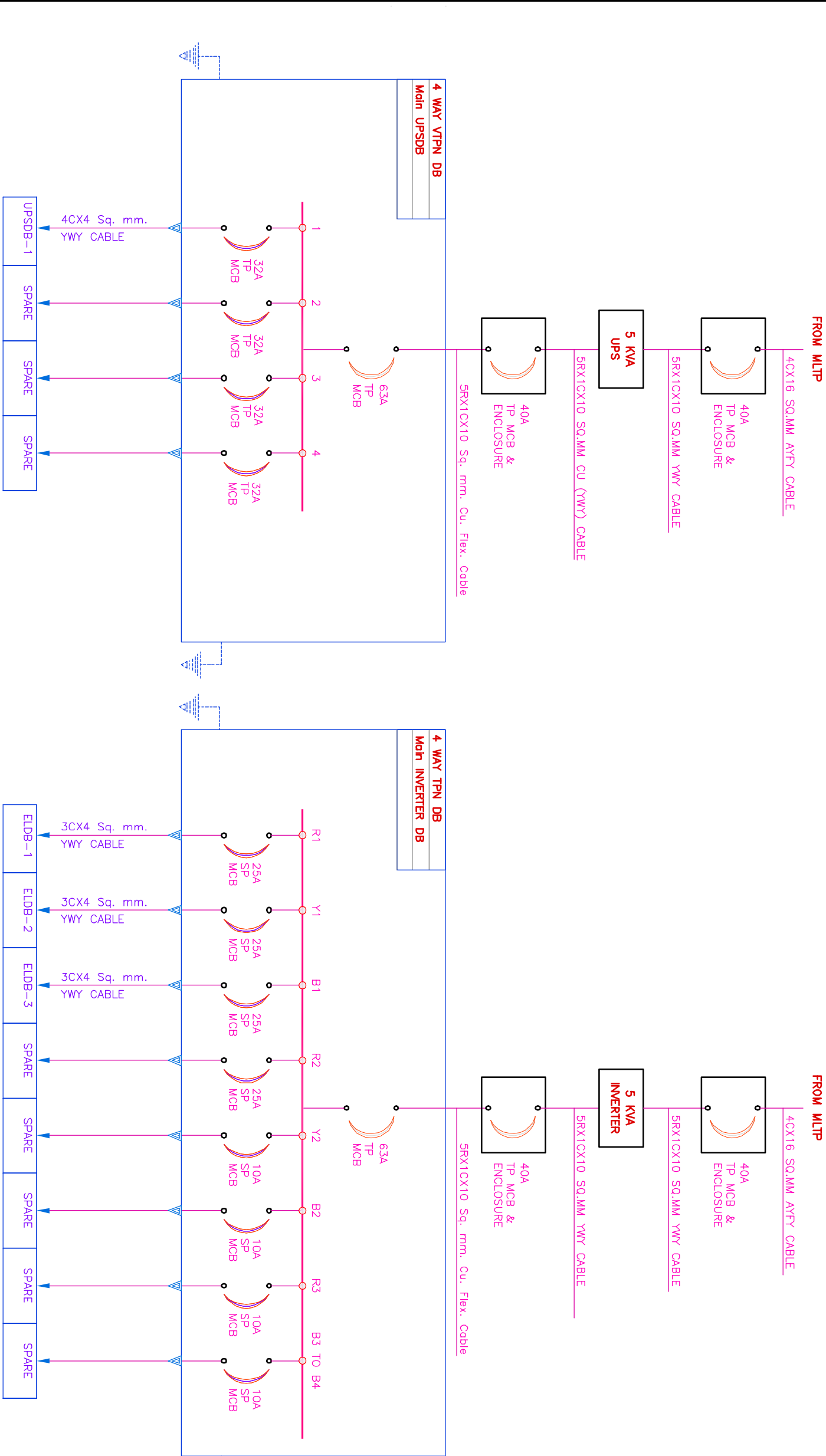
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[illegible]



DRG. NO.:  
1.702 AB\_INPSID\_00  
REV. NO.: - 00

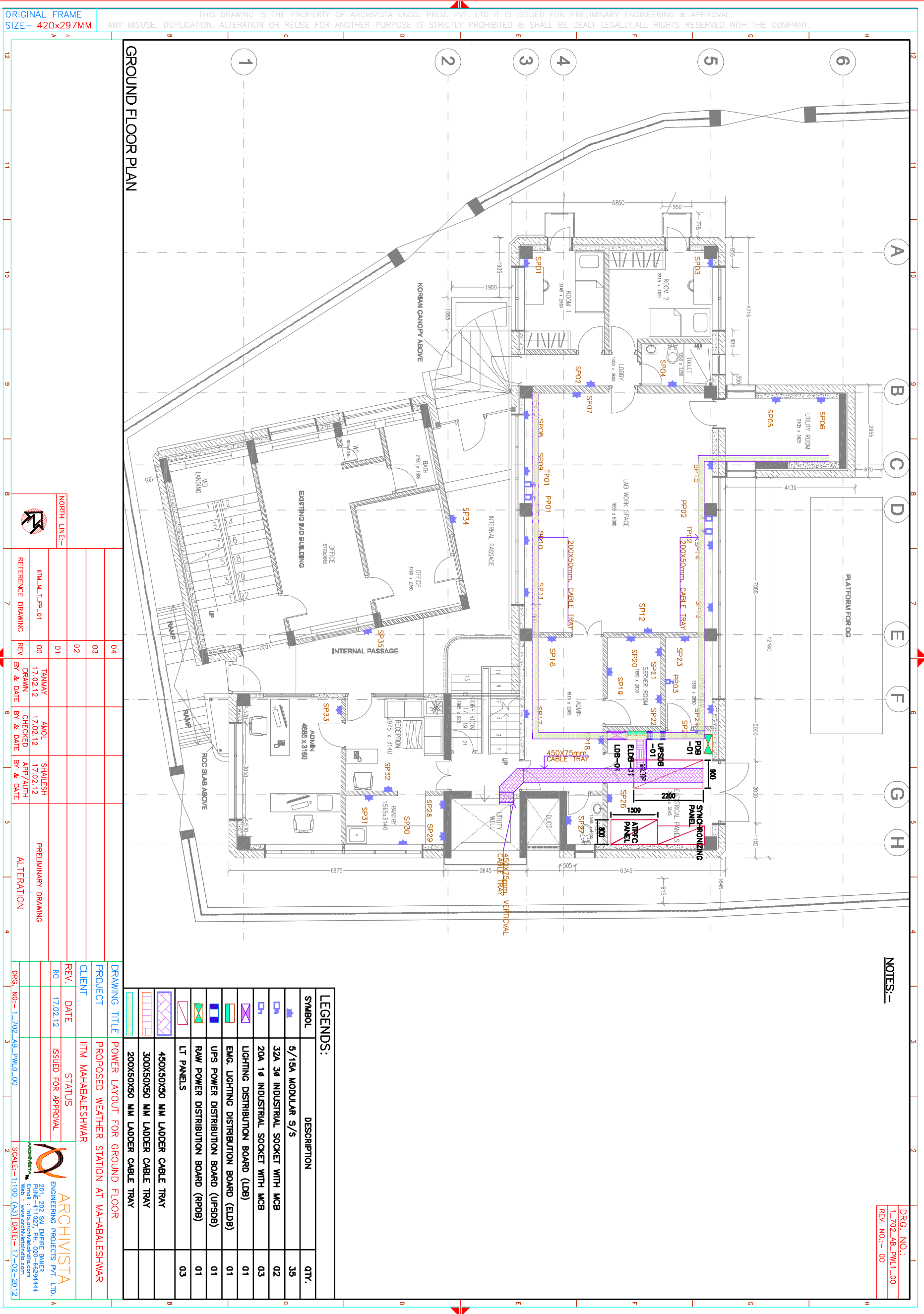


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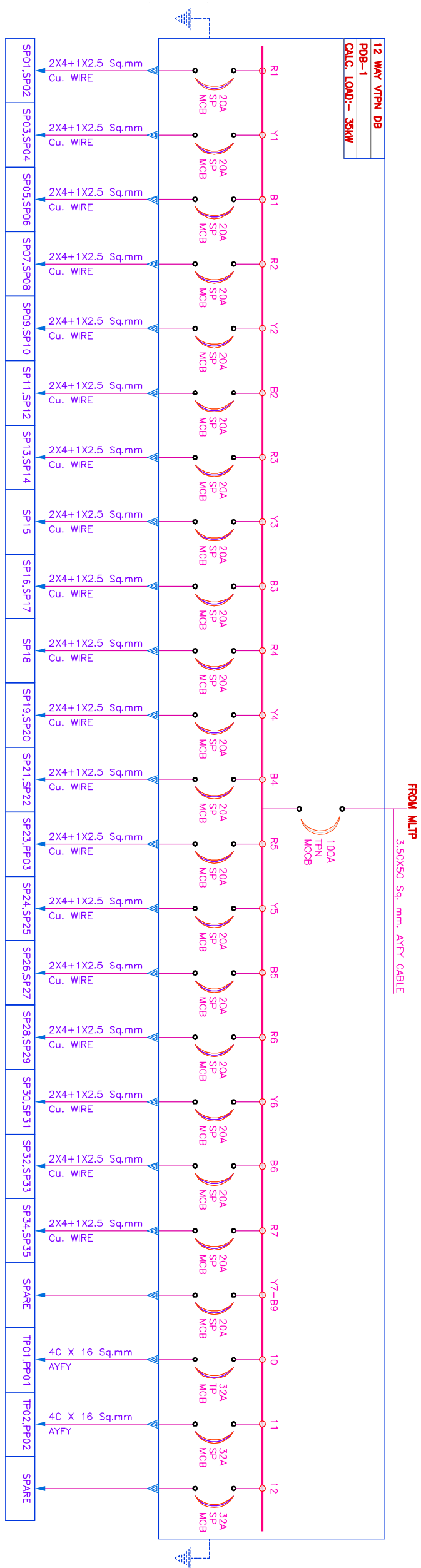
ORIGINAL FRAME  
SIZE- 420x297MM


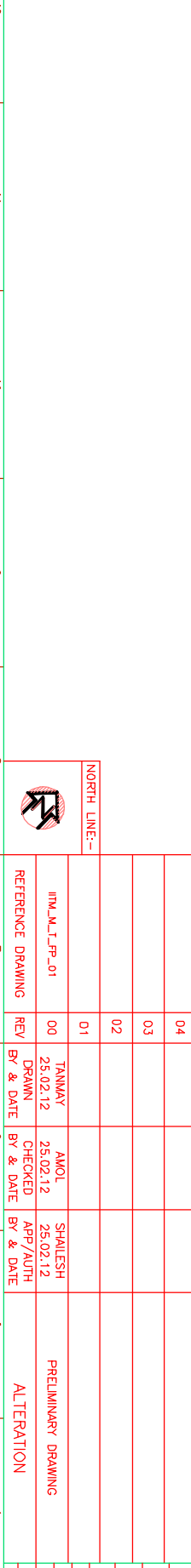















				DRAWING TITLE		MAIN UPS & INVERTER DB SLD	
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REV.		DATE		STATUS			
R0		17.02.12		ISSUED FOR TENDER			
				<div><div>ARCHIVISTA</div><div>ENGINEERING PROJECTS PVT. LTD</div><div>201, 202 SA. EMPRE BAWER PUNE-411027. PH. 020-86294444 Email : info.archivista@a.com Web : www.archivista@a.com</div></div>			
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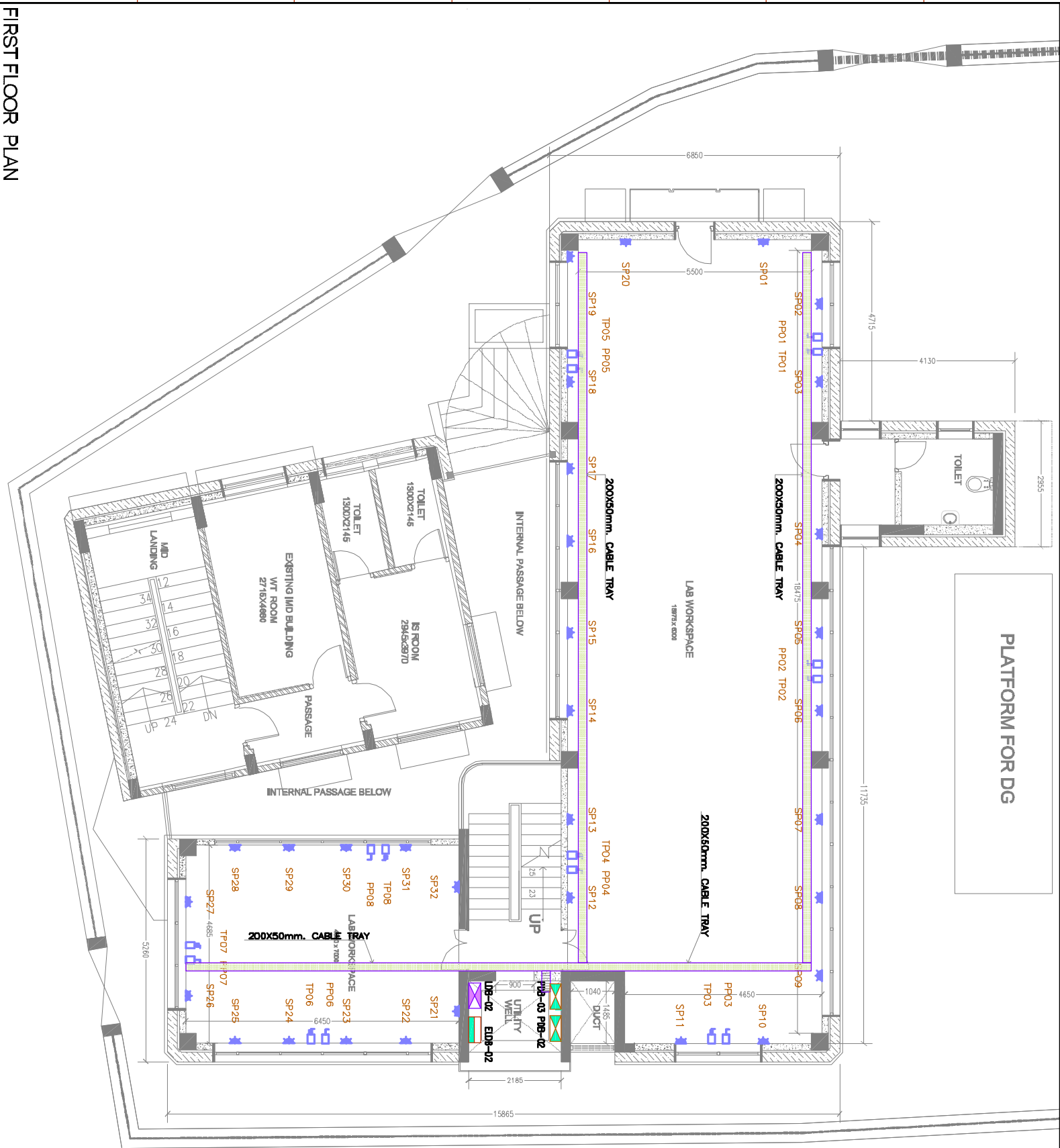


ORIGINAL FRAME SIZE - 420x297MM		ANY
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		



DRG. NO.:  
1.702 AB.PW.3.00  
REV. NO.:-- 00

NOTES:-



FIRST FLOOR PLAN

LEGENDS:

SYMBOL	DESCRIPTION	QTY.
	5/15A MODULAR S/S	32
	32A 3# INDUSTRIAL SOCKET WITH MCB	08
	20A 1# INDUSTRIAL SOCKET WITH MCB	08
	LIGHTING DISTRIBUTION BOARD (LDB)	01
	EMG. LIGHTING DISTRIBUTION BOARD (ELDB)	01
	UPS POWER DISTRIBUTION BOARD (UPSDB)	01
	RAW POWER DISTRIBUTION BOARD (RPDB)	01
	200X50X50 IM LADDER CABLE TRAY	

DRAWING TITLE	POWER LAYOUT FOR FIRST FLOOR
PROJECT	HIGH ALTITUDE LAB AT MAHABALESHWAR

CLIENT

REV.	DATE	STATUS
00	25.02.12	ISSUED FOR APPROVAL

**ARCHIVISTA**  
ENGINEERING PROJECTS PVT. LTD.  
201, 202 SA. EMPRE BANER  
PUNE-411027, PH. 020-68294444  
Email : info.archivista.com

ORIGINAL FRAME  
SIZE- 420x297MM

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NORTH LINE:-



REV.	DATE	BY	DATE	BY	DATE	REFERENCE DRAWING
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02						
03						
04						

ITM.M.L.PF\_02

REV

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DATE

PRELIMINARY DRAWING

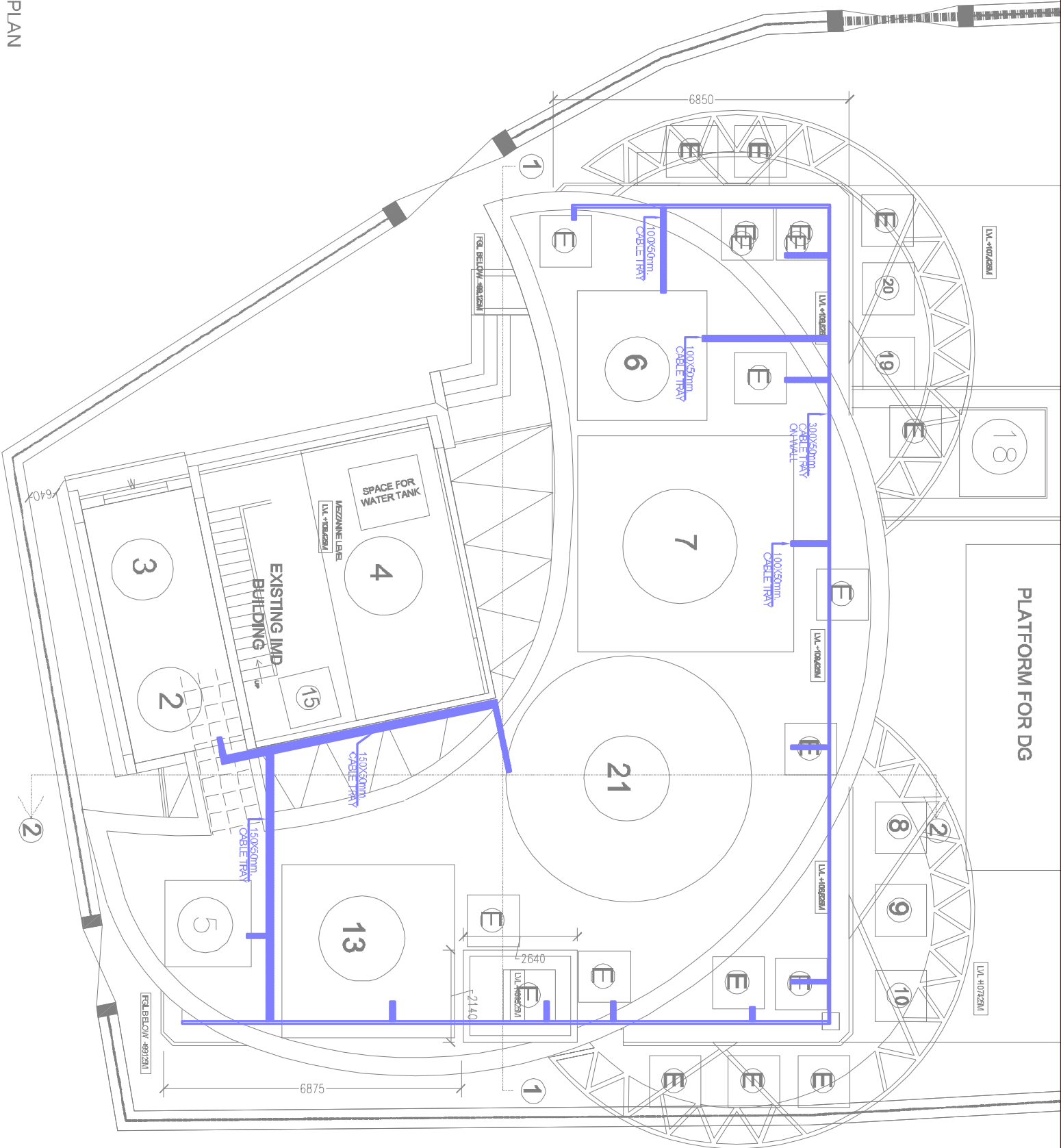
ALTERATION



DRG. NO:- 1.702 AB.PW.1.00


SCALE:- 1:100 (A3)

DATE:- 25.02.12





LEGENDS:	
SYMBOL	DESCRIPTION
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	150X50X50 MM LADDER CABLE TRAY

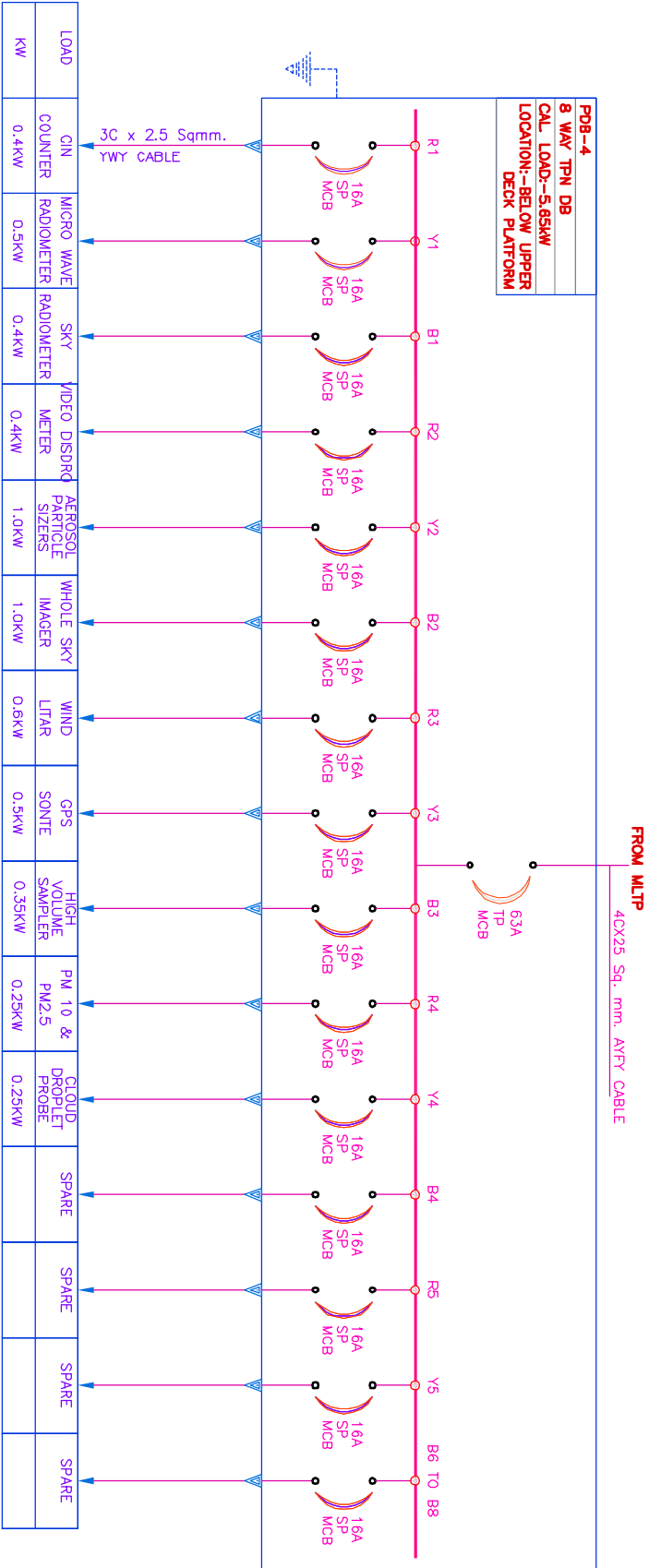
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PROJECT	HIGH ALTITUDE LAB AT MAHAHALESHWAR		
CLIENT	IITM		
REV.	DATE	STATUS	
R0	25.02.12	ISSUED FOR APPROVAL	
			
ARCHIVISTA			
ENGINEERING & PROJECTS PVT. LTD.			
201, 202 SAI ENGINE PARK, PUNE-411027, PH. 020-86094444			
Email : info.archivista@india.com			
Web : www.archivistaindia.com			
SCALE:-1:100 (A3) DATE:- 25.02.12			
DRG. NO:-1-702-AB-PWL-00			

FDB--4

8 WAY TPN DB

CAL. LOAD--5.65KW

LOCATION--BELOW UPPER DECK PLATFORM

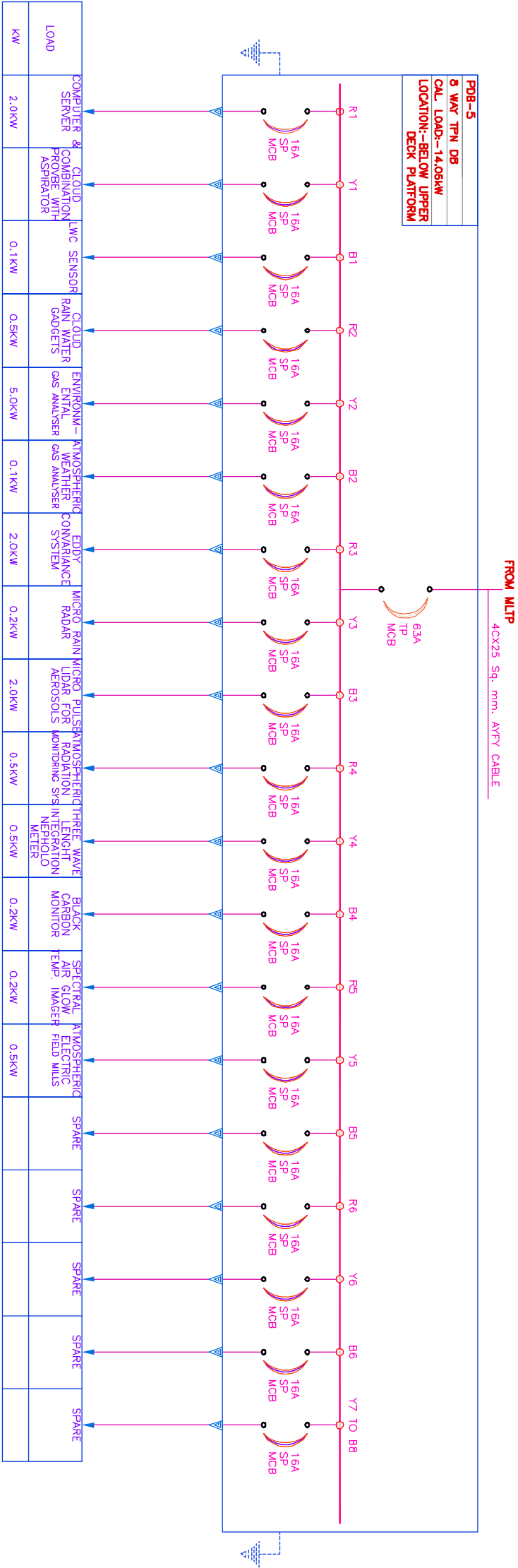


FDB--5

8 WAY TPN DB

CAL. LOAD--14.06KW

LOCATION--BELOW UPPER DECK PLATFORM



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ORIGINAL FRAME  
SIZE-- 420x297MM

DRAWING TITLE

SINGLE LINE DIAGRAM FOR PDB ROOF FLOOR PLAN

PROJECT

HIGH ALTITUDE LAB AT MAHABALESHWAR

CLIENT

IITM

REV.

DATE

STATUS

01

25.02.12

ISSUED FOR APPROVAL

201, 202 SA EMPRE BANER

PUNE-411027, PH. 020-68294444

ARCHIVISTA ENGINEERING PROJECTS PVT. LTD.

25.02.12

PRELIMINARY DRAWING

25.02.12

APPROVAL

25.02.12

APPROVAL

SCALE:-1:100 (A3)

DATE:- 25.02.12

DRG. NO.:- 1.702 AB.PW.1.00


3

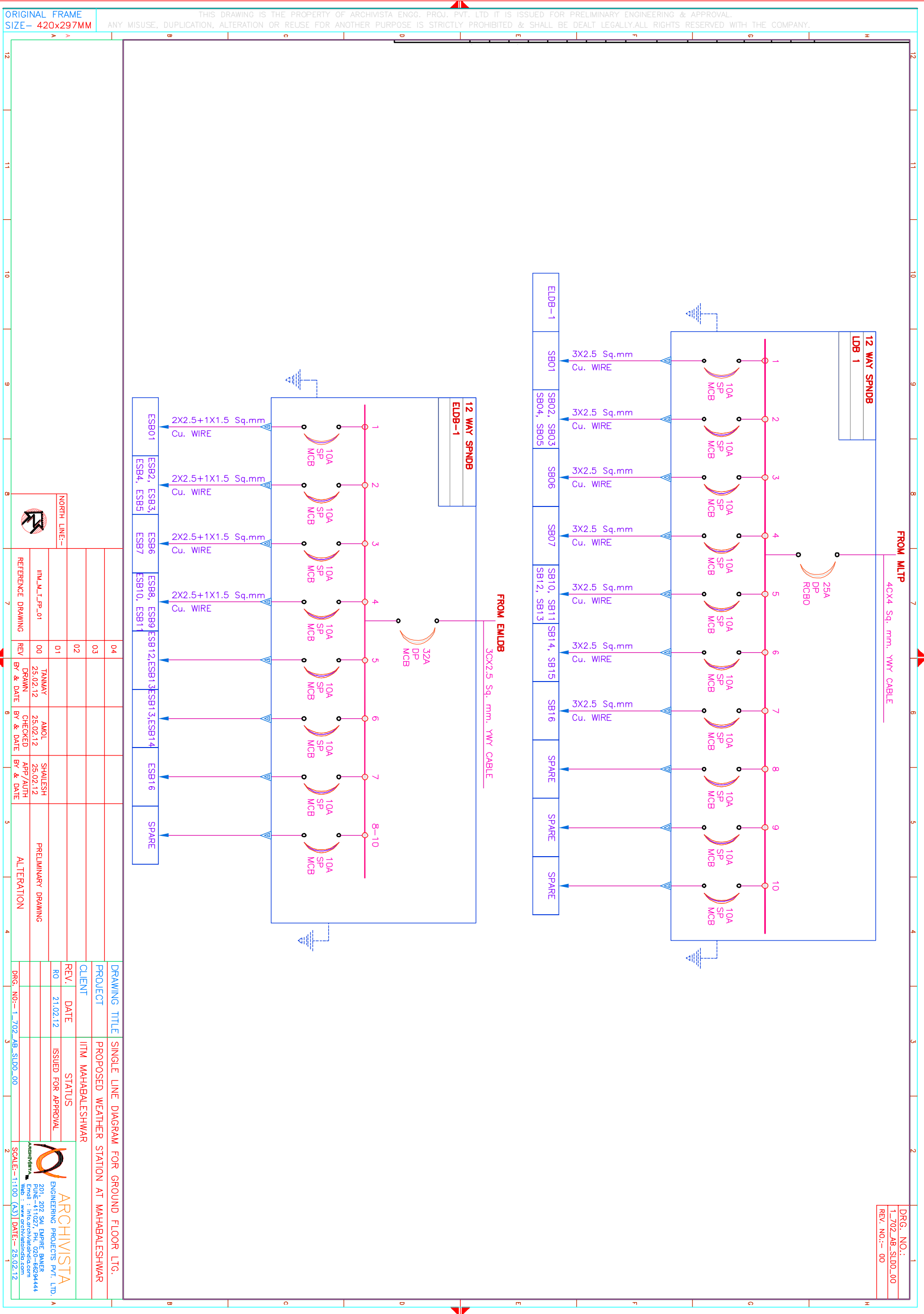
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1

# GROUND FLOOR PLAN

DRG. NO.:
1_702_AB_LTGO_00
REV. NO.:- 00

DRAWING TITLE	LIGHTING LAYOUT FOR GROUND FLOOR		
PROJECT	PROPOSED WEATHER STATION AT MAHAHALESHWAR		
CLIENT	IITM MAHAHALESHWAR		
REV.	DATE	STATUS	
R0	25.02.12	ISSUED FOR APPROVAL	
 <div>ARCHIVISTA ENGINEERING PROJECTS PVT. LTD. 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976,</div>			





DRG. NO.:  
1.702 AB.L11.00  
REV. NO.: - 00

NOTES:-

FIRST FLOOR PLAN



LEGENDS:

SYMBOL	DESCRIPTION	QTY.
	2x30W CFL RECESS MOUNTED BOTTOM OPENING CLEAN ROOM FIXTURE(EQU. TO WIPRO WIP53236)	22
	2x18W CFL RECESS MOUNTED DOWNLIGHTER FIXTURE (EQU. TO WIPRO WCP27218)	03
	1x28W TS INDUSTRIAL FIXTURE (EQU. TO WIPRO WIF 20128)	03
	1x28W CFL DECORATIVE WALL LAMP (EQU. TO WIPRO FWP 42128)	01
	TOILET EXHAUST FAN	01
	MODULAR SWITCH BOARD	10
	LIGHTING DISTRIBUTION BOARD (LDB)	01
	EMG. LIGHTING DISTRIBUTION BOARD (ELDB)	01
	UPS POWER DISTRIBUTION BOARD (UPSOB)	01
	RAW POWER DISTRIBUTION BOARD (RPOB)	01

DRAWING TITLE	LIGHTING LAYOUT FOR FIRST FLOOR
PROJECT	HIGH ALTITUDE LAB AT MAHABALESHWAR

CLIENT

REV.	DATE	STATUS
00	25.02.12	ISSUED FOR APPROVAL

**ARCHIVISTA**  
ENGINEERING PROJECTS PVT. LTD.  
201, 202 SA. EMPRE BANER  
PUNE-411027, PH. 020-68294444  
Email : info.archivista@gmail.com

ORIGINAL FRAME  
SIZE - 420x297MM

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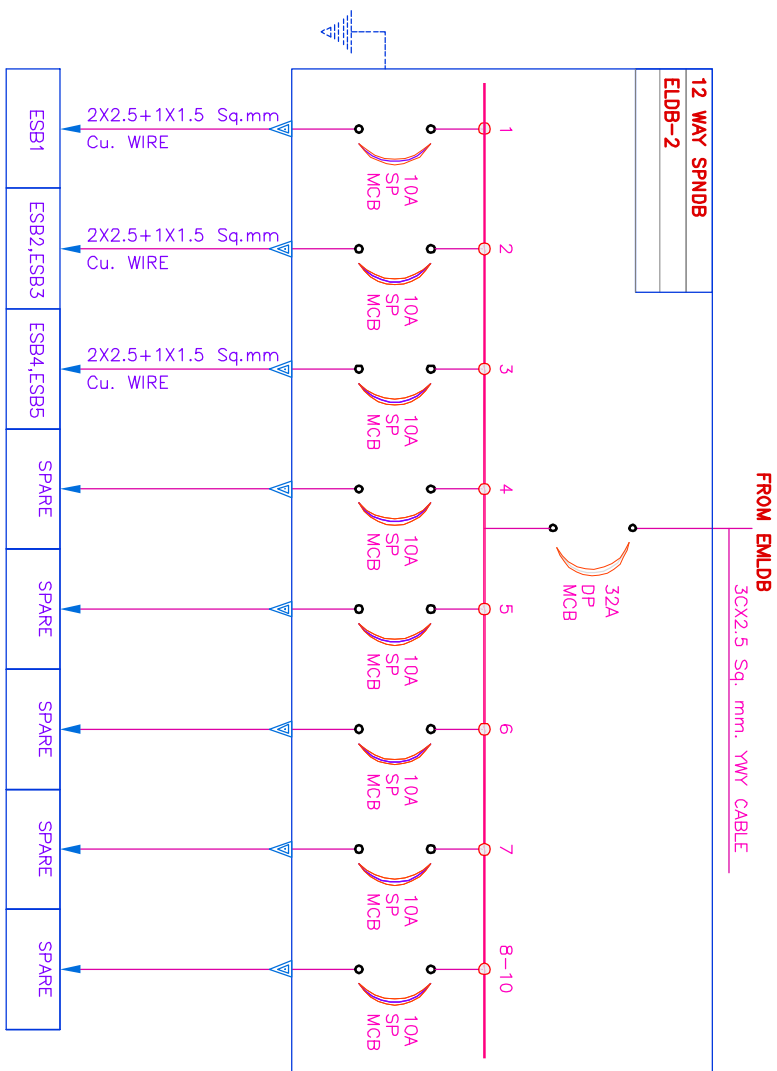
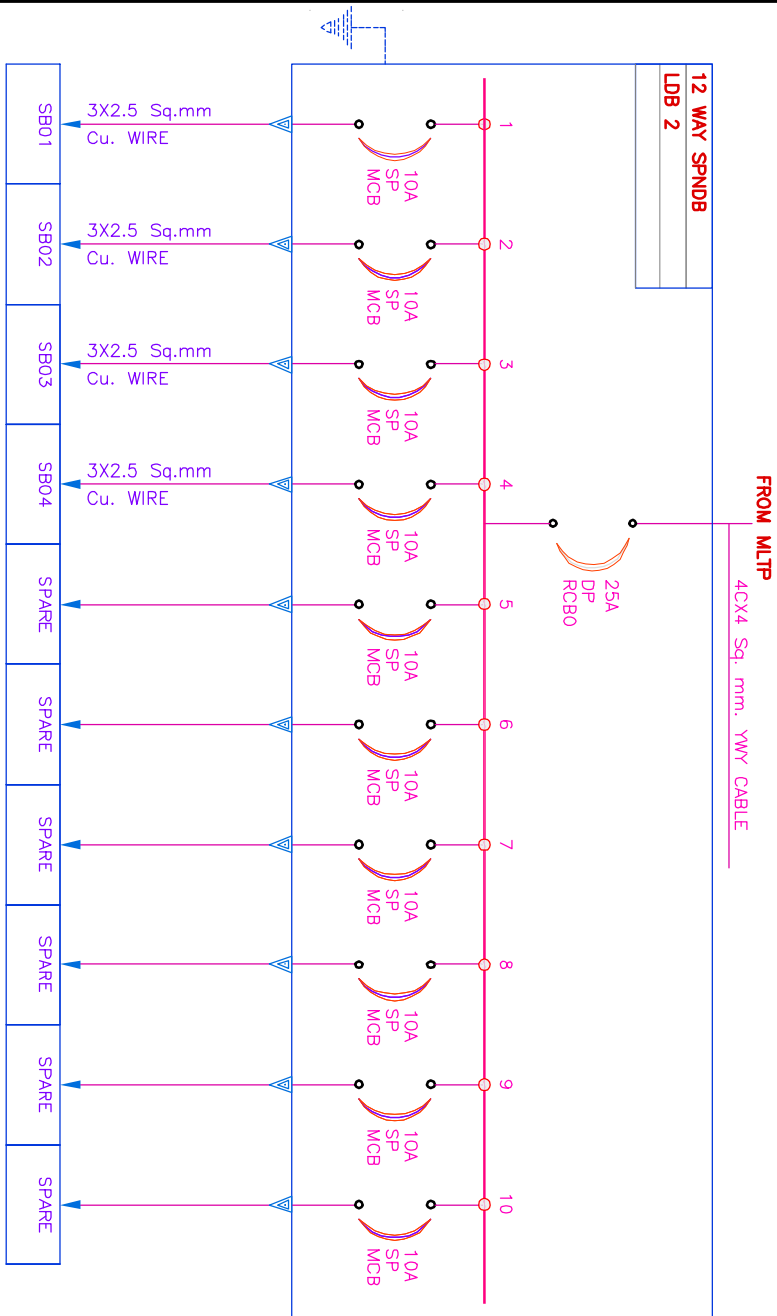
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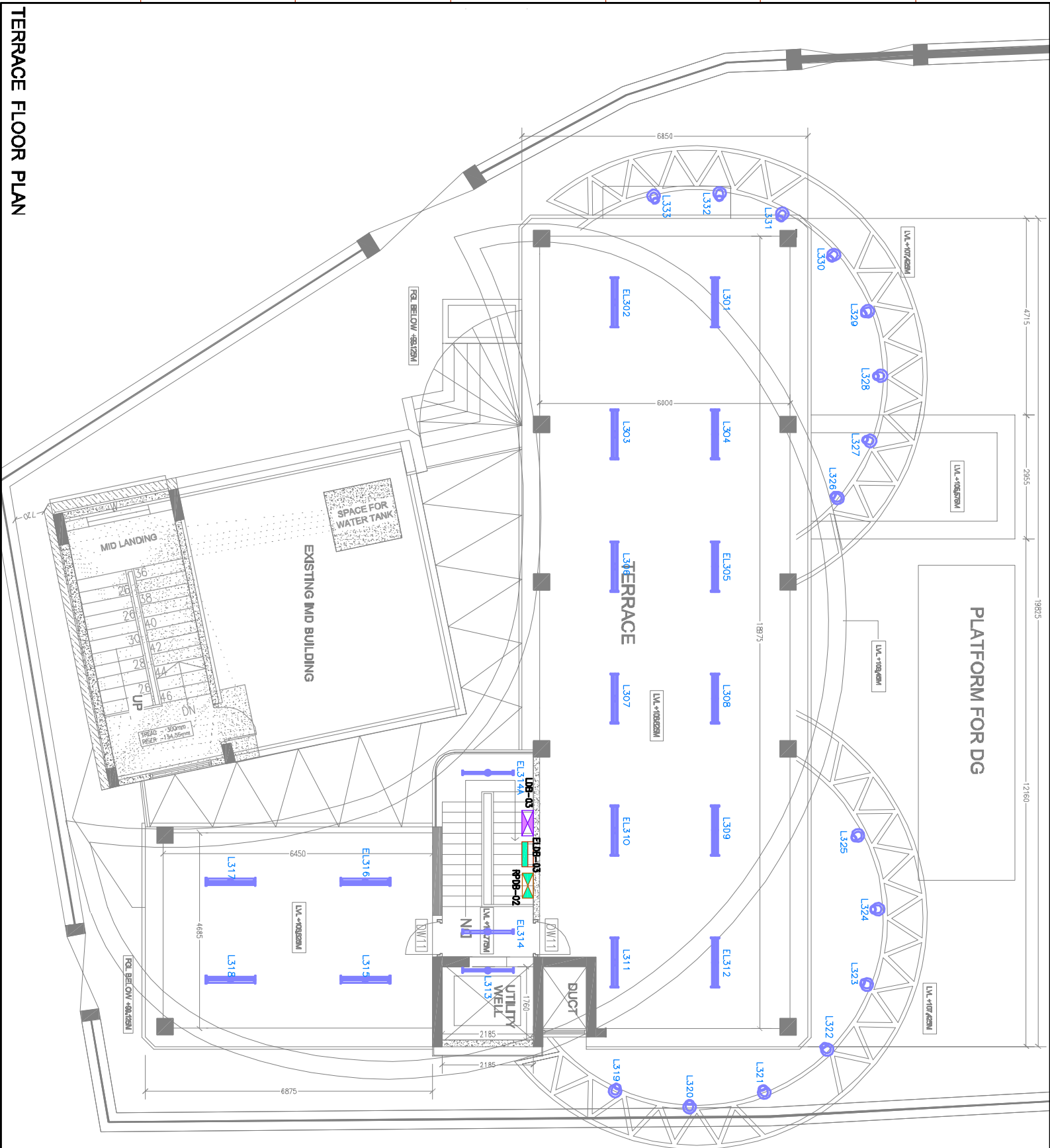
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[illegible]



DRG. NO.:  
1.702 AB.LT02\_00  
REV. NO.: - 00

NOTES:-



TERRACE FLOOR PLAN

LEGENDS:

SYMBOL	DESCRIPTION	QTY.
	1x28W T5 INDUSTRIAL FIXTURE FIXTURE (EQU. TO WIPRO WIF 2022B)	16
	1x28W T5 INDUSTRIAL FIXTURE FIXTURE (EQU. TO WIPRO WIF 2012B)	02
	1X 50 WATT HALOGEN PENDENT LIGHT	15
	MODULAR SWITCH BOARD	10
	LIGHTING DISTRIBUTION BOARD (LDB)	01
	EMG. LIGHTING DISTRIBUTION BOARD (ELDB)	01
	UPS POWER DISTRIBUTION BOARD (UPSOB)	01
	RAW POWER DISTRIBUTION BOARD (RPOB)	01

DRAWING TITLE	LIGHTING LAYOUT FOR UPPER DECK FLOOR
PROJECT	HIGH ALTITUDE LAB AT MAHABALESHWAR
CLIENT	IITM

REV.	DATE	STATUS
R0	25.02.12	ISSUED FOR APPROVAL

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201, 202 SA. EMPRE BANER	PUNE-411027, PH. 020-68294444
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SCALE:- 1:100 (A3) DATE:- 25.02.12



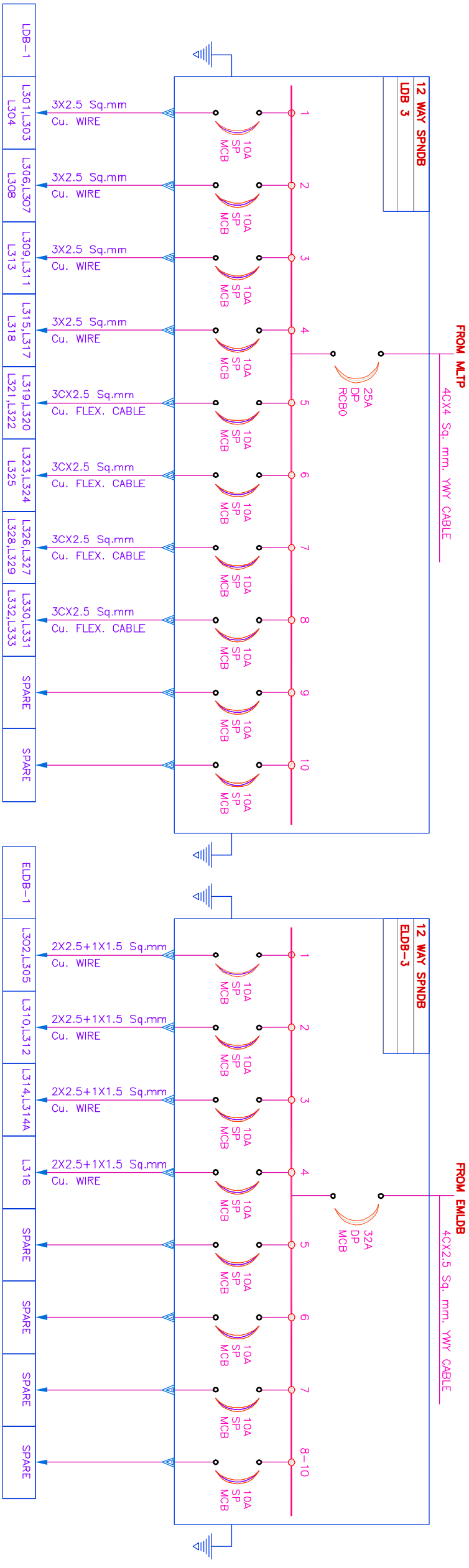
REV.	BY & DATE	BY & DATE	BY & DATE	BY & DATE
01	TANMAY	AMOL	SHAILESH	
00	25.02.12	25.02.12	25.02.12	

REFERENCE DRAWING

ORIGINAL FRAME  
SIZE - 420x297MM

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REV. NO.:-- 00



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ORIGINAL FRAME  
SIZE-- 420x297MM

DRAWING TITLE SINGLE LINE DIAGRAM FOR UPPER DECK FLOOR LTG.

PROJECT HIGH ALTITUDE LAB AT MAHABALESHWAR

CLIENT IITM

REV. DATE STATUS

R0 25.02.12 ISSUED FOR APPROVAL



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PUNE-411027, PH. 020-68294444  
Email : info.archivista@rediffmail.com

SCALE:-1:100 (A3) DATE:- 25.02.12

NORTH LINE:-





ITM\_M.L.FP\_03  
25.02.12  
TANMAY  
DRAFTER  
BY & DATE

AMOL  
25.02.12  
CHECKED  
APP/AUTH  
BY & DATE

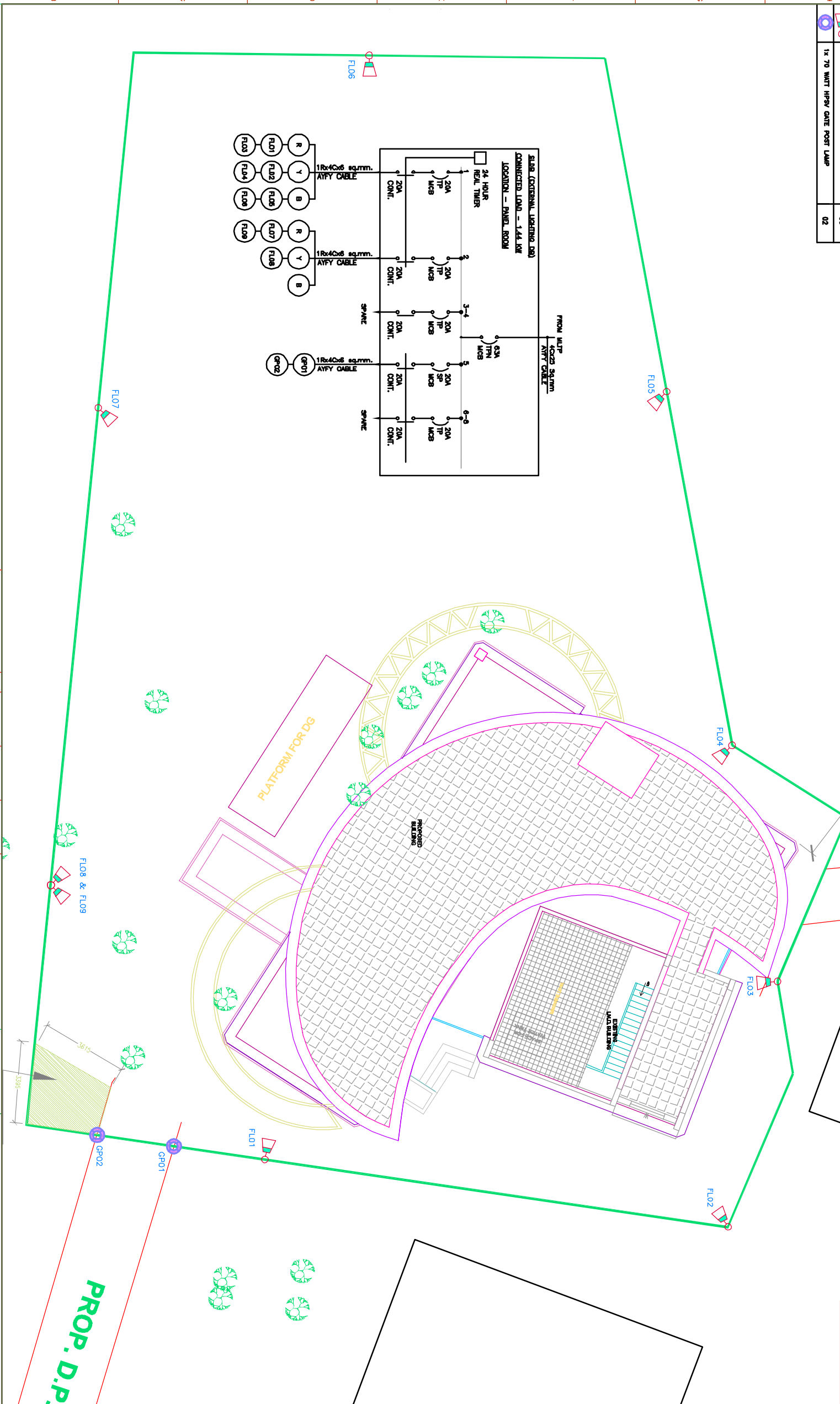
PRELIMINARY DRAWING  
ALTERATION

DRG. NO:- 1.702 AB.SLD2\_00

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LEGENDS:		
SYMBOL	DESCRIPTION	QTY.
	1X250W FLOOD LIGHT FIXTURE ON POLE	08
	1x 70 WATT HPSV GATE POST LAMP	02

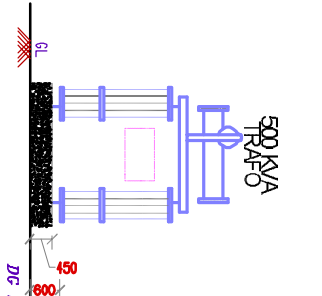
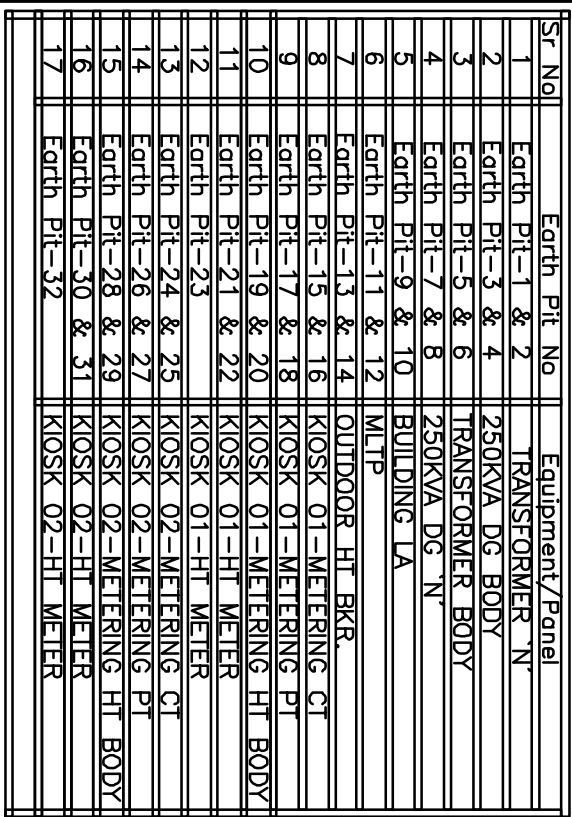
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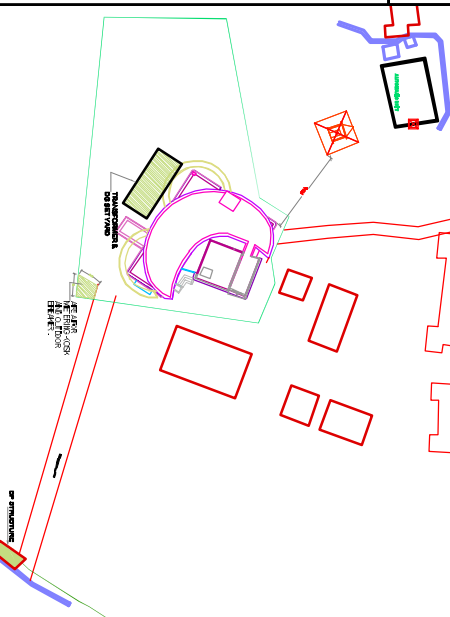
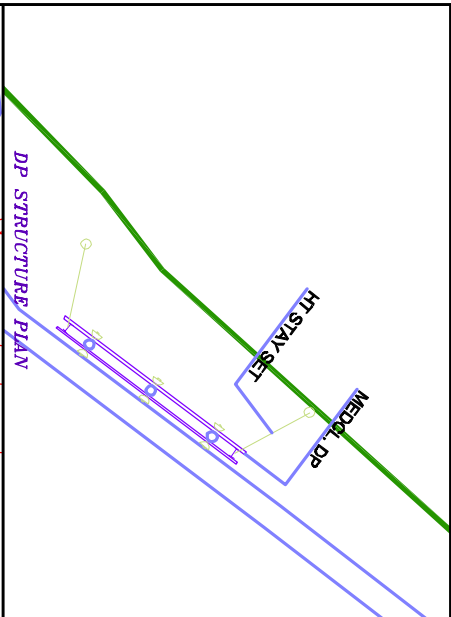
ORIGINAL FRAME  
SIZE- 420x297MM

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		04				
		03				
		02				
	NORTH LINE:-	01				
		ITM_M_L_PP_01	00	TANMAY 17.02.12	AMOL 17.02.12	SHALESH 17.02.12
	REFERENCE DRAWING	REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/ AUTH BY & DATE	ALTERATION



DRG. NO.:
1_702_AB_PWL0_00
REV. NO.:-- 00

DRAWING TITLE	DP STRUCTURE & SUBSTATION LAYOUT		
PROJECT	PROPOSED WEATHER STATION AT MAHAHALESHWAR		
CLIENT	IITM MAHAHALESHWAR		
REV.	DATE	STATUS	
R0	17.02.12	ISSUED FOR APPROVAL	



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ENGINEERING PROJECTS PVT. LTD.

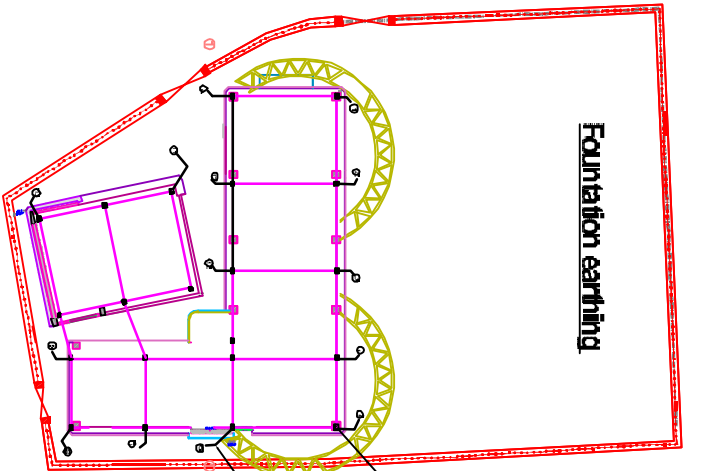
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PUNE-411 002, PH. 020-66234444  
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Web : www.archivista.com

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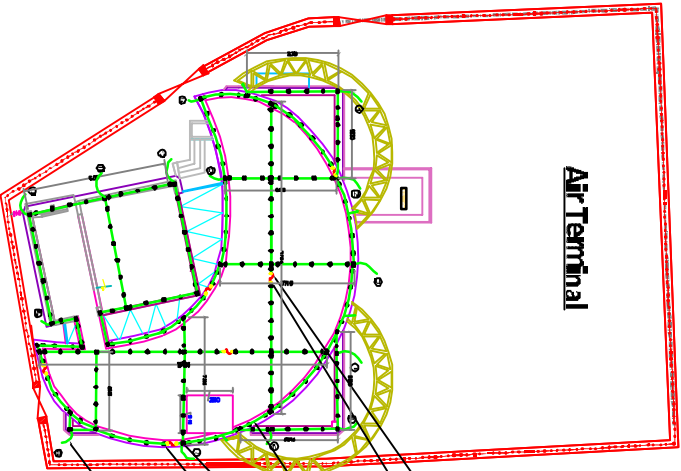
SCALE:- 1:100 (A3) DATE:- 17-02-2012

ARCHIVISTA

EXTERNAL LIGHTNING PROTECTION SYSTEM (CONVENTIONAL METHOD ACCORDING TO IEC 62305-3)



Note:  
1. Foundation earthing of 200mm x 200mm to be installed at ground level & connected to down conductors



Note:  
1. Need to provide intervention for all roof peaks / equipments during execution.  
2. (1,2,3,4...14) — Down conductors

REVISION			DATE		BY		CHECKED BY		APPROVED BY	
1	2023/12	REVISION	1	2023/12	REVISION	1	2023/12	REVISION	1	2023/12
2			2				2		2	
3			3				3		3	
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7			7				7		7	
8			8				8		8	
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NOTE:  
1. All work should be done in accordance with the relevant standards and specifications.  
2. All work should be done in accordance with the relevant standards and specifications.  
3. All work should be done in accordance with the relevant standards and specifications.

ARCHITECT: 

ENGINEER: 

ARCHIVISTA: 

DATE: 2023/12/12

BY: 2023/12/12

CHECKED BY: 2023/12/12

APPROVED BY: 2023/12/12